

**Annotated Atlatl Bibliography**  
**John Whittaker**  
**Grinnell College**

version June 20, 2012

Introduction

I began accumulating this bibliography around 1996, making notes for my own uses. Since I have access to some obscure articles, I thought it might be useful to put this information where others can get at it. Comments in brackets [ ] are my own comments, opinions, and critiques, and not everyone will agree with them. The thoroughness of the annotation varies depending on when I read the piece and what my interests were at the time. The many articles from atlatl newsletters describing contests and scores are not included. I try to find news media mentions of atlatls, but many have little useful info. There are a few peripheral items, relating to topics like the dating of the introduction of the bow, archery, primitive hunting, projectile points, and skeletal anatomy. Through the kindness of Lorenz Bruchert and Bill Tate, in 2008 I inherited the articles accumulated for Bruchert's extensive atlatl bibliography (Bruchert 2000), and have been incorporating those I did not have in mine.

Many previously hard to get articles are now available on the web - see for instance postings on the Atlatl Forum at the Paleoplanet webpage <http://paleoplanet69529.yuku.com/forums/26/t/WAA-Links-References.html> and on the World Atlatl Association pages at <http://www.worldatlatl.org/> If I know about it, I will sometimes indicate such an electronic source as well as the original citation.

The articles use a variety of measurements. Some useful conversions:

1"=2.54 cm    1'=30.48 cm    1 yard = .9144 m  
 1 cm = .394"                      1 m = 3.28 feet (3' 3 1/3")  
 1 mile = 1.609 km    1 km = .622 miles

1 m/sec = 2.236936 mph    1 mph = .44704 m/sec  
 1 km/hr = .2778 m/sec = .622 mph  
 1 mph = 1.609 km/hr = 1.466 fps = .44704 m/sec  
 1 ft/sec = .6818 mph = .3048 m/sec

1 oz = 31.103 gm or 480 grains    1 grain = .0648 gm or .002 oz  
 1 gram = 15.43 grains or .032 oz  
 1 kg = 2.203 lbs  
 1 lb = .4535924 kg, 454 gm  
 1 ton = 2000 lbs = 908 kg, or .907 metric ton, 907 kg  
 1 metric ton, 1000 kg = 2205 lbs

9/5 x degrees C + 32 = degrees F

degrees F - 32 x 5/9 = degrees C

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

**Ackerman, Robert E.** **s**

1996 Cave 1, Lime Hills. In *American Beginnings: The Prehistory and Paleoecology of Beringia*. Frederick. H. West ed., pp. 470-477. University of Chicago Press, Chicago.

SW Alaska, sparse artifacts include 10.7 cm long frag of antler or bone arrowhead slotted to fit microblades. Beveled end of what may be antler foreshaft, w ochre [sim to Clovis?] Pt is assoc w C14 dates 9530 +60 BP, sim to other pts like it in area (West 1996) [thus very early for bow and arrow if right]. Faunal remains w possible cultural modification from lower level w dates 13-15,000 BP.

**Adair, Robert K.** **o**

1994 *The Physics of Baseball 2<sup>nd</sup> ed.* HarperCollins Publishers, New York.

**Ahler, Stanley A. and Phil R. Geib**

2002 Why Flute? Folsom Point Design and Adaptation. *Journal of Archaeological Science* 27:799-820.

Folsom fluting produces a very thin point that can be hafted in a split haft with only leading edge and tip exposed, allowing maximum penetration but controlling breakage so that only the tip breaks off and the point can be resharpened and reused many times. Probably an adaptation to mobile bison hunting where a reliable, maintainable weapon is needed, but where suitable material is not always available. [Assumes used with atlatl. Summarizes previous ideas on fluting, proposes a convincing hafting model.]

**Akerman, Kim** **x**

1978 Notes on the Kimberley Stone-tipped Spear Focusing on the Point Hafting Mechanism. *Mankind* 2(4):486-489.

On light spears 170 gm ave, 150-200 cm long, reed or bamboo with hardwood foreshaft, point attached by resin and sinew. Currently opalescent pyrex ovenware glass preferred for points at Kalumburu, bought for purpose, given to skilled craftsman, fractured with hot wire. Metal leaf points also made. Points often small, 1.5-2.0 cm long. Foreshaft notched but not split, lashed to prevent splitting, butt of point left thick. Resin molded around base of point and down shaft for strength. Impact fractures when hit hard object, shattering if miss in rocky country. Resharpening. Resin hafting advantages: allows point to come free rather than breaking as shaft vibrates in target, curved points can be aligned with shaft, neat join for better penetration, very small points can be used. Large ostentatious

pts more for gift exchange than use. Now made for tourist trade.

**Akerman, Kim**

o

2006 High-Tech, Low-Tech: Lithic Technology in the Kimberley Region of Western Australia. In *Skilled Production and Social Reproduction*. Jan Apel and Kjell Knutsson eds., pp. 323-346. Societas Archaeologica Upsaliensis, Uppsala.

Ground-edge tools like axes, grinding equipment, unhafted flake blade and core cutting tools, hafted knives and scrapers, pressure flaked spearheads in 3 different lithic zones. Heat treatment of rock common.

Kimberley points as spear heads, knives, trade goods. Descriptions of flaking process. Man might have 5-20 at one time, but renew or replace maybe 4/week. Glass favored, takes 15 + minutes.

Composite spears 250-350 cm, ave wt 170 grams, so could be thrown with long spear thrower up to 140 yards, accurate to 80. Solid wood spears thrown with shorter desert style thrower often with adze on handle.

**Akerman, Kim**

2010 To Make a Point – Ethnographic Reality and the Ethnographic and Experimental Replication of Australian Macroblades Known as Leilira. In *Experiments and Interpretation of Traditional Technologies: Essays in Honor of Errett Callahan*. Edited by Hugo Nami, pp. 407-430. Editiones de Arqueologia Contemporanea, Buenos Aires.

Large flake blades, usually quartzite or silcrete, up to 240 mm, hafted in knob of resin as knives for men or women, or as spear tips. “technological observation in the recent ethnographic present may not always reveal the true nature of technological understanding and ability that existed in the traditional ethnographic past.” Quotes several detailed accounts of knapping. Many pieces rejected by knapper before successful blade, but at quarry, others might collect and use his rejects. Hard hammer percussion with large core resting on ground. Current knappers not as skillful – 1960s to 1980s selling blades hafted as knives or spears, but mostly using recovered quarry rejects. Blades for spearpoints have base thinned, hafted with beeswax. Those used in knives are not thinned, and a wooden “finial” may be added to the haft and decorated with totemic marks, but is non-functional. Some recent accounts of traditional knapping are flawed because the knappers observed remembered poorly or had never been very skilled. “some indigenous peoples try to discover for themselves how ‘the old people did it’. I have heard indigenous people describe how Kimberley points were made, by heating a flake of stone and carefully dripping water onto it.”

Describes his replication, compares to Levallois technique.

**Akerman, Kim and Patrick McConvell**

x

2002 Wommera’ - The Technology and Terminology of the Multipurpose Spearthrower in Australia. Paper for ARCLING II Conference on the

Archaeology and Linguistics of Australia, Canberra 2002. Electronic document, URL <http://crlc.anu.edu.au/arcling2/index.html>

Grey 1841 noted similarity Aust words for 'throwing stick': *wamirra* in New S Wales, *amirra* in Central Aust, *midla* in S Aust, *mirra* in W. Sydney area term *wom-murrur* or *wommerera* became standard, changed to *woomera*. But common roots of words not clear, also much variation in spearthrower form and terms. Reflect spread of people/language, or spread of tool? Look at as diffusion of multipurp atl w stone adze. Revised Davidson typology. "Leaf-shaped" throwers assoc w sub-tropical regions, 5 types in W Aust and in central and W deserts. [Typology not usable because no illustrations given, descriptions too brief, appear to be only 2 leaf-shaped types instead of 5].

Leaf types used as dish, music, digging stick, adze (attached stone, tooth, or shell blade). Stone blades used into 1970s, + later for tourist trade. Thrower types that can have blades all assoc with *-mirru-* root in name. No arch evidence for dating, but some rock art. Lewis (1988) Arnhem Land rock art - long period no throwers, then early art w broad atl (like W desert type) starting ca 6000 BP, replaced by x-ray art w long narrow lath atl (like N Aust type) ca 2000-1000 BP

Mirru and related roots also refer clubs in some areas, club words may come from thrower words. Lengthy discussion of sound changes and language relations to conclude many words are related, derive from single form *\*wamirra*. Suggest broad type atl spread from Cape York Peninsula to west, perhaps w people. In N, atl type changed to lath-like when adopting composit reed spears, but kept old word.

**Akerman, Kim, Richard Fullager, and Annelou van Gijn** x

2002 Weapons and wunan: production, function, and exchange of Kimberley points. *Australian Aboriginal Studies* 2002 (1): 13-42.

NW Australia, bifacial pressure flaked points. Microscopic residues and use-wear. Change in production, design, function, and distribution through time. See lithic bibliography.

Oral tales: culture hero Tjungkun made 1<sup>st</sup> spearthrower from limb with branch stub (later became long slender form with lashed on hook). Wodoi made 1<sup>st</sup> stone tipped spears to throw with them. Other myths, intro of pressure flaking by blanket lizard, dentate points made by nightjar etc. Kimberley and other points often used to tip long compound spears, also as knives, and for exchange. Phragmites for shafts of composite spears. Point in resin blob on foreshaft, usually < 4 cm long. Spears long and light, av 170 gm, "low mass, high velocity with point that disengaged from the shaft to promote bleeding." [only light in comparison to other Aust spears].

**Alex, Lynn M.** o

2000 *Iowa's Archaeological Past*. University of Iowa Press, Iowa City.

Drawing of atlatl in use, poor pic of mammoth hunters w atlatls. Bannerstones and gorgets as atlatl weights, with Archaic dates.

**Alexander, B., and C. Alexander** s  
1988 *Les Eskimos: Chasseurs du Grand Nord*. Courbevoi.

source in Stodiek 1993 for photo of ethnographic Inuit throwing a harpoon – atlatl is flipping, vertical

**Alexander, Hubert G. and Paul Reiter** o  
1935 *Report on the Excavation of Jemez Cave, New Mexico*. Monographs of the School of American Research, No. 4. University of New Mexico Press, Albuquerque.

Pueblo III material primarily represented. Loose fill, lots of ash, partly dry with vegetal and artifact remains, looting disturbance. Numerous points, mostly obsidian, mostly look like small dart points, few late arrow points [but outline drawings are pathetic]. Late PIII pottery. Y-shaped antler shaft wrench large enough for dart shafts. Fragment of a fending stick. Arrow shafts and foreshafts. Dart foreshaft, notched for stone point, L = 2.75” diam = .5”, roughened taper. Seven short sticks tapered at both ends but not very sharp may be dart foreshafts too. Possible butt end of a cane dart shaft, cut off. Sporadic occupation beginning early, associated with ceremonial use of nearby hot springs, continuing through late pueblo period to modern times.

**Allain, J. and A. Rigaud** x  
1986 *Décor et fonction: quelques exemples tirés du Magdalénien*.  
*L'Anthropologie* 90:713-738.

“Decoration and function: some examples from the Magdalenian.” Decoration relates to function and is sometimes functional e.g. grips. Ochre remains as traces of mastic on bone points with basal incisions. Bâton percé [“shaft straightener”] shows wear from levering and handle decoration for gripping. Harpoon points more likely to tip hand weapons than thrown.

**Allely, Steve**  
1992 Great Basin Atlatls: Notes from the N.W. Corner. *Bulletin of Primitive Technology* 1(4): 48-56.

Describes several atlatls of different types. [Good illustrations, one of the best sources to use replicating different styles.] Includes good drawings of Roaring Springs, Nicolerson Cave [= Lake Winnemucca], Plush Cave, and McClure atlatls.

**Allely, Steve** o

2008 Ishi's Archery Tackle. In *The Traditional Bowyer's Bible, Volume Four*. Pp.269-290. The Lyons Press, Guilford, CN.

Nicely illustrated with detailed drawings. Bows, arrows, stone and other points. Useful info on fletching, arrow points, drilling foreshaft socket by twirling shaft. Photo shows Ishi's odd shooting style off R side of bow. Arrow fletching not spiraled. Stone pts attached with sinew alone, or sinew + pitch.

**Alva, Walter, and Christopher B. Donnan**

1994 *Royal Tombs of Sipan*. Los Angeles: University of California.

Moche, Peru, fabulously wealthy tomb.

P 175 drawing of spear thrower: straight rod with cast copper hook in form of animal head, hooked handle in form of human head, geometric decoration on shaft. A second atlatl, not shown, had wooden handle carved with bird head. P 127, procession of warriors with clubs, spears, and atlatls (on pot), but mostly shown using clubs or maces and slings in combat.

**Ames, Kenneth N. and Herbert D. G. Maschner**

1999 *Peoples of the Northwest Coast: Their Archaeology and Prehistory*. London: Thames and Hudson.

P 236 clear drawing of the Skagit atlatl carving. See Fladmark et al 1987. [However, no other mention of atlatls, despite chapter on warfare and discussion of weapons.]

**Ames, Kenneth N., Kristen A. Fuld, and Sara Davis** o

2010 Dart and Arrow Points on the Columbian Plateau of Western North America. *American Antiquity* 75(2):287-326.

**Anderson, Kate** o

2011 Slashing and Thrusting with Late Bronze Age Spears: Analysis and Experiment. *Antiquity* 85(328):599-612.

Several forms, probable different uses. Only 6 survive with complete shafts, all over 1.43 m long. 222 spears known from N Britain; sample of 88 examined. Only 3% tip damage from use; 31% edge damaged comparable to swords [nicks and folded edges etc]. Experiment: lead bronze leaf-shaped spears 190 gm [L not given] on shafts 1.5 m L for throwing, .78 for slashing. One sword for comp.

Need a slashing motion, not chop [duh!]. Hard blow snapped shafts, difficult to remove stub. Thrusting and throwing did not produce much damage, so can't rule out. Shields of leather and bronze highly resistant, minor dents thrusting, but penetrated by throws. Short shaft necessary for slashing motion [I don't think they have enough weapons experience to say that - e.g. Japanese naginata is long slasher.] Slashing with spear cut pig carcass deeply, against metal produced lots

of damage to spear. Against sharp weapon, 'chips' [= nicks? not defined]. Against blunt metal, flattening and 'bowing' [dulling and folding?] of edge. [Not enough definition and illustration of damage types.] Damage on prehist shields suggests spears cast against them, but spears slow and dodgeable, "even experienced spear casters" not accurate beyond 3 m. So casting only likely by bodies of men against other groups. [Sounds like comments by inexperienced early atlatl experimenters - how experienced were they? Go read the Illiad.]

Implications - need training for effective use, metal weapons rare, thus elite. Need space to use, weapons easily damaged, suggests short single combat rather than group action. [Interesting, but experimenter probably not experienced enough, some alternatives not considered - e.g. edge damage on thrusting weapons from parrying with another edge.]

### **Angel, J. Lawrence**

**x**

1966 Early Skeletons from Tranquility, California. *Smithsonian Contributions to Anthropology* 2(1).

Early Horizon [Archaic] burials with mano/metate, mortar/pestle, Olivella beads etc, but possible association with extinct bison, horse, camel. [Angel accepts association, but artifacts and stratigraphic problems suggest post-Pleistocene date, no C14 date.]

Hard life indicated by skeletons of 30 individs, 3M, 4F complete.

p3: Diagnoses "atlatl elbow": 6 of 13 individs show arthritis of elbow "usually including eburnation after friction removal of head of cartilage over capitulum, the "ball" against which concave upper surface of head of radius rubs during flexion and extension of elbow and pronation and supination of hand. What repeated and stressful action combines those movements? One thinks at once of baseball pitcher or javelin thrower, except that this equally strains shoulder and clavicular joints." Atlatl allows throw without extending and abducting shoulder, but puts extra stress on arm muscles and elbow. [Important article, but incorrect understanding of atlatl throwing motion.]

### **Anneaud, Jean-Jacques, dir.**

**o**

1981 *Quest for Fire*. VHS, DVD. Fox Home Entertainment.

Movie, starring Everett McGill, Ron Perlman, Nicholas Kadi, and Rae Dawn Chong. After their tribe is attacked by apemen [Australopithecines?] and loses their fire, three Neanderthals [?] set out, meeting hairy cannibals [Homo erectus?] and a hyper-active tribe of fully modern humans. From the woman who joins them, they learn to joke, enjoy face-to-face intercourse, use atlatls, and ultimately to make fire. [Got a lot of hype from using only primitive language designed by A. Burgess and body language by D. Morris. Ultimately a story about becoming human, not too bad, but some silliness – pathetic material culture even for Neanderthals (only stone tool use shown is scraping charred end of spear – Neanderthals without stone tools would be as desperate as without fire), moth-

eaten woolly mammoth costumes, absurd mix of hominids from different times, etc. Atlatl use depicted briefly: grooved stick atlatl with crooked handle, light arrow-like darts. Heros use them to triumph over rivals, but naturally learn without practice, although earlier they were shown to be clumsy rock throwers. The depiction shows them loading and throwing, with darts zinging at high speed into enemies, but doesn't look like the actors really knew how to use them. Wonder who made the gear. See Rosny 1982.]

**Anonymous**

1989 Unusual Spearthrowers from Key Marco on the Gulf Coast of Florida. *The Atlatl* 2(1):4-5.

Two of Cushing's finds described briefly, line drawings. [Not enough info and no proper reference]

**Anonymous**

1990 World's Record Atlatl Throw. *The Atlatl* 3(1):6

Bill Holladay at Rabbit Stick 1989: primitive equipment - 380'5", open equipment - 428'6".

**Anonymous**

1991 Notes from All Over. *The Atlatl* 4(1):8

Manuel White record throw: 476'5".

**Anonymous**

1992 Worlds Record Distance Throw. *The Atlatl* 5(3):7

Wayne Brian 616.8' (188 m) No equipment info.

**Anonymous**

1992 New Record Cast. *The Atlatl* 5(4):7

Wayne Brian 638'8" (194.67 m); unofficial: 690' (210.31 m) 10/7/92. Action photo, no equipment info.

**Anonymous**

1993 Safety First - Says New WAA Board. *The Atlatl* 6(3): 1-2

Establishing guidelines.

News report of boy struck in head by Crow throwing arrow (not atlatl).

**Anonymous**

2008 History Channel's Journey to 10,000 BC. *The Atlatl* 21(2):10.

Mike Frank of VA, Smithsonian Inst, made atlatls and threw and knapped for the show.

**Anonymous**

2008 Death of Kris Tuomala. *The Atlatl* 21(2):16.

**Anonymous [Sean Liam Markley?] x**

2008 Early Warfare: Girls on Top. *The Economist Online*, April 10, 2008.

Electronic document, accessed 4/11/08. URL:

[http://www.economist.com/science/displaystory.cfm?story\\_id=11014530](http://www.economist.com/science/displaystory.cfm?story_id=11014530)

*The Economist* April 12, 2008: 90.

Atlatls at Valley of Fire event, adequate explanation, quotes Shea suggesting early African invention, Whittaker suggesting “equalizer” allowing women hunting success. Paper version has photo of Anu Kramer and Raging Cow.

**Anonymous x**

n.d. Aztec Codex/Codices. *River-Styx.net*. Electronic document, accessed 8/18/09.

URL: <http://www.river-styx.net/aztec-codex.htm>.

Site features underworld and death mythology. This page is descriptive list of codices with some quotes and pictures, source information.

From Aubin Codex [it is NOT, this is from Sahagun], describing Spanish attack on Aztecs at Huitzilopochtli festival and subsequent battle: “... Then the battle began. [The Mexicas] attacked them with arrows and even javelins, including small javelins used for hunting birds. They furiously hurled their javelins [at the Spaniards]. It was as if a layer of yellow canes spread over the Spaniards.” [The javelins are surely atlatl darts.]

**Anspach, Teej, and Rebekah Merrill o**

2004 The Effect of Weights on Atlatl Accuracy. unpublished class paper, Grinnell College.

Throwing at ISAC target with Berg darts, atlatl unweighted and 81 gm weights at 3 positions. For each condition, 18 composite scores of five shots each. Proximal weight poorest; no weight and middle position show no signif diff; distal weight improved accuracy. Suggest improvement is from balancing dart while aiming.

**Antz, Gustav x**

1936 Alte Waffen aus Peru. *Baessler-Archiv* 19:1-4.

[In German. “Ancient Weapons of Peru.”] Star headed mace, stone pointed spears, and “pfeilschleuder” illustrated [but my copy is poor.]

**Aoyama, Kazuo**

2005 Classic Maya Warfare and Weapons: Spear, Dart, and Arrow Points of Aguateca and Copan. *Ancient Mesoamerica* 16:291-304.

In both regions, concludes that bow and arrow arrived earlier than thought (Early Classic, 400-600 AD). [based only on small points made on obsidian blade segments, but probably right] although there is little iconographic sign of bows at any time. Maya elite were involved in craft production, including knapping, and warfare. Endemic warfare explains rise and fall of centers, traceable by points. [General conclusions probably correct, but no real good data on points: he assumes distinctions between bifaces used as tools “spear/knife” and those used as points “dart/spear” based on incoherent and ambiguous use-wear (“cutting and piercing unidentified material”) and size data, never shows correlations with macro impact damage although he depicts it, and makes specific interpretations of sites and regional trends from pathetically small samples from individual sites, apparently reassured just because his overall sample is large. No specifics on atlatls, just assumed some points used with them.]

**Archaeological Institute of America**

o

1999 “Who’s Buried in the Ice News Releases 1 and 3. *Archaeology Online*, URL <http://www.archaeology.org/online/news/iceman/1.html> accessed 9/13/2006

Announcing curation in Royal British Columbia Museum of Kwaday Dan Sinchi body and artifacts including spear and parts of possible hunting tools, plans for study, radiocarbon date between A.D. 1415-1445 on hat and robe.

**Arriaza, Bernardo T.**

o

1995 *Beyond Death: The Chinchorro Mummies of Ancient Chile*. Smithsonian Institution Press, Washington D.C.

Chilean coastal Archaic fishing culture, no pottery, no agriculture. Long tradition of mummy burial, several forms of mummy. Atlatls, light harpoons, drawings p 89, simple stick with attached hook, single finger loop [inadequate information].

**Arutiunov, S. A. and William W. Fitzhugh**

o

1988 Prehistory of Siberia and the Bering Sea. In *Crossroads of Continents: Cultures of Siberia and Alaska*, edited by W. W. Fitzhugh and A. Crowell, pp.117-129. Smithsonian Institution Press, Washington D.C.

Illustrations of various harpoon tips and stone tools. Old Bering Sea Culture (ca 500 BC) “winged objects” elaborately carved of ivory are considered to be counterbalance on the end of a harpoon with heavy head, and incorporate a socket for atlatl hook.

**Ashby, Ed**

o

2012 Papua New Guinea's Bows and Arrows. *Bulletin of Primitive Technology* 43:11-19.

Both stalking and stand hunting. Rusa deer, pigs, crocodiles, small game + fish. Deer taken at up to 25 yards and more. Bows in 80 lb range, pre-WWII of palm, post of bamboo. Strip string, unfletched long arrows. Pre-WWII points barbed wood, replaced now by heavy steel points, but spears still use wood pts. All arrows weighted strongly front of center. Pre-war 80+ cm long, mass around 1000 grains, weight 29-38% FOC. Post-war with steel tips 100+ cm long, mass around 2000 grains, 40+% FOC. Current bamboo bow narrower, because with heavier steel heads, arrows not stiff enough to shoot off of wider pre-war bows. Modern archers use 6-15% FOC, but original stone-tipped arrows 20-40% FOC, and in fact high FOC better - more stable flight, faster paradox recovery, boost in penetration.

**Ashby, Ed**

**x**

1996 Arrow Lethality. Electronic document, Alaska Bowhunting Supply LLC webpage, URL: <http://www.alaskabowhunting.com/Dr.-Ed-Ashby-W26.aspx> accessed 6/2012.

Penetration experiments on African game animals with different broadheads. Single blade broadheads with single bevel penetrate best. Multi-blade forms reduce penetration and are generally more fragile. Kinetic energy and momentum affect penetration, but kinetic energy ( $1/2 \text{ mass} \times \text{velocity squared}$ ) depends more on velocity which drag reduces quickly, while momentum ( $\text{mass} \times \text{velocity}$ ) is more dependent on mass, and is maintained throughout flight and impact. Thus heavier arrow better penetration. Penetration also affected by 1. mechanical advantage of cutting head.  $MA = \text{length of cutting blade divided by } 1/2 \text{ width of blade times number of blades}$ . 2. efficiency with which arrow uses force available, i.e. does not waste it in oscillation. 3. resistance of the arrow, drag by air and target material.

Damage to head limits penetration. Penetration correlates with percentage of killing hits. Most lethal shot angle is animal quartering away from archer, least is with animal quartering toward archer and shot hitting neck/shoulder junction. Single blade broadhead of high mass, with small diameter shaft is best.

**Ashby, Ed**

**x**

2007 Why Single-Bevel Broadheads? Electronic document, Alaska Bowhunting Supply LLC webpage, URL: <http://www.alaskabowhunting.com/Dr.-Ed-Ashby-W26.aspx> accessed 6/2012.

**Ashby, Ed**

**x**

2010 Momentum, Kinetic Energy, and Arrow Penetration (and What they Mean for the Bowhunter). Electronic document, Alaska Bowhunting Supply LLC webpage, URL: <http://www.alaskabowhunting.com/Dr.-Ed-Ashby-W26.aspx>

accessed 6/2012.

**Ashmore, Wendy, and Robert J. Sharer**

**o s**

2010 *Discovering Our Past: A Brief Introduction to Archaeology, 5<sup>th</sup> edition.*  
McGraw Hill, New York.

[Nice enough intro text, well illustrated, short.] P. 56-57 Atlatl replaced by more efficient bow and arrow around 500 AD, but “transformed over time into the calumet or peace pipe, thus becoming an important social and religious symbol.” [Idea probably from Hall. Illustrated with drawings of arrow, wands?, SW atlatl, Key Marco atlatl with rabbit hook, non-existent SW form with a Hopewell platform pipe used as the hook, and calumet. An evolutionary sequence is implied, but this is rubbish. Knapping and lithic technology drawings are poor.]

**Associated Press**

**o**

2004 Ice Patches: Hunting Darts, Bows, and More Surface as Ancient Snows Melt. *The Atlatl* 17 (2): 8-9.

Yukon alpine melting: c14 on dart shaft 9,300 years old, another 1,260, first bow and arrow evidence 1,300

**Associated Press**

**x**

2005 Pa. May Let Hunters Use Prehistoric Weapon. *New York Times*, November 13, 2005. URL [www.nytimes.com/aponline/national/AP-Hunting-Ancient-Weapon.html](http://www.nytimes.com/aponline/national/AP-Hunting-Ancient-Weapon.html), accessed 11/13/05.

State Game Commission considers legal atlatl deer hunt. Quotes Fogelman, Rowe, Perkins, Carr, Lyons. Attitude favorable.

**Associated Press**

**x**

2006 Game Commission Staff Advises Against Ancient Atlatl. *Pittsburgh Post-Gazette* January 10, 2006. URL <http://www.post-gazette.com/pg/pp/06010/635508.stm> accessed 1/11/06

Non-binding recommendation to Board of Commissioners not to legalize atlatl deer hunt, apparently under pressure from anti-hunting groups against “barbarous practices.”

**Associated Press**

**x**

2006 PA Spear Hunters Get ‘Shot Down’ by Game Commission.  
[www.abc27.com](http://www.abc27.com) web page URL  
<http://www.whm.com/news/stories/0106/292684.html> accessed 1/27/06

Rec made to commission not to legalize. Very brief, but with moronic comments from readers at bottom.

**Atwater, Anne E.**

x

1979 *Biomechanics of Overarm Throwing Movements and of Throwing Injuries. Exercise and Sport Sciences Reviews* 7:43-85.

“Overarm throwing ... involves the sequential action of body segments progressing from the larger, slower-moving trunk actions to the faster, distal actions of the relatively smaller arm and hand segments (43).” Usually takes less than 1 second from start until object release, velocity of ball can increase from 6 m/sec at 100 msec before release to 34 m/sec at release, so severe stresses on body.

Overarm baseball + softball throwing 17-39.6 m/sec, similar with either ball. Seen from overhead, ball does not follow straight path [in fact, odd zigzag line] because of rotation of the trunk, tendency to side-arm by bending at waist. Tennis serve similar to overarm throw [and seems likely to be more directly overarm - perhaps that is one effect of atlatl - forces more of a straight overarm motion, for greater efficiency?].

Injury - pitchers have hypertrophy of humerus and upper arm muscles, sometimes inability to fully extend elbow. Physical changes to tennis serving arm and shoulder similar to those of baseball pitchers. Shoulder and elbow problems about equally common. [Much more detail].

**Auel, Jean**

2002 *The Shelters of Stone*. Crown Publishers.

[see Edgar 2002]

**Augustine, Robert F.**

o&gt;s

2009 *Atlatl: An Archaeological Mystery*. XLibris Corporation, Bloomington, Indiana. [a self-publishing company]

Novel. Heroine Dr. Jacqueline Michenaud is an archaeologist at ASU. “Expert in archaic weaponry, J had developed significant practical expertise in the use of the bow, the spear thrower (the atlatl in Mexico and Central America), and the throwing stick (7).” Unfortunately, the story opens with her demonstrating to a class, burying her 18 inch, “similar to a crossbow bolt” dart “to the feathers” in a 2-inch thick pine board (8), which only demonstrates that Augustine and his heroine don’t really know anything about atlatls.

The plot involves a lost Aztec temple in central Arizona, and further improbable self-defense with atlatls found in it. They seem to use short copper darts, with detachable cone-shaped stone points. He doesn’t know much about artifacts or real archaeology either. Writing is not horrible, but amateurish.

**Austin, Donald**

o

2005 California Desert Rock Art. Rock Art CD # 1, Petroglyph.us,

[www.sandcarveddesigns.com](http://www.sandcarveddesigns.com), Culver City, CA.

CD, images and short site descriptions for a dozen S CA sites. Atlatl Cliffs site petroglyphs include several probable atlatls [but since no darts shown, nor atlatl in action, can't be positive], depicted as slightly curved shaft, curved hook always up, sometimes another hook (grip, finger loop?) near bottom, with large round, rectanguloid, or bilobed weight in center. [Look like bannerstones, but not found in this area]. Possible assoc w Pinto site nearby. [Nice images, good documentation for rock art fans].

**Austin, Toby** o

2011 Weighing In On Atlatl Weights. Unpublished class paper, Grinnell College.

Inconclusive experiments; suggests that difference in throwing style can negate any effects of weights.

**Bachechi, L., P.-F. Fabbri, and F. Mallegni**

1997 An Arrow-Caused Lesion in a Late Upper Paleolithic Human Pelvis. *Current Anthropology* 38 (1): 135-140.

By Mesolithic, bow + arrow widely distributed, but no evidence before end of Upper Paleolithic.

A female burial, Epigravettian, San Teodoro Cave, Sicily has fragment of backed triangular microlith in pelvis with sepsis and healing. Part of light point, so arrow likely [not adequate evidence]. Date ca. 14,000-12,000 b.p.

Other examples listed.

**Bacon, Jack** x

1995 World Record Set at Delaney Farm. *Aurora Sentinel* July 19, 1995:15-16.

Engvall distance record with modern gear 848' 6 5/8". Tate interviewed. Aztecs "penetrated metal armor"[myth]. Engvall also holds sling record of 1565' 4".

**Baer, John Leonard**

1921 A Preliminary Report on the So-Called "Bannerstones". *American Anthropologist* n.s. 23(4): 445-459.

C.C. Abbott responsible for term "bannerstone".

3 bannerstones with short stone shafts from NC, one pictured [can't tell if hole goes all the way through]

Describes manufacture process for winged bs from site in PA: slate blocked out, pecked, scraped, drilled, polished. Experiments by McGuire suggest 10.5 hrs for all that.

Fragile, unsharpened, no practical use: "mounted upon handles for ceremonial use".

**Baer, John Leonard**

x

1922 A Prochlorite Bannerstone Workshop. *American Anthropologist* 24:438-440.

Pennsylvania, near 1921 example, different material, different form bannerstones - biconvex, easier to work but same sequence. Assoc with steatite, possibly mined near.

**Bag, Allen J.**

2009 Copper Dart Points. *The Dart* Dec 2009:7.

Offering swaged copper field points – ISAC rules count as primitive. [Yeah, sort of].

**Baggett, Mark**

o

2009 A Hunt with Aunt Jemima. *Primitive Archer* 17(3):32-33.

Killed deer with brown glass point, cane arrow, self bow, 8 yards. Entry between ribs, split rib on other side but no exit.

**Baker, Shawn**

x

2004 Making a Unaaq, a Greenland Style Knob Harpoon. *The Masik: Quarterly Newsletter of Qajaq USA* 2(3):14-15. Electronic document, URL: [http://www.qajaqusa.org/newsletter/Masik\\_Fall2004\\_10043.pdf](http://www.qajaqusa.org/newsletter/Masik_Fall2004_10043.pdf)

Dense softwood or medium hardwood for right weight, for competition must be > 1kg. Poplar, fir. 62 - 79 inches long, 4-5 cm thick. Foreshaft should be bone but plastic is acceptable for competition. Balance point at 40-45%. [More details of construction, good photos.] The two pegs on side of harpoon fit in holes in thrower; should be “snap tight” - harpoon is not held on with fingers.

**Baker, W. E. and A. V. Kidder**

1937 A Spear Thrower from Oklahoma. *American Antiquity* 3(1): 51-52.

Spear thrower predates bows - SW evidence.

Cave find from Cimarron R., NW of Boise City.

Distal fragment of Basketmaker type, groove, flush hook, good illustration.

Associated sandals, corn, no pottery, slotted foreshaft.

**Bandelier, Adolf F.**

x

1877 On the Art of War and Mode of Warfare of the Ancient Mexicans. *Tenth Annual Report of the Peabody Museum*, pp. 95-161. Cambridge, MA.

Arms stored in tlachochcalli or “house of darts”. P 105 “dart or javelin (tlacochtli,

tlatzontectli) was the main weapon of the Mexicans... a short spear of hard and elastic canewood (otlatl)... flint, obsidian, copper points, sometimes multi, often tied to arm of warrior, or several carried loose. Footnote: “Torquemada mentions a sort of cross-bow which he calls atlatl... Atlatl however means a strap (amiento) fastening the helmet around the chin.” Use of cross-bow not established yet. Gonzala Fernandez de Ovieda y Valdes ‘Historia General y Natural de Indias’ mid 16 C, says “...Indians fight with darts which they throw by means of estoricas (a kind of avientos) a well made wooden contrivance. With this they hurl the javelin, always keeping the estorica in hand.” F. W. Putnam of Peabody Mus identifies the atlatl with the ‘throwing stick’ of the Aleutians...” [In other words, dart to Bandelier meant javelin, and he had no real understanding of atlatls or their mention in texts at the time.]

Slings, macana or maccuahuitl swords of wood with obsidian blades in slots. Quilted cotton armor adopted by Spanish subsequently.

**Bandi, H. G.** **s**

1988 Mis bas et non defecation. Nouvelle interpretation de trois propulseurs magdaleniens sur de bases zoologiques, ethnologiques et symboliques. Espacio, tiempo y forma, serie I, *Préhistoria* t.1 :133-147.

[Giving birth and not defecation: New interpretation of three Magdalenian spearthrowers on the basis of zoology, ethnology, and symbology.] See Demoulin 2002.

**Banks, Alan** **o**

2010 Shannon County Bannerstones. *Missouri Archaeological Society Quarterly* 27(2):22-23.

Rare in MO, near W boundary of bannerstone distribution. Only 4 known from Shannon Co. in E Ozarks, 2 unfinished, and one drill core.

**Barge-Mahieu, H., H. Camps-Fabrer, V. Feruglio, A. Peltier, and D.**

**Remseyer** **o**

1992 *Bâtons Percés, Baguettes*. Fiches Typologiques de L’Industrie Osseuse Préhistorique, Cahier V. Editions du Cedarc, Treignes.

**Barker, Wayne, Brian Hayden, and Alistair Hallum** **o**

1981 Western Desert Woomera: Fashioned with Stone Tools. VHS, Australian Institute of Aboriginal Studies.

VHS ca 15 min. Two men from S of Lake McDonald in Central Australia. Shows one throw, holding woomera flat or slightly tilted, with hammer hold, thumb and forefinger raised to spear. Spear looks >2 m long, wooden barb, “can throw more than 100 m.” Select mulga tree, use stone blocks a choppers, notch living tree, split out blank by hammering chopper into deep top cut, prying with stick.

Resharpen choppers by direct percussion with hammer stone, abandon tools on site. Initial shaping with smaller chopper, 2 men working at once. Then small adze, a stone flake on long straight wood handle fixed with spinifex gum. Resharpened with teeth (shown) to avoid loosening hafting, or with odd thrusting blows of sharp wooden stick. Finished by scraping with the adze. Wooden peg hook attached with kangaroo sinew, pours sand on it to dry. Mounts flake on handle with spinifex, oils wood to prevent split. Took 2 men about 12.5 hrs.

**Bassett, Douglas**

o

2007 The Atlatl in New York State. *New York Atlatl Association Newsletter* 3:4-7.

No archaeological finds in NY except points and bannerstones from several Archaic cultures. Photos from Ritchie 1969.

**Bassett, Douglas**

o

2007 Types of Bannerstones in New York State. *The New York Atlatl Association Newsletter* 2 (2): 9-11.

Types and distribution maps from Knoblock.

**Bassett, Douglas**

o

2007 19<sup>th</sup> Annual Eastern Seaboard Atlatl Competition, Letchworth State Park, NY. *The Atlatl* 20(4):3-4.

Variety of games. Attempts to quantify kills on animal targets - 10 targets life size at realistic distances 7-16 m, 60 attempts, 42% hits, ca 1/3 would be captures, 25% quick death, top six throwers 52% hits, 47% retrieval, 32% quick kill.

**Bassett, Douglas**

o

2008 2007 ISAC Highlights from the Youth, Top 25, and Aggregate Record Books. *The Atlatl* 21(2):5-6.

**Bassett, Douglas**

o

2011 Top 100 World Atlatlists in the International Standard Accuracy Contest as of 2010. *The Atlatl* 24(4):3-5.

Ranking by complex calculation: (Total years on list) divided by (sum of rankings for each year) X (total years) X (average score expressed as %) = final score for ranking.

**Bassett, Douglas, and Pascal Chauvaux**

o

2008 The European Round: A Short History, Description, and Some Personal Best Scores. *New York Atlatl Association Newsletter* 3(2):8-10. Also electronic document on WAA Webpage, accessed 4/08, URL:

<http://www.worldatlatl.org/Articles/The%20European%20Round%20-%20PC.doc>

**Bassett, Douglas**

2010 2009 Highlights from the Youth, Top 25, and Aggregate Record Books. *The Atlatl* 23(2):6-7.

**Baugh, Dick**

1986 A Note on Indian Bow Making, or the Secrets of Sinew Revealed. *Flintknapping Digest* 3(1): 10-12.

Experiments with sinew – says it shrinks 3%.

**Baugh, Dick**

1994 A Note on Indian Bow Making, or the Secrets of Sinew Revealed. *Bulletin of Primitive Technology* 7(1):68-69.

Experiments with sinew and sinew backings.

**Baugh, Richard A.**

1998 Atlatl Dynamics. *Lithic Technology* 23(1):31-41.

Video digitizer and mathematical model used to predict velocity of darts under given conditions. - horizontal force, wrist torque, mass of hand, radius of gyration, weight of dart, length of atlatl. Simpler model than Cotterell and Kamminga 1989.

Hand-thrown dart has short lever action (hand+wrist) while atlatl is much longer lever.

Conclusions: Atlatl length (between .3-.75m) has little effect on velocity, although optimum length was .45 m. Adding a weight to atlatl can increase velocity up to 2.7%, but if atlatl at optimum length, always loses velocity. Heavy darts do better with short atlatls. Hand thrown dart (2 different weights) has 62-75% kinetic energy of same thrown by atlatl. Flexible atlatl transfers more energy to dart - their atlatl stored ca. 6.9% of dart's kinetic energy - more flex would be even better. Dart flex contributes little energy to forward motion, is mostly vibrational, but important in getting straight throw despite curving motion of atlatl. [Are differences of 3-7% real or random? I am dubious about effects of both atlatl weights and flex, but he's right that dart flex adds little energy. I have trouble understanding his explanations of physics.]

**Baugh, Dick**

2001 Arrow Straightening. *Bulletin of Primitive Technology* 22:51-52.

Use of heat and grooved steatite shaft straightener.

**Baugh, Richard A.**

2002 The Tuning of Atlatl Darts. *Bulletin of Primitive Technology* 23:89-91.

Force is not applied in a straight line, so dart must flex. If end kicks up, dart is too limber, if down, too stiff. Test before fletching. The harder you throw, the stiffer the dart should be. Fairly wide range is acceptable; well-tuned dart works for hard to moderate throw but kicks down for easy toss. Periodicity of dart vibration must match distance/time of throw. Flex of atlatl has little effect on “tuning” and flex of atlatl or dart contributes almost no energy to throw.

**Baugh, Dick**

2002 Atlatl Flexibility Analysis Via Computer Modeling. accessed 7/02 on <http://www.primitiveways.com/pt-atlatlflex.html>.

“Extravagant claims made for increased dart velocity with flexible atlatl.” Uses computer model to show that to get 11% increase in kinetic energy, need to deflect the tip of the atlatl ca. 10 cm. [Possible with some very flexible atlatls.]

**Baugh, Richard A.**

2003 Dynamics of Spear Throwing. *American Journal of Physics* 71 (4): 345-350.

Atlatl is a lever, operating principle is “Wrist torque applied to the length of the atlatl allows wrist rotation to increase the velocity of the dart.” Simple computer model to predict velocity of dart, affected by mass of dart and length and mass of atlatl. Horizontal force and wrist torque versus hand position derived from video record of throws; two other variables are hand mass and hand radius of gyration. Some horizontal force applied by hand, but most force from wrist rotation of the lever arm formed by atlatl. Spear, ball and atlatl throws are all the same except for the length of this lever. Can model a flexible atlatl by inserting a massless spring in model between hook and dart.

Model results: Atlatl length for max velocity is shorter than most actual use, but this may be because model assumes that human effort is not affected by mass of atlatl, or difference in velocity from atlatl length may be too small to be perceptible. Atlatl weights reduce velocity slightly, more as they are larger and further from hand. [His graph suggests up to 30% decrease in velocity with 120 gm wt at 80% of distance from hand.] Flexible atlatl should increase velocity. [But seems to have less effect than weights, maybe 12% increase. Also, his model does not take account of the dart flex, and he uses a range of spring models “representing actual practice” – but nowhere is there evidence that he actually measured atlatl flex.]

[I have a hard time evaluating the mathematical model, but the results make sense. We need more of this kind of work.]

**Baugh, Richard A.**



Godine Publisher Inc, Jaffrey, NH. (reprint of original edition 1890, Charles Scribner's Sons, New York.)

p. 195 "Throw-Sticks" "The same race that invented the wonderful boomerang also originated the equally ingenious throw-stick..." [illustration and inadequate explanation. Also boomerang, whip-bow, bolas, fish spear, etc].

**Beattie, Owen, B. Apland, E. W. Blake, J. A. Cosgrove, S. Gaunt, S. Greer, A. P. Mackie, J. E. Mackie, D. Straathof, V. Thorpe, and P. M. Troffe** x  
2000 The Kwaday Dan Ts'inchi Discovery from a Glacier in British Columbia. *Canadian Journal of Archaeology* 24 (1+2): 129-147.

"Long-ago person found" 1999 in glacier margin by hunters. Careful archaeological recovery [contrast to disgracefully botched Austrian Oetsi ice-man], but artifacts collected from wide area around body. Dates at least 2 events: clothes 1415-1445 cal AD, wooden artifacts post 1655. Assoc w body and same dates: 1. knife? wood handle w iron stain in leather pouch 2. basketry hat 3. hide/fur garment frags 4. disk bead 5. hide pouch – considered medicine pouch so not examined [sheesh!] 6. simple wooden dart, sapling 170 cm long, sharpened tip, dimpled prox [fletching not mentioned] 7. proj foreshaft, wood 125 cm, beveled one end, broken other.

Other artifacts: 8. sapling walking stick, 230 cm, near body but dates later 9. poss wood proj foreshaft 180 cm, notched and beveled end, distant, later date 1490-1665 cal AD 10. complete wooden implement sim to atlatl, or to netting or snare setting tool. Curved with hook at distal end, comes to flattened rounded point at prox end, 72 cm long, zig-zag décor and ochre staining. Distant, C14 gives several possible late date ranges from 1530 to 1950. 11. dart or arrow shaft frags, 30 cm, late.

Bits of salmon, prob carried by man, also plant remains near by.

Ongoing DNA, parasitology, diet, skeletal etc studies not reportable yet. Male late teens early 20s, missing head except some hair, feet, R arm. No trauma or tattoos. Historically Athapaskan and Tlingit groups.

[Would be surprisingly late for atlatl gear, but doesn't sound right to me. Dates and actual associations are confusing - what really goes with the body? The "foreshafts" are too big, more likely shaft segments. What's the problem with the atlatl? If it's whole, you should be able to tell if it's an atlatl. Inexcusably, there are no photos of the wooden artifacts, and the description is feeble. Atlatls are not typical in ethnographic times in this area, and if dates and ID are right, this find makes at least two instances. Way too much info on the freezer and conservation details but not enough on the interesting issues. I attempted to communicate with the archaeologists ca 2005, and it appeared that the bullshit "sensitivity" about burial finds these days was holding up proper publication. As if a dead hunter cares whether other people see his gear! However, see Richards et al. 2007 - dates and isotopic analysis of the body were allowed, so perhaps we will someday see the artifact info.]

**Beck, Charlotte**

x

1995 Functional Attributes and the Differential Persistence of Great Basin Dart Forms. *Journal of California and Great Basin Anthropology* 17(2):222-243.

Corner-notched forms eg Elko occur earlier and last longer in E than W. Large side-notched forms mostly occur where large corner-notched forms have long temporal distributions. Large stemmed forms probably = thrusting/knives, change to atlatl corner-notched forms ca 8500-7500 BP. Corner and side-notching appear same time, but corner eventually dominates, so perhaps more functional, carried on into arrow times, until very late side-notching resumed on arrow points. Costs vs benefits of diff forms, based on “design principles”: dart pt should be sharp, symmetrical, impact resistant. CN/SN no diffs in material, manufacture cost, or width + sharpness (influencing penetration), or symmetry/balance. But SN more likely to break higher up point at notches, can’t be resharpened, reducing use-life.

**Beck, Charlotte, and George T. Jones**

o

2008 Archaic Times. In *The Great Basin: People and Places in Ancient Times*, Catherine S. Fowler and Don D. Fowler, eds., pp. 44-53. School for Advanced Research Press, Santa Fe.

Summarizes the period in a readable, authoritative, and well-illustrated book of popular/professional archaeology. Archaic foragers, beginning 8500 BP, local diversification. New technologies: notched pts replaced stemmed Paleoarchaic points, more efficient hafting, usually break at notches leaving reworkable portion. Probably reflects introduction of atlatl. [Fig 6.3 is the somewhat inaccurate Driver drawing of atlatl use from Plog.] Atlatl “can deliver a stone-tipped spear with considerable accuracy and force over distances of 40-50 feet... effective tool against animals ... herded into places where they could be ambushed.” Antelope traps, game drives, nets discussed. Projectile point types and chronology. Bow and arrow arrived 2000-1500 years ago, in Late Archaic, evidenced by Rosegate series proj pts (small corner-notched). Bettinger thinks easier individual hunting, led to more meat sharing.

**Beck, Curt W.**

x

1996 Comments on a Supposed Clovis “Mastic.” *Journal of Archaeological Science* 23: 459-460.

Tankersley’s definitions of mastic, amber not correct. True amber does not melt. His tests not adequate to establish what the material on the Clovis point is. If it is not amber it doesn’t serve as another shared trait between Up Pal and Clovis. [Some of the quibbles are silly, some good, but Beck also misses the point – was the resin adhesive on the point fresh or fossilized at time of use? Can we tell?]

**Becker, Lou**

1992 Atlatl Boar Hunt. *The Atlatl* 5(3):1-5.

Large darts - 160-195 gm, steel broadheads, > 1 m penetration in boar at 15-20 m.

**Becker, Lou**

1995 Atlatl and Primitive Self-Bow Boar Hunt 1995. *The Atlatl* 8(3):7-8

Hunt story, no lessons.

**Becker, Lou**

1995 Care and Feeding of Wooden Atlatl Darts. *The Atlatl* 8(2):1-2

Favors poplar, birch woods. Target = 117 gm, hunting = 259 gm, fletched with 3 or 4 feathers 6.5-7.5 inches long. Explains straightening darts by "stroking" with a hook.

**Becker, Lou**

1999 Let's Exercise those "Atlatl" Muscles. *The Atlatl* 12(1):4-5.

Simple exercises with spring cable set.

**Becker, Lou**

2001 Hunting Rough Fish with the Ancient Atlatl. *The Atlatl* 14(2):12-13.

2002 Hunting Rough Fish with the Ancient Atlatl. *The Cast* Spring 2002:15-16.

Michigan carp fishing. Heavy dart (190 gm). Prefers banks and wading to boat.

**Becker, Lou**

2001 Atlatl Rough Fish Hunting Equipment. *The Atlatl* 14(3):10.

Prefers wood or fiberglass darts, hand held reel, gives instructions for making reel.

**Becker, Lou**

**o**

2008 Chucking Darts at Woodchucks. *The Atlatl* 22(1):16-18.

Tips on woodchuck behavior. Ranges around 15 yards, uses rigid wood atlatl and cane or wood darts with broadheads. Field dressing and pie recipe.

**Bell, Robert E.**

**x**

1962 Stone Bird Effigies from Ecuador. *Central States Archaeological Journal* 9(1):28-29.

Similar to birdstones, used as hooks on atlatls, related forms used as finger rests tied to handle. Birdstones in US could also be atlatl hooks.

**Bellier, C. and P. Cattelain**

x

1989 Troisième Championnat International Rhénan de Tir au Propulseur. *Bulletin de la Société Préhistorique Française* 86(7):166-167, 194-195.

Competition organized by Stodiek at Cologne-Klettenberg, 5 women, 15 men participated. New distance record over last year's 101.5 m - now M. Schirren 140.6m, H. Eckard 132.6, P. Chauvaux 115.45 m. Accuracy best with long "sagaies" - Chauvaux, Pirotte, Cattelain, and Sonja Souvenir champs. Scientific value of such games: compare equipment, throwing styles, and test efficiency.

**Bement, Leland C., Ernest L. Lundelius, and Richard A. Ketcham**

o

2005 Hoax or History: A Bison Skull with Embedded Calf Creek Projectile Point. *Plains Anthropologist* 50 (195): 221-226.

Amateur river find, Oklahoma. Tests include: CT scan, determining that bone flexed = fresh at impact. Shattered point can be reconstructed, damage consistent with impact. Biometric analysis of skull concludes *Bison antiquus occidentalis*, correct for Calf Crk period. C14 date on skull 5,120±125 BP uncal agrees.

So CC pts not just knives, but atlatl dart pts (cites Hutchings velocity ideas).

**Benson, Elizabeth P.**

o

2008 Iconography Meets Archaeology. In *The Art and Archaeology of the Moche: An Ancient Andean Society of the Peruvian North Coast*. Steve Bourget and Kimberly L. Jones, eds., pp. 1-21. University of Texas Press, Austin.

Archaeol now confirming artifacts, architecture, and rituals seen in iconography. E.g. mace as symbol; ritualized fighting but iconography often metonymy - "slings + spearthrowers shown but not used. This rather fits the pattern of other shorthand depictions. It probably should not be an argument against serious warfare.

**Berenguer, Jose, Carole Sinclair, Luis Cornejo, and Manuel Escobar**

elec

2009 *Pescadores de la Niebla: Los Changos y sus Ancestros*. (Fishers of the Fog: The Changos and their Ancestors). Museo Chileno de Arte Precolombino, Santiago, Chile.

[Exposition catalog, in Spanish, with English summaries and fine color photos.] Marine Gatherer phase along coast from 10,000 BP, followed by Early Fisherman stage, with hook appearing in 6<sup>th</sup> millenium BC, complex mummification in some areas (Chinchorro culture), beginnings of agriculture in some areas, many localized cultural variations. Late Fisherman stage, invention of raft, travel far on open ocean, agriculture. Photo of elaborate atlatl (*estólica*) of wood, [one-hole S. American type] with two faces decorated with copper mineral eyes, and a slot, 53 cm long, p23. Also bows, arrows, several depictions of foreshafts with harpoon,

stone, and spine points [chronology unclear].

**Berg, Robert S.**

1995 A Wild Boar Hunt at Cold Brook: An Eolithic Adventure. *Chips* 7(3):4-5.

1996 A Wild Boar Hunt at Cold Brook: A Stone Age Adventure. *The Atlatl* 9(1):1-2

Same short account of killing boar with atlatl and dart.

**Berg, Bob**

2001 Aztec Atlatl Battle. Thunderbird Atlatl Webpage (<http://www.thunderbirdatlatl.com/>) accessed 10/11/01.

Rules for a team game.

**Berg, Bob**

2001 Benefits of Atlatl Weights. . Thunderbird Atlatl Webpage (<http://www.thunderbirdatlatl.com/>) accessed 10/11/01.

Flex of atlatl and dart has little effect because you can't get out more energy than you put in. Weights help accuracy only. Weight closer to distal end is less efficient.

**Berg, Bob**

o

2002 The Atlatl Hunt that Got Weird or Blunt Trauma. *The Atlatl* 15(2):12

Bob lent his atlatl, killed deer with a rock.

**Berg, Bob**

o

2002 Atlatl Long Shots and Primal Instinct. *The Atlatl* 15(1):8

Hunting fallow deer, two long shots, 40-55 yards. Doug Majorsky only wounded the deer because dart was too light (3 1/2 oz) and stone point too loose. Berg killed his, gear not specified [but presumably stone tip].

**Berg, Bob**

o

2003 Fishing with Atlatls and Harpoons. *The Cast Spring* 2003:15.

Carp and gar, using night lights, harpoon tips, line on darts. Photos of tackle and catch.

**Berg, Bob**

o

2004 Atlatl Hog Hunt on the Alapaha River. *The Atlatl* 17(2): 1-2.

Killed hog at 12 yards [no other useful info].

**Berg, Bob** x

2005 Bannerstones and How They Relate to the Atlatl. Electronic document, URL <http://www.thunderbirdatlatl.com/newspost/arc5-2005.html> accessed 1/20/08.

Part of a kit of tools used to make and repair atlatl darts - bannerstone is spindle weight to spin string and taper dart shafts. Experiments show it works - need cordage for whipping dart shafts and attach fletching. Used as flywheel on bowdrill arrangement to spin shaft while using abrasive in leather to round and smooth dart shaft. Bannerstones are designed to spin, and holes range from too large to too small for atlatl, and too heavy. [These last are unsupported assumptions and contradicted by other experiments, but the basic idea is reasonable and shows how replicative experiments + archaeological evidence can still remain equivocal].

**Berg, Bob** x

2006 Benefits of Atlatl Weights. Electronic document, URL <http://www.thunderbirdatlatl.com/articles/ramble/bow.shtml> accessed 1/20/08.

Flexing shaft and atlatl stores little energy. Weights add stability to cast.

**Berger, Billy** o

2009 The Art of Making Primitive Arrows. *Primitive Archer* 17(2):16-22.

Good tips apply to atlatl darts too.

**Berger, Billy** o

2009 The Lethality of the Primitive Bow. *Primitive Archer* 17(5):30-35.

Defends accuracy, power and effectiveness of primitive bow and stone tipped arrows, lots of anecdotes of successful hunts.

**Berger, Billy**

2011 How to Make Pine Sap Glue. *Primitive Archer* 19(2):48-53.

Tips for hafting stone arrow points with sap and sinew.

**Berger, Billy** o

2011 How to Remove Sinew from a Deer. *Primitive Archer* 19(5):32-39.

**Bergman, Christopher A. and Edward McEwen** o

1997 Sinew-reinforced and composite bows: Technology, function, and social implications. In *Projectile Technology*. H. Knecht, ed., pp. 143-160. Plenum Press: NY.

Summarizes bow types; discusses technology and manufacture and mechanics of composite bows, as still made in Mongolia.

**Bergman, C. A., E. McEwen, and R. Miller** **xo**

1988 *Experimental Archery: Projectile Velocities and Comparison of Bow Performances*. *Antiquity* 62 (237): 658-670.

Bow developed end of Upper Paleolithic, earliest examples are Mesolithic, earliest composite bows 3<sup>rd</sup> millennium BC in Asia. Experimental bow comparisons should use correct reproductions of old bows and arrows proper to each bow. Velocity is used as measure of comparison.

Arrow velocities achieved were 30-60 mps from a variety of self and composite bows. Compared to 195 gm, 152 cm dart thrown with replica Basketmaker atlatl at 23 mps.

**Berndt, Ronald**, editor

1964 *Australian Aboriginal Art* Ronald Berndt, pp. 44-59. The Macmillan Company, New York.

Includes pictures of spearthrowers, see Strehlow 1964, plate of pictograph hunter attacking x-ray style kangaroo with odd-looking spear thrower, plate of incised Central and Western art including spearthrower, plate of spears and painted flat lathe spearthrowers from Arnhem Land (Groote Eylandt and Yirrkalla).

**Berndt, R. M. and C. Berndt** **s**

1970 *Man, Land, and Myth in North Australia: the Gunwinggu People*. East Lansing: Michigan State University Press.

Creation myth: "Ngalgulerg (a mythical woman) gave us women the digging stick and the basket we hang from our foreheads, and Gulubar Kangaroo gave men the spear-thrower." [Not a smart move by the Kangaroo! But presumably it represents Kangaroo giving self as human food.]

**Best, Anne** **o**

2003 *Regional Variation in the Material Culture of Hunter Gatherers: Social and Ecological Approaches to Ethnographic Objects from Queensland, Australia*. BAR International Series 1149.

Objects collected 1849-1914 from Queensland (N peninsula of Aust) examined to see if stylistic variation within Q forms regional patterns by drainage or valley system. Uses Bags/baskets, Message Sticks, Boomerangs, Shields, Spears (N = 202), and Spear-Throwers (161).

Lots of generally useful summary of theory - style, hunter-gatherers, use of museum collections. Style of artifacts expected to convey social information,

localized by social group with some environmental input [from available material and function, both of which she considers partly stylistic]. Social info conveyed at many levels of complexity and audience. Rock art as supporting evidence.

Spears: mostly 2-part: light wood for proximal piece [main shaft?] and hard for distal point end. Variety of barbs and prongs used.. N Qnsld usually with thrower, hollowed prox end. Hunting and combat. Photos of making barbs, throwing 4-prong spear w thrower. Distribution mostly considered in terms of point types.

Spearthrower or wommera: Act as extension of human arm. Eyre (1845:305) observed 30-100 yd throw with thrower, 30-40 by hand. Cape York broad bladed throwers used as spear guard during combat. Cundy argues much variation from technol - light high velocity spear or heavy slower combined with proper throwers. Boomerang and straight-lath forms used in short range exchange in Cape York and Rainforest regions, leaf-shaped form exchanged in extreme W and shell-handled forms part of long down the line trade from Gulf coast inland. Some areas prefer hand thrown spear - throwers lacking in E Coast and Riverine [SE] areas, most plentiful Cape York [peninsula].

Defines 7 types: 1. straight lath with no handle, 2. straight lath with handle of shell or wood, 3. slight paddle shape, 4. paddle shape with handle, 5. boomerang shape [all these are variants of Queensland type with shaft edge up, large attached vertical peg hook, and often shell handle], 6. leaf shape with adze [W or Central Aust type woomera], and 7. cylindrical shape [stick with hook, one with hair tassel, Mornington Island type].

Distrib: 1 - S central parts; 2 - more N, E Cape York with wood handles, W side and Gulf with baler Melo shell. 3 - paddle shape unique to Cape York, mostly Gulf side (W). 4 - slight paddle shape, never w wood handles, all CY and mostly Gulf. 5 - boomerang form S part of CY and Rainforest area, along E coast. Some are >70 cm long. 6 - all 8 specimens from extreme S = social contacts, Roth says 4 uses: wommera, pituri plate, spear pt sharpener [adze], and sword. 7- extreme W of Gulf - Mornington Island and adjacent mainland at Burketown.

Roth says of 5 - used for fish and other close range game, held different from all other wommeras with blade between thumb and first finger instead of between 1 + 2 fingers. E Coast and Riverine [S E] parts of Qland lack throwers.

[There are simple drawings of artifact types, and nice historical photos of people with them, but disappointingly, no detail photos of artifact specimens, so much of the variation she discusses is poorly illustrated.]

### **Bettinger, Robert L. and Jelmer Eerkens**

o

1999 Point Typologies, Cultural Transmission, and the Spread of Bow-and-Arrow Technology in the Prehistoric Great Basin. *American Antiquity* 64(2):231-242.

Great Basin transition to small points (= bow and arrow) ca. 1350 B.P.

Two areas anomalous: 1) central NV lots light pts that should be darts - probably because of resharpening limited material. 2) E. CA light pts with base/neck too



combat. As a result, language, ethics, brain size etc all possible. Historically, increasingly effective distance weapons make possible larger social groups. Example: change from atlatl to bow and arrow in N. America allowed complexity and large populations. [Suffers from the weaknesses of all single-cause, overgeneralized theories – many specifics don't really fit all that well.]

**Bindon, P., Raynal, J.P., and Sonnevile-Bordes, D. x**

1987 Sagaies en bois d'Australie occidentale: fabrication, fixation, fonctions. [Wooden Spear Points from Western Australia : Manufacture, Attachment, Functions.] In *Le Main et l'Outil: Manches et emmanchements préhistoriques*. D. Stordeur ed., pp 103-116. Lyon: Maison de l'Orient.

Small beveled wooden points currently made in Wiluna area can be either spear barbs or spear-thrower hooks on Western Desert woomera type atlatl, and resemble bone points from Upper Paleolithic Europe.

**Bird, Douglas, and Rebecca Bliege Bird x**

2000 The Ethnoarchaeology of Juvenile Foragers: Shellfishing Strategies among Meriam Children. *Journal of Anthropological Archaeology* 19:461-476.

Children usually assumed to have little effect on subsistence and thus on arch record. Long juvenile period necessary to learn skills.

Children feed selves but select different shellfish from adults, learn from other children. They collect lower quality resources partly because slower, so encounter fewer of the high quality. They transport more home before processing, increasing presence of low-ranked resources in site.

**Bird, Douglas, and Rebecca Bliege Bird s**

2005 Martu Children's Hunting Strategies in the Western Desert, Australia. In *Hunter-Gatherer Childhoods: Evolutionary, Developmental and Cultural Perspectives*, edited by Barry S. Hewlett and Michael E. Lamb, pp. 129-146. New Brunswick, Transaction Publishers.

Children age 5-14 hunt goanna (burrowing lizards) in rocky patches with digging sticks, in preference to different goannas hunted by adults in sand fields. Size affects success more than age/experience, probably because speed of walking increases number of encounters (ca 1.5/hr). [Western Desert, but no info on any use of woomera by child or adult].

**Bird, George**

1985 The Atl-atl or Spear Throwing Stick. *The Artifact* 23(3):7-18. El Paso Archaeological Society.

Personal meanings of atlatl, describes basic manufacture, woods, finds no difference with weights, likes short dart 2x as long as atlatl

[Over simple and impressionistic, nothing new, but ok]

**Bird, Junius** o

1951 South American Radiocarbon Dates. In *Radiocarbon Dating: A Report on the Program to Aid in the Development of the Method of Dating*. F. Johnson, ed. *Memoirs of the Society for American Archaeology* 8:37-49.

Suggests dates on Nazca atlatl material [see Johnson 1985] differ because darts may be younger wood than the atlatl.

**Birkett, Courtney** o

1999 Lengths Not To Go To in Atlatls. *The Atlatl* 12(1):3.

Reports her experiment with different lengths of atlatl: thrown distance increases with longer atlatl, but beyond 2.5' gets too clumsy.

**Bittmann, Bente, and Juan R. Munizaga**

1984 Comments on a Double Mummy Containing a Spear Thrower, in the "Anke Nielsen Collection", Iquique, Northern Chile. *Indiana* 9:383-419. (Berlin)

Chinchorro Culture, Late Archaic, 5000-1000 BC, coastal, harpoon + spear throwers, also earliest evidence of bow in Americas, prepared mummy burials.

Double infant mummy wrapped in cloth + leather.

Atlatl = 51.7 cm, wood, grooved, hook separate and missing, finger loop on one side of handle only

Describes other S. Am. atlatls - diverse forms, long comparative and typological discussion.

**Blair, J. Allan** x

1977 Banner Stones or Spinning Stones? *Arch Notes* 77(7):37-39.

Durable + small, so not banners, mass too far from center line + hole too narrow, so not atlatl weights. But works as flywheel on spindle.

**Blair, Michael** x

2001 Applying Age-Old Physics. *The Science Teacher* 68 (9): 32-37.

Uses atlatl, trebuchet, and fire-plow to teach physics. Compares force of hand-thrown and atlatl spears, gives formula.

**Blitz, John H.**

1988 Adoption of the Bow in Prehistoric North America. *North American Archaeologist* 9(2):123-145.

Reviews regional evidence: Arctic by 3000 B.C. (microblades and small pts);

Subarctic 500-600 AD (small bifacial pts); Plains N by 200 AD, WY by 500 AD, S Plains after 500 AD (small notched pts); Great Basin reduction in pt size AD 1-500, small triangular pts (Desert Side Notched and Cottonwood Triangular) appear 800-1200, if Rosegate series are arrow pts, then bow ca. 200 AD, with probable overlap with atlatl; NW and CA after 500 AD (shift to small pts); Southwest "unambiguous" replacement in Basketmaker III 575-750 AD; NE Woodland triangular Levanna pts 600-700 AD; MidW and SE sudden appearance small triangular pts ca 700 AD.

Patterns: 1. Small points are the only widely useful archaeological criteria. 2. Spread was N to S and rapid so diffusion is indicated as well as migration. 3. Long stasis in Arctic, quick spread further S. 4. Beginning 200 AD, intensifying after 500 AD is trend to small pts. When small and large pts coexist (Gt Basin), there is also other evidence for atlatl. When sudden shift to small pts (SW, Plains, MidW, SE) atlatl rapidly disappears from record.

Atlatl best for water-based hunting, but bow better accuracy, range, more efficient. But no evidence of major change in hunting pattern or success with bow. Bow might enhance individual hunt success and thus individual prestige, or better warfare, allowing intergroup competition and expansion. Some evidence of warfare increases after bow - bodies with points, defensive structures.

Bow spread across ecological boundaries as result of its "contagious competitive advantage in intergroup conflict."

### **Blurton Jones, Nick**

s

2005 Introduction. In *Hunter-Gatherer Childhoods: Evolutionary, Developmental and Cultural Perspectives*, edited by Barry S. Hewlett and Michael E. Lamb, pp. 105-108. New Brunswick, Transaction Publishers.

Human extended juvenile period can be seen as allowing foraging skills to be learned before maturity and reproduction. But children learn rapidly, may even be better than adults at some skills, forage optimally for their size (selecting prey and location that are efficient for them), and also hunters may learn late: "Kung do not begin to hunt until they are 20 or so (Nancy Howell p.c.), and Walker et al (2002) show that Ache hunting success increases during the adult years, as it does among the Hadza (Marlowe 2000a, Blurton Jones and Marlowe 2002). These findings contradict the earliest ideas about subsistence learning and the juvenile period, that learning is not all accomplished before adulthood. Most Ache and Hadza men are married with children long before they reach their peak hunting efficiency. Foraging must be learned, but it is learned as a juvenile and adult and seems to have little direct relationship to the age at which reproduction begins."

### **Boas, Franz**

x

1955 [1927] *Primitive Art*. Dover Publications, New York.

Chapter on Style:

"...we may consider as works of art undecorated implements made by a perfectly

controlled technique -- in other words, made by a virtuoso. Such are polished stone axes, chipped arrow or lance heads, iron spear heads, spoons, boxes; in short, any object of daily use, provide only the form which we may recognize as conceived in crude specimens, is worked out in a perfect technique.” p 144  
 P 145 example of regional styles is Eskimo throwing sticks from different areas, illustrated with small engraving of different forms: “fixity of type...related to manner of use” ... The adaptation of the hand to the handle does not permit the use of forms that require unusual muscular movements which would lessen the accuracy and ease of use. Therefore the variations of form are confined to the limits established by the fixed motor habits of the people. Even if a variation should appeal to the eye, it will not be adopted if it should require a new adjustment of the hands...”

p 149: ...resistance to sudden changes... is expressed through an emotional attachment to customary forms.... Love of the special tool... induces man to bestow much labor upon the manufacture...a love that implies pleasure in customary movements as well as in the form of the implement. This mental attitude is one of the most important sources of conservatism in the form of objects of use, and of the tendency to give them the greatest possible technical excellence. The intensity of the emotional relation between a person and his tool is naturally greatest when maker and user are the same person; it must decay with the ease with which substitutes are obtained. Here is one of the causes of the rapid decay in the beauty of form of native utensils as soon as European tools and manufactures are introduced.”

**Boas, Franz** s

1938 *General Anthropology*. DC Heath and Company, Boston.

Pp 243-244: “Increased initial velocity of the thrown lance is also secured by an artificial lengthening of the arm by means of a wooden implement, held in the hand, which ends in a peg or groove – an artificial hand that holds the end of the spear. This point being farther removed from the shoulder moves more rapidly and gives to the weapon an increased impetus. The throwing board is probably a very ancient invention.” (quoted in Webb 1957)

**Bock, John** s

2005 What Makes a Competent Adult Forager. In *Hunter-Gatherer Childhoods: Evolutionary, Developmental and Cultural Perspectives*, edited by Barry S. Hewlett and Michael E. Lamb, pp. 109-128. New Brunswick, Transaction Publishers.

Skill and “growth-based embodied capital” examined among San and Bantu semi-settled foragers in Botswana. Measured arm pull strength, efficiency in mongongo nut processing, and fishing success with line (boys) and baskets (girls). Mongongo processing improves from age 10-40, declines after, when controlling for arm strength. Continued increase after growth stops in 20s suggests growth-

based embodied capital [ie strength] not the primary factor [ok, but then why does efficiency decline?] Girl's fishing catch rate depends on age, size of fish, somewhat on strength. Boys success affected by strength more than age (= ability to pole canoe to good spots), but size of fish is age-dependent (= higher skill in finding fish, using technology).

**Bocquentin, Fanny, and Ofer Bar-Yosef**

**x**

2004 Early Natufian Remains: Evidence for Physical Conflict from Mt. Carmel, Israel. *Journal of Human Evolution* 47:19-23.

Kebara Cave excavs 1931, thoracic vertebra from burial of Natufian age (14,500-13,000 cal BP) with lunate microlith embedded in body. No healing. If hafted transversely as point, entered body from L, perforated lung. If hafted laterally as barb or edge, entered from below and in front, hit heart. [Would be a light point, probably arrow, but dart also possible.] Social tensions in terminal Paleolithic/Mesolithic hunter-gatherers on cusp of agriculture.

**Boeda, Eric, J. M. Geneste, C. Griggo, N. Mercier, S. Muhesen, J.L. Reyss, A. Taha, and H. Valladas**

**o**

1999 A Levallois Point Embedded in the Vertebra of a Wild Ass (*Equus africanus*): Hafting, Projectiles, and Mousterian Hunting Weapons. *Antiquity* 73:394-402.

Umm el Tlel in El Kowm basin, Central Syria, open air Middle Paleolithic site. Deep, many layers Acheulean to Neolithic. Level IV 3b'1 = Mid Pal, Mousterian, with thermoluminescence dates >50,000. Small mesial [middle] fragment of triangular Levallois point, 1.4 cm long, bending fractures both ends. In the vertebral foramen [spinal cord] of 3<sup>rd</sup> cervical [neck] vert [which is broken open, although it looks like the whole thing, both pieces, are present]. Passed through the wall of the vert, needed considerable force. Tip missing, not enough space for it in bone, so likely broke on soft tissue, broken point penetrated bone [That would really need lots of force - it's not very sharp.] Force needed, and bending fracture after penetrated bone both indicate point was hafted. Bitumen as hafting mastic in other levels at site. Probably a projectile, but can't tell what kind, could also be thrusting spear. Suggest parabolic trajectory to enter from R and above, thus likely to be thrown. [Other scenarios equally possible.]

**Boldurian, Anthony**

**o**

2007 Weaponry of Clovis Hunters at Blackwater Draw. In *Seeking Our Past: An Introduction to North American Archaeology*. Neusius, Sarah W., and G. Timothy Gross, eds. On accompanying CD. Oxford University Press, New York.

Accepts assumption that Clovis had atlatls, discusses hafting models for Clovis points and bone rods, and promotes idea of a socketed harpoon with C point as end-blade [for which the archaeological evidence is nil - he's speculating based

on one Archaic specimen and analogy to Inuit harpoons.]

**Boldurian, Anthony T. and John L. Cotter**

**o**

1999 *Clovis Revisited: New Perspectives on Paleo-Indian Adaptations from Blackwater Draw, New Mexico*. University Museum Monograph 103, University of Pennsylvania, Philadelphia

Summary and reanalysis of early work by Howard at key site. Geology, type artifacts, excavation account, old and new interpretations.

Pp 94-104 - Projectile point hafting and use: Could be atlatl dart, or thrusting, or both represented by Clovis points. Cotter in 1937 proposed bone rods as foreshafts, also suggested use as lance points (Upper Paleolithic analogy), or as foreshaft to fit a toggle harpoon head with point on it (Inuit analogy). Stanford has same idea. Made experimental versions. Toggles date to early Archaic at least, cordage earlier, might help entangle mammoth or help track it. Counter arguments: if rod survives in sites, why no harpoon heads? "The idea of being attached by a line to a panic-stricken mammoth is not an attractive one." (102) All ethnog toggles used on sea mammals.

Cotter and Hibben among early archys looking at Solutrean antecedents to Clovis.

Folsom points from site mostly damaged, a few new, both workshop and repair/discard represented.

Clovis seen as generalized hunters - Blackwater draw produced also manos, turtle + tortoise bones. But points definitely used on mammoth (blood residue in Alaska). Water as key resource, common to many kill sites. Mammoth populations already declining by 15 k BP, so Clovis would have pushed toward extinction, but as generalized hunters can't be blamed for all.

Folsom as ecological succession to Clovis, many technological connections. Clovis origins debates summarized. Cotter early noted many technological similarities to general Up Pal cultures in N Europe, and to Solutrean in specific, but Hibben's Sandia Cave sequence (shouldered, unfluted pts like Solutrean, followed by fluted version) must now be discarded. Good arguments against Solutrean theory [but he still wants to consider it.] Perhaps entry from both Siberia and across Atlantic.

**Boone, Elizabeth H.**

**s**

1989 Incarnations of the Aztec Supernatural: The Image of Huitzilopochtli in Mexico and Europe. *Transactions of the American Philosophical Society* 79(2):1-107. Philadelphia.

Huitzil began as minor hunting god of Mexica tribe, became state cult of Aztec Triple Alliance Empire, dominated by Mexica. Came to embody sun, undermining Tonatiuh, patron of eagle and jaguar warriors - war god, ensuring sacrifice demanded by sun. At Great Temple, worshipped alongside Tlaloc, god of rain and agric fertility. But H images strangely rare, probably because limited to important sites of state cult, and varied by context, so Europeans constructed

their own when portraying Aztec world.. But his attributes usually include serpent atlatl. Hummingbird helmet or head ornament is the only feature unique to H among gods.

Fig 17 shows page of Codex Telleriano-Remensis fol. 25r depicting H as nomad with blue face stripes, shield, hunting bag, and 2 long “spears” in other hand - plainly atlatl darts as they are fletched, with cane joints, and barbed tips, but no atlatl.

Later European representations of Aztec life are “classicalized” and analogized to the devil, and H’s serpent atlatl becomes a snake.

### **Borden, Charles**

1968-69 The Skagit River Atlatl: A Reappraisal. *B.C. Studies* 1:13-19.

Found in river (Taylor and Caldwell 1954). Yew wood, 2-hole grip with integral loops, 41 cm long, distal end (hook) missing, carved human head surmounted by rampant monster served as weight near grip to balance while aiming. Compares to Marpole and Locarno Beach (early NW coast) art styles and recent to argue for NW origin. May depict Sisiutl, double headed serpent diety controlling sea resources - appropriate for marine hunter. Probably Locarno Beach age (last millenium BC). [see also Fladmark et al. 1987; picture of carving in Ames and Maschner 1999:236]

### **Bostrom, Pete**

2004 An Indiana Atlatl. *Lithic Casting Lab Webpage*, accessed 1/04 at <http://lithiccastinglab.com>

Nice photos of antler handle, slate humped bannerstone, and antler hook “found several years ago by W. Miller” Davis Co, IN. Indian Knoll type gear. [Supposedly found together, but who knows, and if it was, then represents a looted burial with no reliable archaeol information.]

### **Bourget, Steve**

**s**

2001 Rituals of Sacrifice: Its Practice at Huaca de la Luna and Its Representation in Moche Iconography. In *Moche Art and Archaeology in Ancient Peru*, J. Pillsbury, ed., pp. 88-109. Yale University Press, New Haven.

Warfare with clubs to capture sacrificial victims. [atlatls not used in war]

### **Bourget, Steve**

**o**

2001 Children and Ancestors: Ritual Practices at the Moche Site of Huaca de la Luna, North Coast of Peru. In *Ritual Sacrifice in Ancient Peru*, edited by Elizabeth P. Benson and Anita G. Cook, pp. 93-118. Austin, University of Texas Press.

Ancestors and children, warfare and deer/sea lion hunting symbolically related.



fletching, copper point, no foreshaft. [No info on length or weight.]

**Bradbury, Andrew P.**

o

1996 Bow and Arrow in the Eastern Woodlands: Evidence for an Archaic Origin. *North American Archaeologist* 18(3):207-234.

Re-does Thomas classification function using ethnographic specimens. Discusses differences between weapon systems and their requirements. Functions use width and neck width, elim length, tests on 579 haffed specimens. Lots of Late Archaic pts = arrows [but is his sample good – can't tell – lots of small things in Archaic, but relatively few Woodland specimens]. So bow and arrow arrived in L Archaic, specifically Merom and Matanzas pts, but concurrent use, atlatl not replaced until late Woodland [details useful, but he needs more evidence than point size].

**Bradley, Bruce**

o

2001 Getting to the Point: Arrowheads at Stix and Leaves Pueblo. *Indian Artifact Magazine* 20(1):36-38, 81.

PI-II SW CO, private site, 26 rooms, several kivas. Kivas and pithouse burned – dates 850-875, 949-970, 1054-; Old pts collected by puebloans, 1 notched for pendant or ritual use.

Late PI has dart pts – but no atlatl in earlier BMIII – was it reintroduced? By new people? Also late in PI tanged arrowheads, in PII cornernotched [much like tanged ones], in mid PII narrower pts, then convex base with side notch. Manufacture sequence described from failures. Flaking tools. [Comparable to my Grasshopper points]

**Bradley, Bruce A., Michael B. Collins, and Andrew Hemmings**

o

2010 *Clovis Technology*. International Monographs in Prehistory, Ann Arbor, MI.

Clovis technological focus was on bifacial complex and blade complex, with minor component of small tools, and where preserved, bone and ivory.

Stone raw materials indicate mobility or exchange, include intentional choice of nice ones [authors' emphasis on cache sites may exaggerate this]; p.9 some like Knife River Flint were available but not used. P.57 heat treatment apparently not used.

P.56: “Bifacial technology was used by Clovis for the majority of their primary tool blank production, either as cores for flake blanks or as bifaces and proj points. Even the production of blades used a basically bifacial technique...” [one reason for me it doesn't resemble Solutrean industry at all]. Lengthy discussion of overshot flaking. [Numerous illustrations and detailed examples show the variety of point finishes, local or individual styles, but their selection is biased in favor of “nice” pieces, especially in a few color photos.]

Bone, ivory, antler used includes at least llama, dire wolf, horse, mastodon, mammoth, and deer. Most known from FL rivers where no real

context. Forms include long beveled rods. Bone points more reliable, could compensate for high failure rate of stone points in manufacture (>50%) [that's got to be an exaggeration]. Good for puncture wounds, especially if greased, possibly with red ochre [huh?]. So 3 projectile forms: thrown stone C points, thrown short bone pts, thrust long curved ivory points. Atlatl hooks of paleofauna bone in FL rivers indicate atlatl use. Some C points highly fractured, may indicate high velocity impact - need more testing p120. Stone and short bone points, including one barbed one, intended to remain in animal, long point as close quarters lance. One bone pt from Blackwater draw mammoth has diving hinge high velocity impact fracture, other examples. Also some rods that are not points. Atlatl hooks made of proximal phalanx of llama, vestigial mammoth tusk, and beveled ivory rod fragment [photos and details].

**Brennan, Louis A.**

s,x

1975 *Artifacts of Ancient America*. Stackpole Books, Harrisburg, PA.

[Respected amateur archaeologist.] Focus on E N.Am. but general info. Detailed description + typologies of most classes of artifacts: flaked stone including points and tools, ground stone including axes, bannerstones [he accepts as atlatl weights], antler, bone, basketry, wood, copper, ceramics.

[Some interesting mistakes and outdated info: a Folsom point labeled as "Clovis," accepts Sandia, Pikimachay, and Old Crow flesher dated 27,000, probably because he favors a pre-Clovis, pre-projectile point culture. Lengthy but weak description of knapping, e.g. p20 making flake blades "overcomes disposition of stone to flake conchoidally" by preparation of platform and calculation of angle and force of strike. For some reason, doesn't use "knap" or "knapper," uses "chipping" and "flintsmith."] Recognizes heat treatment p24, but "because direct exposure to fire causes pot-lidding... core materials about to be worked were heated in hot water or other indirect method [the hot water is nonsense]."

Lengthy point typology includes section on atlatls p 29-33. Bow replaced ca AD 1 in SW, AD 1000 in NE, atlatl survived in Aztec and Arctic where allows kayak use + bow strings get wet. Ballistics: weight forward of midpoint. "Rule of thumb that stone point <1.75 inches is arrow point is not a bad one. On the other hand, it is not a reliable one either." Some small points too early for bow, probably on light composite dart. Four good photos of Richard Regensburg of DL Division of Archaeology using atlatl. Indian Knoll type with antler handle + hook, wooden bannerstone, 4 oz as suggested by Mau, close to hook. "Although it appears that the dart is about to be catapulted, the proper throwing motion is to keep the dart and atlatl in contact on a straight horizontal line throughout the entire casting action; the atlatl adds to the length of time of this contact, in effect lengthening the arm (31)." [Must have got this from Howard 1974. Ironically, his 4<sup>th</sup> photo clearly shows Regensburg using the atlatl correctly, flipping the dart away with the atlatl vertical as the dart leaves, contradicting what Brennan and Howard think happens.]

**Breuil, H.** x  
1952 Lascaux. *Man* 52 (152): 110-111.

In French. Responding to Lechler 1951 - he "doesn't know what he's talking about." Object at foot of man is hooked spearthrower with handle. Bird on staff object is not propulseur, because all Up Pal specimens have the carving as hook, not handle. [he misunderstood Lechler who said no such thing]. Magdalenian sculpted atlatls were all ceremonial. Existing specimens were fixed in wooden handles. It must be totem or funerary marker - espec with bird head on man.

**Brian, Wayne** o  
1992 Crashing the Barrier. *The Atlatl* 5(2):7-8.

Anecdote of record throw. No info on equipment.

**Brian, Wayne** o  
1994 This'n That. *The Atlatl* 7(2): 2.

Claims Guinness record of 638' 8" (209.53 m), but also 660'3" and 699' witnessed, personal best (9/93) 727' (238.52 m) [non-primitive equipment]

**Brian, Wayne** o  
1999 Stone Atlatl Finger Loops. *The Atlatl* 12(3):1-2.

Allen Denoyer found S AZ specimen, now recognized as similar to British Museum Aztec atlatl's loops (pictured). BW replicated [on a Basketmaker form atlatl]. Looks like petroglyph depictions.

**Brian, Wayne** o  
2008 Primitive Pottery Reproduction. *The Atlatl* 21(1):14.

Mimbres reproductions, including two versions showing atlatls in use [which is anachronistic, but looks real nice.]

**Bridges, Patricia S.**  
1989 Changes in Activities with the Shift to Agriculture in the Southeastern United States. *Current Anthropology* 30(3):385-394.

Skeletal info from Archaic and Mississippian burials in Pickwick Basin, Alabama. Longbone shaft cross-sections reflect stresses.

Miss. have overall greater shaft circumference = greater stresses/workload in agricultural population. Males more change in arms than legs, females more overall, suggests females took on more new agricultural tasks. Female Miss. stronger and more symmetrical arms = mortar and pestle corn grinding. Male Miss. arms more symmetrical, more forearm strength = change to bow and arrow from

atlatl. Archaic males have higher prevalence of elbow osteoarthritis than Mississippian, but both early and late have more on right than left elbows, and early females have highest right-dominant elbow osteoarthritis. [So mixed weak support for skeletal reflection of change from atlatl to bow.]

**Bridges, Patricia S.**

1990 Osteological correlates of weapon use. In *A Life in Science: Papers in Honor of J. Lawrence Angel*, J.E. Buikstra, ed., pp. 87-98. Center for American Archaeology.

Bridges (1990) compared Archaic (atlatl using) and Mississippian (bow and arrow using) skeletal populations from northwestern Alabama. She expected to see more arthritis of elbow and shoulder (specifically arthritis in radial/humeral articulation, olecranon fossa lipping, and acromioclavicular joint porosity), and greater difference between left and right arms in both arthritic conditions and dimensions in the Archaic population, and also expected that males would be more affected in both populations than females. In fact, there were no clear patterns, and she was forced to conclude that “in this region, changes in hunting technology appear to have had a minimal impact on the physique.” While “atlatl elbow” occurred in 15 to 26% of her male specimens, it was slightly more common in females, and equally common in both periods, so “it is impossible to attribute atlatl elbow to any specific activity.”

**Bridges, Patricia S.**

1992 Prehistoric arthritis in the Americas. *Annual Review of Anthropology* 21:67-91.

Surveys arthritis in reports of 25 prehistoric Indian groups, mentions atlatl elbow and references self and others cited here. No good connection between atlatl and arthritis.

**Bridges, Patricia S.**

1996 Skeletal biology and behavior in ancient humans. *Evolutionary Anthropology* 4:112-120.

**British Museum**

x

1912 *A Short Guide to the American Antiquities in the British Museum*. London, British Museum.

Figure 23 good drawing of Aztec atlatl with shell finger loops, warrior and snake in relief [and gilded. No info on provenance. AM5226].

**Brokensha, Peter**

1987 *The Pitjantjatjara and Their Crafts*. The Aboriginal Arts Board, North Sydney.

Ethnography mostly written in 1970s, updated 1980s, some old photos. Rifles have replaced spearthrower, but old men retain theirs for fighting. Men make all weapons and sacred boards, women wooden bowls and animal carvings. Spearthrowers are of woomera scoop type, called “miru.” Thin and flexible [those I have handled are not really] 87 cm long, 8.6 wide, 450 gm, made of mulga wood. Lashed-on hook, spinifex gum handle with inset adze flake. Reports from 1800s show same form. Cites old reports of “accuracy as good or better than average shot with a rifle up to 60 yards.” Photos of manufacture 1975 with steel tools, takes about 10 hours, can sell (tourist market) for \$8. Hunting spear was compound with broad wood blade with a barb lashed on it. Total length 2.7 m, weight 370 gm [huge!]. Manufacture of spinifex gum described.

**Brooks, Alison, and David Leslie** s

2011 Recognizing and characterizing projectile armatures in the early Middle Stone Age of Africa. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

“Lithic projectile armatures represent a significant innovation over thrust spear points in hominin subsistence strategies with relevance to both the life history and behavior of our genus. Recognizing proj points archaeologically is difficult, plan and shape of a proj point may not differ from that of a thrust armature except for in its area and weight, nor would we expect thrust spear technology to disappear with the advent of projectile armatures. Currently, researchers disagree on the timing of this important innovation, with some arguing for appearance of projectile technologies during the Middle Stone Age, others during the Upper Paleolithic. Others have argued that the pointed forms of the African Middle Stone Age were not weapons armatures at all but rather resharpened scrapers. This paper will review three aspects of MSA pointed forms: tip attributes, basal treatment, and overall form and will discuss the utility of these in determining the onset of projectile technology. We argue that many of the later MSA industries (Aterian, Aduma, #Gi, Sibudu, Stillbay, Howiesons Poort) contain projectile armatures, based on these criteria. In addition, the early archaeological record of the Middle Stone Age documents a number of different point forms date to ~300 kya or before and based on the above criteria, some may be candidates for early projectile technology.”

Late Pleist inventions: poison, dogs, proj weapons. Spears continue after bow (Kalahari). MSA bifaces – ochre in binding/mastic leaves hafting traces + harpoons with string wera on bases + microliths with ochre in mastic all 60-75 kya. Blombos Cave 75 kya bifacial spear tips. #Gi Cave bifacial + unifacial pts, 10% with impact, symmetrical small pts <5 cm long 70-80 kya, hunting buffalo, wart hog – good to be at distance  
Pts small, 8-10 grams, prefer use of exotic stone from up to 200 km away, hafted w ochre compounds – so are they projectiles? TCSA Tip Cross Sectional Area (Shea) in range of thrusting spear but not ethnog atlatl or bow

Weight – in arrow and dart range [but comp to US data]  
Possible earlier hafted points at Olorgasailie 340 kya

**Brooks, Alison, Lisa Nevell, John E. Yellen, and Gideon Hartman** o  
2006 Projectile Technologies of the African MSA: Implications for Modern Human Origins. In *Transitions before the Transition: Evolution and Stability in the Middle Paleolithic and Middle Stone Age*. Edited by Erella Hovers and Steven L. Kuhn, pp. 233-255. Springer, New York.

African Middle Stone Age differs from Middle Paleolithic of Eurasia [“Neanderthal”] industries in having many projectile points. Small size implies not just simple spears. Compound artifacts imply cognitive sophistication. Regional styles imply communication and social groups. Examples: 1) =Gi Site, 77k BP, in Kalahari, 41% of MSA assemblage is pts. Small, triangular, bifacial, ca 41 mm long, 14 mm T, thinned bases for hafting, made on discoidal core flakes, lots impact damage. In size range of ethnog dart + arrow pts. 2) Aduma, Ethiopia, >70k BP, lg bifacial pts, lg pts on Levallois flakes, 100-20 mm L, range of ethnog spear, dart, + arrow pts. 3) Tabun, Israel, MP Levallois + Mousterian pts, roughly contemp w Aduma, 70-50 mm L, range of ethnog spear pts.

MSA pts smaller, more retouched than MP, comp to Thomas ethnog pts where spear thrower pts weigh 2-8 gm, arrow pts mostly 4 gm or less. No arch or ethnog spear throwers known in Africa, but the Aduma pts trend lg to small thru time, are within size range, and African Late SA pts are arrow size when Euro using atlatl, so maybe Africa passed thru spear thrower stage earlier. MSA early spear throwers would fit with other early “modern” traits like use of marine resources, regional styles, [bone tools], ornament + pigment use

**Broughton, Jack M., Michael D. Cannon, Frank E. Bayhan, and David A. Byers**

2011 Prey Body Size and Ranking in Zooarchaeology: Theory, Empirical Evidence, and Applications from the Northern Great Basin. *American Antiquity* 76(3):403-428.

Ethnographic and archaeological evidence to support argument that hunting larger animals is more efficient in calory return per hour effort than hunting smaller, even when they have high mobility and failure risks. No atlatls.

**Brown, James** o

1996 *The Spiro Ceremonial Center: The Archaeology of Arkansas Valley Caddoan Culture in Eastern Oklahoma*, volume 2. University of Michigan, Ann Arbor.

Pp. 465-66. In both looted material and controlled excavation, specimens of boatstones, bannerstones, and bar atlatl weights. Most such appear in the area before 500 A.D., but at Spiro they are in burial contexts of the Evans Phase

(1000-1100), at a time when bow and arrow are represented by many small arrow points. Three boatstones are animal effigies, one apparently a locust or cicada, one a double-headed turtle, one a lizard. Bar weight of quartz crystal. Six to eight butterfly, pick, and hourglass bannerstones "attributed to the site" from looter collections. Would be out of normal chronological place, probably secondary use as ornaments. [Hamilton 1952 illustrates more of these artifacts, and an atlatl is depicted on a shell cup in Phillips and Brown 1975 plate 9.]

**Brown, James Allison**

o

1954 Wooden Artifacts. In *Caves of the Reserve Area*, edited by Paul S. Martin, John B. Rinaldo, and Elaine Bluhm. Fieldiana: Anthropology Volume 42. pp. 181-211. Chicago Natural History Museum.

Atlatl distal fragment of typical SW type with shallow channel and short integral hook. Photo shows short and badly weathered. One slotted foreshaft 9.3 cm L, .9 cm diam.

**Brown, Jeffrey L.**

1967 The Use of Atlatl Weights: A Suggestion. *Southwestern Lore* 32(4): 84-85.

Mechanical principles (atlatl as lever) suggest that weight decreases efficiency by adding inertia, but also adds angular momentum which increases stability of throwing arc and thus accuracy.

**Browne, Jim**

1938 Antiquity of the Bow. *American Antiquity* 3(4): 358-359.

Precursor to Browne 1940, disputes Baker + Kidder 1937 that bow relatively recent, says Folsom points "made for efficient bow and arrow shooting"

**Browne, Jim**

x

1940 Projectile Points. *American Antiquity* 5 (3): 209-213.

Size of points is not a good marker for dating "pre-bow" - Pt 87 mm long, 37 wide on arrow still shoots - many "too large" pts actually ok for bow and arrow. Experiments with self bow and Basketmaker type atlatl: "Any close degree of accuracy is impossible with atlatl and spear." (uses overhead sweep, full extension) 6 mo practice "can't hit buffalo 1 out of 10 at 30 yards." Bow much more accurate. Dart greater penetration than arrow with same pt. Maximum atlatl throw 81 yards. [I wonder why his accuracy was so poor with atlatl?]

**Brownold, Charles, and Bertram Brownold**

o

1942? Good Sport with a Throwing Stick. [Unknown magazine "HW"?]

[Clipping from unknown craft or pop science magazine bought ebay, ad says

1942, but no date on article.] Simple design for an Eskimo atlatl, 36" unfletched darts of 1/2" dowl, target at 20 to 30 yards. [You'd have a hard time making this work very well].

**Bruechert, Lorenz W.**

1996 The Bannerstone: A Continuing Enigma. *The Atlatl* 9(2):1-3.

Atlatl weight theory (Webb) is most accepted, but experiments show doesn't add force or velocity. Baer, Blair suggest "spinning stone" [= spindle whorl] from ethnographic analogy, a find with short slate shaft in bannerstone hole [but only a few wild fibers are suitable for spinning, and associations documented by Webb and others suggest atlatl connection].

**Bruechert, Lorenz W.**

1995 Recovery of a Spear Thrower in Chile. *The Atlatl* 8(1): 1-2

Possibly associated with female burial, cemetery ca 1600AD [he must mean BC - Cinchorro stage, Early Agricultural] .

Long narrow stick, curved, 60 cm L, 15 mm W, missing hook, partly cane, poor illustration shows what seem to be finger loops.

Info summarized from Focacci + Chacon 1989.

**Bruechert, Lorenz W.**

1998 Mummy Burial of the Muisca Empire. *The Atlatl* 11(2):1

Recovered with mummy, ceramic cup.

Straight wood shaft with lashed on shell male hook, and larger shell hook forming grip. Ceramic date 1300-1450. [Photo, no measurements]

**Bruechert, Lorenz**

1999 Dart-Throwers in Washington and Oregon: Similarities and Differences. *The Atlatl* 12(2):1-5.

Whale-bone frags from Seaside, Oregon, Par-Tee Site represent up to 75 throwers. Reconstructed with male or mixed hook [unclear how good the evidence] and integral carved double loop handle like Aztec. Weights found [but not apparently in association]. Dates here and elsewhere show use of atlatl until almost 1000 AD on Pacific Coast. Compares to McClure, Roaring Springs, and Skagit.

**Bruechert, Lorenz**

1999 Iceman Discovery in British Columbia, Canada. *The Atlatl* 12(4):1-2.

Glacial find, man with equipment including atlatl, only 2nd found in BC, apparently new type. Probably caribou hunting, ca. 1445 AD. [short note only,

refs other finds, this is Kwaday Dan Sinchi, and probably not atlatl]

**Bruechert, Lorenz**

2000 Discovery of an Iceman in Northern British Columbia *Chips* 12(2):12.

Kwaday Dan Sinchi find briefly described. Unusual form atlatl. Dates C14 420-530 BP [this is real late, after bow, I'm not convinced it's an atlatl].

**Bruchert, Lorenz**

o

2000 *Old and New World Dart-Throwers and Related Topics: An Annotated Bibliography*. World Atlatl Association, Aurora, Colorado.

Very thorough and useful bibliography, some annotation, mostly abstracts from articles. Divided into 9 main topic areas, with topical index and keywords. Lots of hard-to-find ethnographic references. [Now mostly included in my biblio]

**Bruchert, Lorenz**

2001 Publication Confuses Early Old World Dart-thrower Use. *The Atlatl* 14(3):7.

Criticizes Farmer 1994 – N. African Middle Paleolithic origins of spear thrower based on redating of Aterian stemmed points. These are not adequate evidence of atlatl. [Quite right!]

**Brues, Alice**

x

1959 The Spearman and the Archer: An Essay on Selection in Body Build. *American Anthropologist* 61 (3): 457-469.

Selective pressures in primitive societies where occupation is not specialized should push for bodies efficient for major subsistence activities. Body size is limited by food, so shape is more likely to be selected for. Body is muscles and skeletal levers. Early hominids should be large with lateral build, bulky muscles, short limbs for crushing strength at close quarters before development of effective weapons, but this reduces speed and would tend toward herbivory since such an animal would not be able to catch prey. Earliest weapons would be Dart's femur clubs used by Australopithecus [a now discredited idea], again favoring bulky strength. Spear is first projectile weapon [unlikely]. Throwing would promote more "linear" bodies with longer lever arms, an advantage of modern humans over the "muscle bound" "lateral" Neanderthals. Throwing stick extends arm, could be a means of adapting spear use to people with "lateral" short build. Linear African people don't use it, throw spears by hand alone.

Bow relies on stored energy input by strength of arm, so shorter limb segments better, probably developed by "lateral" people. "Linear" folk use very long bows, requiring less force multiplied by longer draw, but less efficient. Spear is used by running hunters, bow by stalking hunters, again with suitable bodies for each.



waste dump.

**Brundage, Linda** **o**

2007 A 'Little' Noticed Score. *The Atlatl* 20(3):11.

NY youth league. Keegan Gerber age 11 scored 74. Marlin Bassett age 4 twice hit 10X.

**Bryce, Byl** **x**

2003 The History, Hunting Tactics, and Specialization of the Atlatl and Dart. Unpublished class paper for C. Hilton, "Modern Human Foragers" Grinnell College.

**Bryce, Byl** **o**

2007 Are Two Hands Better Than One? *The Atlatl* 20(2):11.

Experiments with two-handed long atlatl - difficult and not too successful.

**Bryce, Byl** **x**

2008 An Historic Atlatl, or Phatamu, From Mesoamerica. *The Atlatl* 22(1):11-13.

Describes + illustrates Tarascan atlatl and dart, Lake Patzcuaro, Mexico, collected in 1950s by D. Salzman.

**Bryce, Byl** **x**

2010 East Meets West: An Analysis of Style in Basketmaker II Flaked Stone Technology. Unpublished MA thesis, Northern Arizona University.

**Bryce, Byll, Jacob Barrera, and Mike Wells** **x**

2003 Analysis of Atlatl Score in Relation to Dart Level, Wrist Flip, and Sex. Unpublished class paper for J Whittaker, Grinnell College.

**Buck, Paul E., and Anne DuBarton** **x**

1994 Archaeological Investigations at Pintwater Cave, Nevada, during the 1963-64 Field Season. *Journal of Great Basin Anthropology* 16(2):221-242.

Surface collections of dart + arrow shaft frags and points. 143 wood or reed compound dart frags, 18 wooden foreshafts, mostly broken at distal end, up to 19 cm long. Frags small, longest 21.8 cm, "hardwood" [no species ID]. Some reed darts apparently had wood socket inserts. 31 arrow shafts + foreshafts, foreshafts sim to dart, but smaller. Painted decoration in brown and green, white, red on both darts + arrows. 74 stone points; 60 dart, 6 arrow. Elko, Gypsum Cave/Gatecliff, and Humboldt series [Middle Archaic dart types], Rosegate corner-notched arrow pts. Many pts have pitch adhering, impact fractures.

C14 dates on wood and packrat middens loosely associated with artifacts:

3255+80 B.P, 3,400+80 B.P. On two shafts from surface: 6500 B.P. On hearth charcoal near surface 9300+170 B.P. So most material pre-3000 B.P., one early date on dart shaft, possible info on transition to bow [or that's much later stuff - seems too early for transition, and no dates on specimens].

**Budinger, Dave**

**o**

2006 Atlatl Be the Day: Sports Group Could be Spearheading Safe Way to Hunt Suburban Deer. *Pittsburgh Post-Gazette* Feb 9, 2006. Reprinted in *The Atlatl* 19(2):8.

Legalization considered in Pennsylvania. Describes atlatl, mentions WAA. Humorous but ok.

**Bulmer, Ralph**

**s**

1968 The Strategies of Hunting in New Guinea. *Oceania* 38(4):302-318.

“enthusiasm for hunting is greater than its material contribution...would appear to warrant.” Intellectual aspects: strategy, sometimes requires elaborate + precise knowledge of game, sometimes not. Only large or dangerous game is feral pig and cassowary. Various wallabies usually most important, then tree marsupials and rodents, birds, monitor lizards etc. Male activity, taboos on women handling weapons and axes. Bow + arrow, spear, club, throwing stick. Blow-pipe + sling rare. [no atlatl] Wood or bone arrow tips, several types for different game. Stalking, ambush, drives etc. Weapons require close range [no measures given].

**Burland, C. A.**

**x**

1952 Lascaux. *Man* 52 (154): 111-112.

Responds to Lechler 1951. Should interp cave art in terms of hunters. Hooked object is spear thrower with cross handle “as used on Lake Patzcuaro today”. Bird object could be counter-balanced spearthrower, stabbing implement, or ceremonial staff. Bison can't be disembowelled by a wooden spear.

**Burton, Jeffery F.**

**o**

1988 Hunters and the Hunted: The Prehistoric Art of Tom Ketchum Cave. *Kiva* 53(4): 335-356.

Pedregosa Mts, SE AZ, 200+ simple black elements, not conforming to published styles. Lots of quadrupeds - deer, sheep, dog - some geometrics. A couple “arrows” and bows, one possible atlatl under a quadruped [figure shows line 21 cm long with two small cross bars toward one end - possibly but not definitely an atlatl, especially in absence of other evidence or depictions]. No temporally diagnostic artifacts. No horses in art, so prehistoric, bow = after 500 AD, but possible atlatl suggests earlier use.

**Bushnell, D.I.****x**

1904 Two Ancient Mexican Atlatls. *American Anthropologist* 7:218-221.

In Italy, probably from Cortez. Highly ornamented, gold-coated, non-functional? One is odd double atlatl [is this symbolic rather than practical?]. Both straight, inflexible shaft with groove and integral hook, no evidence of loops which they should have. L = 605 and 575 mm. [No discussion of iconography]

**Bushnell, David I.****x**

1906 North American Ethnographical Material in Italian Collections. *American Anthropologist* 8:243-255.

Two Mexican atlatls in Florence Museum (Bushnell 1905). Another in Kircheriano Museum in Rome. Same kind of wood, dark and heavy, resembling rosewood, gold rubbed away from much of surface, carved in low relief on both faces: back in continuous group of figures, hook anthropomorphic, decoration of 5 human figures each side of groove. [Handle plain, no loops or visible attachment for them.] L = 565 mm, W 20 mm prox, 39 distal. [Photo reproduction not good enough to see details well, no description of iconography]. All 3 atlatls “ceremonial, as no actual weapon would have been so elaborately decorated and covered with gold.”

Other items in Florence from Cortez: mask in Uffizi Gallery, jade, obsidian mirror in Prof Giglioli's collection, Codex in Biblioteca Nazionale, plus stuff in Rome, probably once belonged to Medici's. [Meaning that somehow this royal material from Cortez was acquired from them by several collectors and institutions - source of BritMus atlatl?] Pigorini 1885 records 14 other mosaic items in European collections including 7 in Christy collection of BM. [Describes other N. Am. ethnographic material not relevant to atlatls].

**Bushnell, G. H. S.****x**

1949 Some Old Western Eskimo Spear-Throwers. *Man* 49: 121, plate N.

Four, Cambridge U. Museum. Collected by Swaine, 1790s on Vancouver exped. Typical forms, some decorated, repaired. Finger hole + grooves, ivory hook, conifer wood. [No dimensions given but clear plate].

**Butler, B. Robert, and Douglas Osborne****o**

1959 Archaeological Evidence for the Use of Atlatl Weights in the Northwest. *American Antiquity* 25(2): 215-224.

104 specimens, 3 main types, weights range 30-300 gm, distribution mostly Columbian and Fraser Rivers, steatite, felsite, limestone, galena.

Type 1: dome with flat sides + flat or concave base, drilled through sides, one zoomorphic

Type 2: elongate "boatstone" with flat base, notched at ends

Type 3: most common, short, globular, notched across center

Dates est 2500-600 BP

Some found in pairs, mixed types, one assoc with copper bead, most probably in cremation burials.

**Butler, William B.**

**o,x**

1975 The Atlatl: The Physics of Function and Performance. *Plains Anthropologist* 20 (68): 105-110.

Counters Howard 1974 - his straight line throw would be unnatural and inefficient. Atlatl *does* work as lever. Motion extends above head to height equal to length of arm and atlatl [which is not really correct either]. Uses a mathematical model, reanalyzes Howard's distance figures for velocity and momentum [did he actually try it? - not mentioned, I expect not. His model is better than Howard, and he admits it is simplified, but some assumptions are so incorrect that I suspect they wreck the model: e.g. the arm and atlatl do not move in a simple arc as one straight unit with pivot point at shoulder. The wrist + atlatl lever is more important.] Calculates a 76% increase in force with atlatl over arm alone, distance increase of at least 1.5 times [these seriously underestimate the advantage of atlatls]. Weights do not increase velocity or distance of throw.

**Butler, William B.**

1977 Atlatl Functions, Fancy, Flex, and Fun. A Reply to Howard. *Plains Anthropologist* 22(76 pt 1): 161-162.

Admits that functional length of atlatl is not arm + atlatl, just idealized model. Reiterates rotational view, suggests experiment with dart held parallel to shaft to prove impossibility of Howards model, and that dart does rotate on spur [but doesn't do it], mentions possibility of flexing atlatl adding to the throw, analogous to spinning rod (but the motion is still an arc). Need experiments to see if flexing atlatl requires same energy to propel dart as rigid one.

**Butler, William B.**

**x**

1979 The Wood Projectile Point Penetration Study. In *Megafauna Punchers' Review* Vol 1 No. 1, edited by Bruce Rippeteau. [unpublished, circulated]

Spoof journal title of informal report on butchery experiments with circus elephant "Margie" in Denver, June 1979. Includes butchery account by Rippeteau, Clovis thrusting spear experiment by Bruce Huckell. Other participants included B. Bradley, M. Wormington, G. Frison.

Butler made 2 darts of pine dowel, 122 cm long, 92 and 99 gm, apparently unfletched, with sharpened ends, one fire-hardened. Penetration poor, only 3-7 cm when thrown from 3-4 m away into belly skin. Suggests need heavier darts and small diameter sharp points.

[Very primitive experiment with poor equipment, doesn't seem Butler was very

experienced with practical atlatl use at this time either.]

**Butler, William B.**

**x**

1980 Penetrating Elephant Hides with Wood Atlatl Darts. *Plains Anthropologist* 25 (90): 353- 356.

[More formal report of above, but flaws still make it not very useful]. Est velocity 23.2 m/sec, but not measured, darts “much too light and of extremely poor balance” (unfletched), too dull. Lesson: need to be prepared ahead for opportunities like this.

**Buttin, F.**

**x**

1964 Les Propulseurs de Leonardo de Vinci. *Bulletin de la Société Préhistorique Française* 61(1):56-64.

Drawings of slings, including some apparent rigid forms adapted to throwing spears from a midpoint attachment. [Unclear if really in common use.]

**Cabaraux, Anne-Francoise**

2002 Why Do They Throw? *The Atlatl* 15(4):15

Short profiles of Jacques Pernaud, Uli Weigel, Russell Richard, Pascal Chavaux.

**Cade, Chris**

**o**

2009 Hunting Hogs with Rocks. *Primitive Archer* 17(4):16-19.

Bow hunt on ranch, 550 gr arrow w obsidian pt, 10 yd, broke rib on entrance + passed through.

**Cady, Willoughby M.**

**x**

1949 Remarks on the Weighted Atlatl. *The Masterkey* 23(2):59-60.

As arm is straightened horizontally, atlatl is vertical and dart departing. Hook travels faster than weight, so “momentum of weight keeps it on its forward way and assures that the dart moves faster than the weight.” Optimum position should be 36-45% of distance from handle to hook [but reasoning not given].

**Cahill, Tim**

**x**

1987 Perfecting Stone Age Technology: The Atlatl, A Great Leap Backward. *Mother Earth News*, July, 1987. Accessed 2/2002 BPS Engineering web page <http://www.atlatl.com>.

Aztec against Spanish, puncture armor [hype].

Bob Perkins and Paul Leininger, engineering students at Montana State U., “whose work will revolutionize archaeological thinking about atlatls.” The

“Mammoth Hunter” is first working commercial atlatl, have sold about 75 of them. Explains theories that need flexible atlatl and dart, weight tunes them. “You actually launch a wave down the dart. It reaches the end and begins to travel back. Meanwhile the atlatl bends back and stores tension. At the point of launch, the waves from the atlatl and the dart should cancel one another and turn into acceleration. The dart should be stretched out to its full length as the atlatl is releasing its stored tension. A weight will bring these waves into phase...it’s a timing device.” [Good explanation, but theory is incorrect because neither atlatl nor dart oscillates before throw, they merely bend, and all this flexing adds little if anything to dart velocity.] At 1985 5<sup>th</sup> World’s Open Atlatl Context, only 2 out of 50 competitors used flexible darts. [Check that – hard to believe since rigid darts don’t generally work at all.] Perkins and Leininger claim to have popularized flexible dart 1985, winning in 1986.

**Cahill, Tim**

x

1998 What About Atlatl Bob? *Outside* 23(12):55-60. (December 1998)

Facetious account of Bob Perkins and his encounters with atlatls and primitive skills. [Atlatls not very well described for public audience.]

**Cain, David I.**

x

2010 Atlatl Weight, Power or Accuracy: Experimental Use of Weighted Atlatls. Poster presented at annual meeting of Plains Anthropological Society.

100 shots @ with weight close to handle, close to hook, accuracy measured as distance from center of target. More consistent with weight close to handle; distal position adds power and tends to overpower the dart in throwing [unlikely].

**Cain, David Isasc**

x

2012 Sticks with Stones: Controlled Experimentation in the Use of the Weighted Atlatl. Unpublished MA thesis, Missouri State University.

Reviews atlatl history, experimentation, principles as lever. Weight - symbolic or practical? Investigates effect on power and precision using a mechanical thrower. A clay pigeon launcher as power, a couple lever arms, and release mechanism [photos, but needs mechanical diagram with details of structure] - largely simulates forearm and wrist action. Atlatl 1-piece osage orange 82.5 cm long, 77 grams without weight. Darts 6’ pine dowels, fletched. Moveable lead weight, 95 grams. Expect same throw each time, compare by measuring distance to measure power. Precision [= consistency] measured by shot clustering. 164 weighted shots, 164 unweighted.

Results: All else equal, weighted atlatl throws shorter range, weighted mean range 21 m, unweighted 25 m, and little overlap in the two groups in distance. [So a reduction of about 15% by adding weight.] Distance to center of cluster of shots weighted was 2.79m, unweighted 4.24m, so adding weight

improved precision. [However, there may be a bit more dispersion with increased distance of unweighted shots, so the increased cluster of weighted shots may be illusory. Oddly, the plot shows almost all shots dispersing to the Left of the line of throws, so there is a bit of a bias in the machine too.] Conclusion: weights reduce power, but have a practical advantage increasing precision, thus probably accuracy, so probably not just symbolic artifacts. [Good experiment, not unexpected conclusions, but hope he uses the ingenious machine to test some more ideas.]

**Callahan, Errett**

**o**

1994 A Mammoth Undertaking. *Bulletin of Primitive Technology* 1(7):23-39.

“The Ginsburg experiment” – butchering circus elephant with Stanford, Bonnicksen, Morlan, G. Haynes in 1978. Focus here on spear tests to examine hafting and basal ends of Clovis points. A few hand throws – penetration only to point hafting. Most throws with simple stick atlatl, unweighted – penetration half depth of chest cavity. Concludes atlatl necessary to kill elephant with Clovis weaponry. Variety of points and haftings tried, some illustrated. Deep slot, tapered distal end on foreshaft as wide as point base, not just flute, seems to work best. Penetration usually ends with foreshaft if shaft is larger diameter, so long foreshafts best. Best results with long flexible unfletched spear. [Useful discussion and illustration of hafting alternatives, unfortunately he never did the detailed evaluation of the alternatives that was planned.]

**Callegari, G. V.**

**x**

1934 Un Nuevo Precioso “Atlatl” Mexicano Antiguo Recientemente Descubierto en Roma. 25<sup>th</sup> International Congress of Americanists, La Plata. *Actas y trabajos cientaficos del XXV Congreso internacional de americanistas*. Vol 2 : 7-9.

In Spanish. Elaborately carved, gilded atlatl w “bone” finger loops. So highly decorated must be ornamental, not functional, and belonging to one of last Aztec kings. Same designs as Florence specimen [From which it may be copied, fake, See Beyer 1934.]

**Cameron, Constance**

**x**

1988 Birdstones and Their Associations. *Pacific Coast Archaeological Society Quarterly* 24(4):54-62.

Two from CA-Ora-327, Morro Canyon, Orange County, small “pelican” type with downcurving beak and longer “cormorant” type with long neck and short, high, small beak. Dates from shell + charcoal assoc 940-570 BP for first, 2700 + 70 for second. These and other forms described, occur in caches with other effigies, burial contexts, random. [Cameron regards these as effigies, no mention of atlatls. The beak could be a hook but I doubt these are atlatl parts - they are shaped somewhat like Peruvian forms, but the hook end is close to the body or

small and frail, the base is small and rounded and would not attach well, and being made of steatite, many are surely too fragile to use as atlatl hooks. So these are not birdstones in the Midwestern sense - an unfortunate coincidence of names.]

**Campbell, Paul D.**

1999 *Survival Skills of Native California*. Gibbs Smith Publisher, Salt Lake City.

Covers all sorts of stuff in detail. Chapter on atlatls and darts pp. 307-319. Good illustrations + info on several ancient atlatl specimens (Cerro Cuevoso, Buena Vista, Nicholerson, Roaring Springs), some male hooks on round shaft with single finger loop, others flat board with double finger notches. Late survival in Baja California. Dimensions for some archaeological dart shafts given. [Unfortunately promotes incorrect atlatl-as-spring and ancestor of bow theories].

**Campbell, Paul**

o

2011 Stone Age Spear Throwers: Antiquity, Flight Fundamentals, and the Compound Pendulum Effect, Part 1. *Bulletin of Primitive Technology* 41:70-83.

Extensive survey of atlatl history, mostly ok. Bows might be as early as spear thrower but don't survive; earliest from "Magdalenian sites around 12,000 years ago in France and N Germany." Tube or stick atlatls, some with cross bar handles "could be gripped closer to the spur for short range targets and toward the end of the handle for longer range targets, including herds of antelope or flocks of birds." Paleolithic ones have carved bone hooks or weights. [He considers these "very short, inflexible" implying examples are complete, which is probably not the case.] Flat board atlatl is other basic form, more recent.

Very short atlatl implies heavy spear, not needed after giant ice age mammals. "Yet some Aborigines... and Inuit... threw very heavy darts until recently. And to throw them, the Alaskan Yupik used very short, stiff, thick, inflexible board style throwers..." [But Australian throwers are extremely long and heavy] Atlatl explained as lever system, so as atlatl lever shortens, heavier spear becomes optimal, while human effort remains the same, and heavier dart compensates for reduced velocity. Describes basic throw. Dart flex necessary but not for spring energy. Shorter atlatl more accurate for close range, also shorter dart, but weight needed for penetration. All elements compromise: heavy dart more momentum and penetration, shorter range; lighter, longer dart more distance, higher velocity, but less penetration, more flex distortion in throw, can compensate by shortening atlatl, etc.

Several illustrations of different atlatls [Key Marco find described inaccurately]. Illustration of Winnemucca and Hogup Cave, with detailed replic of HC.

**Campbell, Paul**

o

2011 Stone Age Spear Throwers: Antiquity, Flight Fundamentals, and the Compound Pendulum Effect, Part 2. *Bulletin of Primitive Technology* 42:26-34.



“model patterns of morphological variation in middle-late Holocene stemmed projectile points from Patagonia through comparative methods. With this purpose we explore the potential of different analytical strategies using projectile point shapes, obtained by means of geometric morphometrics. Phylogenetic, spatial and environmental variation were used to build a set of statistical hypothesis to explain the morphological patterns in different scales. Morphological data comes from digitalized images of published projectile points for different patagonian areas. Morphometric characters were obtained using landmark and semilandmark descriptors. Mean shape by area was computed and used in cladistic analysis to model diversification trends.

Then, phylogenetic, geographical and environmental coordinates were estimated for each data set and used as predictor variables in multiple regression procedures. Different models were compared based on statistical significance, explained variance and relative complexity. Mobility, interaction and change in middle-late Holocene human populations in Patagonia can be discussed in light of these results.”

[Excessive jargon and labor to show some possible geographic variation in point shape.]

**Carnegie, David W.**

x

1898 *Spinifex and Sand: A Narrative of Five Years' Pioneering and Exploration in Western Australia*. C. Arthur Pearson Ltd, London. Reprinted Hesperian Press, 1982.

p 340-341: Kimberley district spears of superior manufacture, with heads of glass, quartz or insulator from telegraph line. “Spears will pass right through a cattle-beast, and which are themselves unimpaired unless they strike on a bone.”

Telegraph damaged, attempt to reduce by leaving bottles at poles. Spear heads fixed in lump of gum. “Up to a distance of 80-100 yards the spears can be thrown with fair accuracy and great velocity.” L from 10-15'. Woomera held as in sketch [shows flat decorated N Desert form held edge up, spear across fingers, pinned by thumb.] Central desert forms cruder. In Kimberley use light board throwers 2.5-3.5' long.

**Carneiro, Robert L.**

x

1970 Hunting and Hunting Magic Among the Amahuaca of the Peruvian Montaña. *Ethnology* 9(4):331-341.

Field work 1960, population ca 500. E. Peru tropical rainforest. Hunting + horticulture, 50% + 40 % of subsistence, 10% fish and other. Generalized hunters of most mammals, including cat species, tapir, peccary, deer, capybara, anteaters, sloth, armadillo, coati, squirrel, also large birds, caiman, lizard, turtles. Tapir and spider monkey preferred, and most common game. Individual hunting with bow and arrow only. B + A always carried by man, effective. Peach Palm wood, 6-6.5

feet long. Arrow 5' long, flower stem of cane *Gynerium saggitatum*, with hardwood foreshaft and bamboo lanceolate point. Also hardwood pt w bone barb for small game, and blunts for bird. No poison. Spiral fletching. Bow draws 60-75 lbs. Tracking and stalking skills; more important than marksmanship. "Generally, a hunter tries to close to within 40 feet or less before shooting." Dogs help find game or bring it to bay. Blinds sometimes used.

No magic in horticulture, but hunting uncertain and dangerous, much magic, but no totem animals, prohibitions, or propitiation of animal spirits, or increase magic. Positive magic to improve hunter, weapons, or make game "tamer" and easier to catch: smearing blood on weapon or hunter, plant leaves or infusions, drinking excrement of boa constrictor, hawk talons, bee stings + caustic plants on arms, inoculation with frog poison (hallucinogenic).

**Carr, Kurt W., Christopher Bergman, and Christa M. Haag** o  
2010 Some Comments on Blade Technology and Eastern Clovis Lithic Reduction Strategies. *Lithic Technology* 35(2):91-125.

Blade industries rare in N. Am. Compares E C to more standardized blade-dependent early European industries. E C does have blades, but much rarer, less regular than Euro Upper Paleolithic and Epipaleolithic, and use less high quality material, more expedient, variable, inconsistent core preparation. EC also makes fewer tools on blades, and almost never projectile points. EC points are bifacial, curated + resharpened, while Euro points are on blades, discarded when damaged. Clovis blades occur where large material is available. Clovis adaptation more mobile, less dense population than Europe.

[Although Solutrean industries are not discussed, this applies - one reason why they are not reasonable ancestors for Clovis industries,]

**Carroll, Chris** x  
2006 Atlatl Battle. *National Geographic* (October 2006) 210(4):no page numbers. [and not in all issues - bizarre way to publish a magazine].

Brief atlatl background, photo of thrower at Solutre, drawing of throw motion, quotes JW, mentions PA legalization.

**Carstens, Kenneth C.** x  
1978 Review of Great Basin Atlatl Studies. *American Anthropologist* 80 (3): 741-742.

**Carter, Clayton** o  
2008 The Atlatl: A Modern Adaptation. *Bulletin of Primitive Technology* 36:81-83.

With cord loop at end, can throw dart with nock like an arrow.

**Casanova, E.** x

1944 Una Estolica de la Punta Jujena. *Relaciones de la Sociedad Argentina de Antropologia* 4:115-132.

[In Spanish. "A Spearthrower from P. J."] With burial in cave. Poor Xerox shows thin flat narrow lathe form, abruptly narrowed to straight handle, and even narrower distal end with hook lashed on. [resembles N Australian Gros Eyelant form to me]. L= 57 cm, W = 3 cm, T = 6-9 mm. Lengthy comparisons with other atlatls.

**Castleton, Kenneth B., and David B. Madsen** x

1981 The Distribution of Rock Art Elements and Styles in Utah. *Journal of California and Great Basin Anthropology* 3(2):163-175.

60 elements and styles grouped into "geometric, representational, and bizarre" categories and distributions mapped, some associated with particular prehistoric cultures, Desert Archaic, Fremont, and Anasazi. Dating and cultural assignment difficult [and their sample is small and uneven]. More art in S + E (Colorado Plateau) than N + W (Great Basin). Atlatl is "element relatively restricted to CO Plat." and especially in SE corner of state. Duck headed men and elaborate headresses restricted to SE corner. More interaction shown along Colo R. and on CP (ie between Anasazi + Fremont) than between CP and GB (ie between two variants of Fremont).

**Cattelain, Pierre** x

1986 Traces Macroscopiques d'Utilisation sur les Propulseurs Paléolithiques. *Helinium* 26:193-205.

[Macroscopic use-wear on Paleolithic spear throwers]  
Experimental and Australian ethnographic analogies.

**Cattelain, Pierre** x

1988 *Fiches typologiques de l'industrie osseuse préhistorique, cahier II: propulseurs*. Publications de l'Université de Provence, Aix en Provence.

[Typological notes on prehistoric bone artifacts, book 2, Spearthrowers] First finds by Lartet and Christy 1864 Laugerie-Basse, identified as harpoon tip with barb, recognized in publication by de Mortillet 1891 (and unknown correspondent from Ireland in 1864). Distinguishes three types: male, female, and androgenous [hook + groove like Basketmaker]. Considers only specimens that are clearly parts of atlatls, 118 pieces. Hook wear: slight ring depression around tip, scratches on the back, polish on the tip, and scratches on the face of the atlatl under the hook. Brief experiments: atlatls last well, throwing darts 400-500g, transfix goat carcass. [poor diagram and unclear stroboscopic photo of throw shows overhead flip, but not flex of dart]. Works as lever arm. Ethnographic types illustrated. The

rest is partial catalog of specimens, discussed under three types (M, F, A), [with mediocre line drawings and poor photos.]

**Cattelain, Pierre**

**x**

1989 Un crochet de propulseur Solutréen de la Grotte de Combe-Saunière 1 (Dordogne). [A Solutrean Spear Thrower Hook from the Cave of Combe-Saunière 1.] *Bulletin de la Société Préhistorique Française* 86(7):213-216.

In French. Short distal end piece with male hook, made of reindeer antler tine. Solutrean levels, associated with shouldered points. Decorated with a few lines. On tine, so originally short. Similar specimens beveled to attach to atlatl, tried experimentally. [If context correct, earliest spear thrower find]

**Cattelain, Pierre**

**x**

1994 La Chasse au Paléolithique Supérieur: Arc ou Propulseur, ou Les Deux? *Archeo-Situla* 21-24:5-26.

[In French. "Hunting in the Upper Paleolithic: Bow or Spearthrower, or Both?"] Not until Mesolithic do we have preserved hafts to show arrow use of small point forms.

Grotte de Combe-Saunière I in Dordogne, many pointes à cran (shouldered points), Solutrean, with projectile impact fractures, also backed microblades, laurel leafs, and part of hook of atlatl made of reindeer antler from same levels [thus earliest known atlatl hook].

Summarize ethnographic, experimental info on bows and atlatls for comparison. [Good drawn sequence of atlatl throw, best currently available]. Propulseur (p6) "elongates the hand and integrates it into a complex lever system, with principle axes at pelvis and shoulder, then elbow and especially the wrist, which at the end of the movement, thanks to rapid rotation, gives the critical impulse."

Upper Paleolithic forms [figure includes Combe-Saunière (simple flat hook) and Mas d'Azil (complete, with faun aux oiseau)] from upper Solutrean (ca 17,500 BP) to upper Magdalenian (ca 12,500 BP). Experimental reconstructions show efficiency.

Two main ethnographic groups: Arctic, and Other. Arctic: long description of different Inuit and other types, factors affecting dimensions and form such as game, size of user, local style + materials, spears. Other: Australia as example, similar info + figures.

Distance of throws, mostly from imprecise Australian ethnographic info. Tindale measured attempts at wallaby image: good accuracy to 27 m, poor at greater. Ethnographic records of child training from both areas.

Bows: More or less parallel info as for atlatl. Figures of Holmegaard and Vis I Mesolithic bows. Origins probably in Upper Paleolithic, oldest bow and arrow fragments from Stellmoor Germany, Ahrensburgian terminal Paleo (ca 11,000 BP). Dani, New Guinea ethnographic example.

Comparisons: bow used in all environments, atlatl especially in open. Both highly variable, but different bow or atlatl types closely associated with their particular projectile forms. Hunting distance for atlatls up to 45 m, but usually 30-20 or less; same for bow. Bow more accurate: on same targets, atlatlists score 65% of archer scores, beginners learn bow faster.

“Except in extreme cases, the form and size of most Paleolithic projectile points do not allow us to classify them as points of spears thrown by hand or by atlatl, or points of arrows” (p20). Experiments with both common. Discusses own experiments with 100 Gravette points replicating finds at Abri Pataud. Different haftings on darts and arrows, variation in weight and size of points. Goat carcass target, 145 throws, 127 bow shots, 41% and 25% misses. More breakage with atlatl, especially flex breaks, but more extreme fractures with bow; still can’t tell what shot the Abri Pataud points.

### **Cattelain, Pierre**

o

1997 Hunting during the Upper Paleolithic: Bow, Spearthrower, or Both? In *Projectile Technology*, H. Knecht ed., pp. 213-240. Plenum, New York.

Defines atlatl and bow. Spearthrower works by lever action. Discusses two geographical groups 1) Arctic – “used exclusively from a seated position in kayaks in a marine environment” and 2) Australian, used standing in terrestrial settings. Both are highly variable, used with variety of projectiles, often diff forms for same purpose or for specialized purposes, no consistent patterns. Throwing distances recorded over 100m, but hunting from 10-45 m, usually less. Bow range is similar. Bow is more accurate, cites European contests using same distance and targets, participants score 65% as well with atlatl as with bow. Lengthy discussion of experiments with Gravette points replicating finds at Abri Pataud. Goat carcass target, 145 throws, 127 bow shots, 41% and 25% misses. More breakage with atlatl, especially flex breaks, but not really distinctive, so can’t conclude whether were dart or arrow points. [Good article, ethno + exper info, refs].

### **Cattelain, Pierre**

x

2000 L’apport de la comparaison ethnographique à la connaissance et aux tentatives de reconstitution des propulseurs paléolithiques. In *La chasse dans la Préhistoire/ Hunting in Prehistory*, Anthropologie et Préhistoire 111. C. Bellier, P. Cattelain, and M. Otte eds., pp. 60-69. Société Royale Belge d’Anthropologie et Préhistoire, Bruxelles.

[In French. The contribution of ethnographic comparisons to the understanding and reconstruction of Paleolithic spear throwers.] Mortillet 1891 first recognition of paleo spearthrowers by analogy to Aust + AmInd. Early sources Arctic (depiction of Greenland Inuit 1577), Mexican (codices, art, chroniclers), and Australian (ethnog), accumulated info to 20<sup>th</sup> C, useful now. More than 100 possible atlatl parts from Solutrean + Magdalenian levels in Europe. Most studies say not really useable because: too short, too curved, other uses more likely, too

fragile + decorated. Now we can reject these arguments. 1. Complete examples show modification for attachment to longer handle. 2. Curvature misunderstood, and not an obstacle. 3. Use-wear on hooks confirms atlatl use. 4. Wear and repair even on decorated ones confirms use. Ethnographic suggestions of size, material, form of accompanying darts, and use. All kinds of game attested, as well as warfare. Australian claims ranges up to and even over 100 m, hunting range usually 15-20 or 30 m.

**Cattelain, Pierre**

**x**

2004 Un propulseur inédit de la Grotte du Placard (Vihonneur, Charente, France). *Notae Praehistoricae* 24: 61-67. On web at URL: <http://users.skynet.be/fa057790/placard.pdf> accessed 10/25/05.

In French. "An unpublished atlatl from the Grotte du Placard." In Musée d'Angoulême, from 19<sup>th</sup> C excavations by J. Fermond, no stratigraphic info. Short oval slip of antler, notched to form hook, thinned proximally to splice into wooden shaft. Two others same form known from different sites, plus 3 more variants from Placard. Probably Magdalenian, around 15000 cal BC.

**Cattelain, Pierre and Claire Bellier**

**o**

2002 *La Chasse dans la Préhistoire: du Paléolithique au Néolithique en Europe...et ailleurs*. Guides Archéologiques du Malgre-Tout, CEDARC, Treignes, Belgium.

[Hunting in Prehistory: from the Paleolithic to the Neolithic in Europe... and beyond.] Booklet, focus on artifactual evidence, well illustrated with line drawings and a few color photos, lots of pictures of European stone and bone dart points, some Upper Paleolithic and ethnographic spear throwers. Also spears, bows, boomerangs, etc.

**Cattelain, Pierre and Marie Perpère**

**x**

1993 Tir Expérimental de Sagaies et de Flèches Emmanchées de Pointes de la Gravette. *Archéo-Situla* 17-20: 5-28.

[Experimental shooting of spears and arrows armed with Gravette points.] Detailed description of experiments replicating and using points from Upper Paleolithic Abri Pataud, see Cattelain 1999.

**Cattelain, Pierre, and Jean-Luc Rieu**

**o**

2002 *Le Propulseur*. Musée de Malgre-Tout, Treignes, Belgium.

Glossy color pamphlet, 6 pages. Well illustrated basics of Old World archaeology and ethnography of atlatl.

**Cattelain, Pierre, and Ulrich Stodiek****x**

1996 Propulseurs Paléolithiques Inédits ou Mal Connus. *La Vie Préhistorique* 1996 : 76-79.

In French. “Unpublished or little-known Paleolithic spear throwers.”

Ten specimens, mostly fragments with hooks. One notable one is small ovoid hook, complete with bevel for attachment to shaft from Roc de Marcamps. [See Cattelain 2004 for another similar].

**Charles, Mona C. and Sally J. Cole****o**

2006 Chronology and Cultural Variation in Basketmaker II. *Kiva* 72(2):167-216.

Lengthy description of regional variants’ material culture and rock art. Considers small projectile points as evidence that bow and arrow were fairly widespread in BM II. [I think it interesting that they present this with little discussion, but as far as I know, there are no datable BM depictions of bow and arrow, and Coles, the rock art expert, cites none.]

**Chastain, Dennis****x**

2008 Peter Lindsay: Primitive Technologist. *South Carolina Wildlife* November-December 2008: 4-9.

PL makes stone tools, blowguns + atlatls using stone tools. [OK story, but atlatl info poor - confused definitions, flex as spring, “hinge” instead of hook, “penetrated Spanish breastplate armor”, etc].

**Chatters, James C.****o**

2001 *Ancient Encounters: Kennewick Man and the First Americans*. Simon and Schuster, New York.

First half covers the disgusting story of how the Corps of Engineers and Indian activists tried to destroy Kennewick and prevent scientific study. Second half describes and interprets the find in light of other early skeletons (they are physically different from Archaic and later Indians) and presents Chatters’ theories of the peopling of the Americas.

Kennewick (adult male skeleton, Washington state, C14 dates  $8,410 \pm 60$  B.P. = 7330-7580 BC calibrated) has a Cascade type projectile point in healed wound in his right hip. Angle suggests that he tried to dodge, so probably not accidental. Depth suggests high velocity, probably atlatl.

**Chatters, James C.****o**

2004 Kennewick Man: A Paleoamerican from the Northwestern U. S. In *New Perspectives on the First Americans*. B. T. Lepper and R. Bonnicksen, eds, pp. 13-26. Center for the Study of the First Americans, Texas A+M University Press, College Station, TX.

Details of pathology including involvement of “atlatl” point in hip, he says entered from anterior, near iliac crest, caused acute, then chronic infection with lytic area, new bone, and drainage cloaca, contra to analysis by Powell and Rose.

**Chatters, James C., Sarah K. Campbell, Grant D. Smith, and Phillip E. Minthorn** o

1995 Bison Procurement in the Far West: A 2,100-Year-Old Kill Site on the Columbia Plateau. *American Antiquity* 60(4):751-763.

Tsulim site, deflated site of entrapment in sand dunes, teeth and lithics primary remains MNI 8 bison, one event. C14 ca 150 BC. On basis of point stem measurements, most points dart, but some arrows too. Other cited work shows atlatl retained for at least 1000 yrs after bow adopted on C Plateau. “It is possible that during the first centuries after the bow’s adoption, it lacked the impact power necessary to penetrate the hide of larger or thick skinned species...” [But all based on point size, other site reports.]

**Chauvaux, Pascal** o

2000 Pascal’s Corner. *The Atlatl* 13(3):11.

Photo of stone atlatl, Pre-Classic Maya, from San Juan de Los Arcos, Jalisco, Mexico, in Royal Museum of Art and History, Brussels, Belgium. Votive, 27 cm long. [Mexican form, looks to be non-functional, with squared vestigial loops (not actually pierced), groove and hook. No info on material or weight.]

**Chauvaux, Pascal**

2003 European Prehistoric Atlatls Inventory Trial. *The Cast* Spring 2003:12.

Map showing location of European atlatl finds with photos of specimens.

**Christenson, Andrew L.**

1986 Projectile Point Size and Projectile Aerodynamics - An Exploratory Study. *Plains Anthropologist* 31 (112): 109-128.

Useful theoretical consideration of variety of factors. [Includes my favorite jargon: points are part of "complex projectile delivery systems."]

**Christenson, Andrew L.** x

1986 Reconstructing Prehistoric Projectiles from their Points. *Journal of the Society of Archer-Antiquaries* 29:21-27.

“A pointed-tip projectile is principally a device to kill by introducing the tip, carried through the air on the end of a shaft, into the prey.” [Mr. Point, meet Mr. Prey]. Point traits provide clues about rest of projectile: Size, form, breakage, and

wear.

Size attributes - Weight: Center of gravity must be in front of center of pressure, either heavy point, or fletching to rear. Affects impact force + penetration. Neck Width: reflects shaft diameter. Graphs of weight show decrease thru time 8000-1000 BC, then increase 1000 BC – 600 AD, then decrease again 600-1700 AD. [But his figure of point types is not grouped by those times.] Early points on atlatl darts; atlatl “has the effect of lengthening the arm of the thrower”. Reduction in size should reflect smaller shafts and addition of fletching, thus greater range, but less shock-force and penetration. Increase in size in middle sequence is an enigma. Late reduction in size = bow and arrow. B+A advantages in stalking and espec war: projectile range, more shots per time.

Form attributes: barbs suggested as war arrows, but early metal points usually not barbed. Barbs allow greater length cutting edge per weight. Late SW atlatl pts side-notched, similar size early arrow pts basal notched + barbed. Serration probably associated with cutting use, but also on small late arrow pts.

Breakage: impact fluting unique to projectiles. Burination usually impact too, but like snaps can occur on knives. Wear usually indicates knife use, sometimes impact striations on obsidian.

[Somewhat simplistic discussion aimed at European archers.]

### **Christenson, Andrew L.**

o

1987 Projectile Points: Eight Millenian of Projectile Change on the Colorado Plateau. In *Prehistoric Stone Technology on Northern Black Mesa, Arizona*. Edited by William J. Parry and Andrew L. Christenson. Southern Illinois University Center for Archaeological Investigations, Occasional Paper No. 12, Carbondale.

Dismal state of SW proj pt studies – emph on ceramics, provenience details usually ignored. Functional effects of point attributes on killing power (diagram): Width + thickness affect cross-sectional area > wound size/bleeding. X-sect area also > penetration. Weight + velocity > impact force > penetration. Blade edge length, point sharpness, shaft diam all > penetration.

Barbs increase cutting edge per weight. Base grinding to reduce splitting, edge grinding to reduce cutting seizing. Resharpening usually indicates knife use, often results in beveling which conserves material. Various kinds of breakage from impact, most also can be from knife use, tip fluting unique to projectiles.

19 hafted knives from literature: only 3 with distinct stem. 9 hafted with pitch only, 6 combine pitch + sinew, 3 sinew alone. 36 illustrated hafted dart pts: L from 33-62 mm, almost all have shoulder or stem, all hafted with seizing. 15 arrows: all but one side-notch or unnotched triangular, L 14-31 mm, all hafted with sinew, sometimes + pitch.

Analysis here – 334 artifacts, 188 assoc with well-dated site components, 6 temporal groups: E Archaic 6000 BC, L Archaic 1300-900 BC, Basketmaker II 800 BC – 300 AD; E/M Ceramic 800-950 AD; L Ceramic 1050-1150 AD; Navajo 19-20<sup>th</sup> C.

Most bifaces multi-purpose – pts with both knife wear and impact. Only one too large for proj use. Sees three major temporal trends: Fauna remains same, so not a cause of change. Shift from atlatl to bow. Decrease in mobility leads to reduction in multifunctional bifaces, increase in single function proj pts. [But that last is also affected by size change to small arrow points, independent of mobility, which he does admit.]

BMII pts “surprisingly light for dart points” mostly 1.8-2.2 grams. E/M Ceramic pts 20% lighter, usually 1.0-1.45 grams, neck widths smaller [but actually although more smaller points, they cover same range as BMII in both weight and neck W.] Blade edge length distribution is essentially the same. Little differences in breakage patterns. Resharpening, espec beveling, declines from BMII. Size, neck width/shaft diam, and tip cross-sectional area decline with change to bow. Point cross-sectional area also a measure of durability – declines, as does base grinding, indicating less multi-purpose use.

Recycling points for use or ritual common – here BMII sites have probably Archaic pts. Most BMII pts side-notched, resemble San Pedro type, some corner-notched resemble Elko. Side-notch = standard atlatl dart pt, on wood foreshaft 6-8 mm diam. Drawing Fig 5-5 shows Broken Roof Cave, Sand Dune Cave, and White Dog Cave specimens. Often wear shows use as detached knife. One atlatl weight on Black Mesa from mass burial at D:7:3141: calcite, loaf-shaped, groove across convex upper surface, simple incised line decoration. Multifunction point an advantage to traveling hunter, but relatively short blade edges, resharpening reduces symmetry + penetration. 10 dart pts show burning, presume intentional, ritual.

E/M Ceramic points: some probably Archaic collected. Small points fit Rosegate type, indicate arrival of bow. Arrival dates poor – Morris claims BMII woman killed by arrow at Battle Cave, Canyon de l Muerto, and Prayer Rock district caves have primarily arrow remains, 430-670 AD but provenience poor. Tularosa Cave suggests shift 700-900 but mixing problem. Bow advantages: range – atlatl 20-30, max 80, bow 30-45, max 140m. Reduced proj size, espec weight, reduces impact force and thus less penetration of arrow compared to dart. Blk M arrow pts same cutting length as earlier darts, but reduced weight and x-sect, thickness, and neck width. Barbed = stay in wound. 80% show light wear = used as knives on detachable foreshafts. Presume simple self-bow. Neusius and Phagan (1983 SAA paper) suggest stone pts for small game are heavier, less labor, so more durable than pts for big game in Dolores area sites.

Late Ceramic pts: more side-notch + unnotch triangular, return to heavier shafts, perhaps stronger bow. In some PIII sites hafted with pitch only to stay in wound. High freq light edge wear but resharpening rare = still used as knives.

Navajo collect old pts for ceremonial gear, use, and interest. N used sinew backed bow and heavy wooden arrows with metal points.

**Churchill, Steven E.**

**x**

1993 *Weapon Technology, Prey Size Selection, and Hunting Methods in Modern Hunter-Gatherers: Implications for Hunting in the Palaeolithic and Mesolithic.*

*Archeological Papers of the American Anthropological Association* 4:11-24.

Literature survey of 96 recent hunting peoples finds: 1. association between hand delivered spears, large prey, certain hunt techniques dependent on features of terrain. 2. less dependence on terrain with atlatl 3. use of bow without regard to prey size or terrain. Early hunting without projectile weapons involved narrow range of strategies and limited prey. Effective exploitation of wider range of terrestrial mammals occurred after efficient projectiles.

Addition of stone points improves penetration. Changes in form begin with Aterian, mostly Up Pal, including stems + other base modification to reduce drag, most important with projectile. Australian use of large asymmetrical stone dart tips shows that Levallois points could also be on darts, but need actual atlatl find to confirm, which we have by Solutrean. Bows by 10,500 BP at Stellmoor.

Hand-delivered spears: mostly thrust, thrown rare. Mostly with large animals, in situations of “disadvantage” hunting (i.e. surrounds, dogs, swamps). Atlatl associated with smaller prey, ambush and “approach” hunting, i.e. stalking. [But he only has 9 atlatl cases, all Australians, doesn’t include water fowl or mammals.] Average effective ranges: thrust spear 0/contact; thrown spear 7.8m, atlatl dart 39.6 m, bow and arrow 25.8 m. Bow used with all hunting techniques (disadvantage, ambush, approach, pursuit, encounter). Shorter av. range than atlatl because need to hit smaller target on large animal. [But does not consider use of poison. And all bows are not equal.] Before projectiles, hunters limited to larger game and cooperative or disadvantage hunting, dependent on landscape features.

Atlatl effective shock weapon against smaller game; maybe less so when larger animal body cavity must be penetrated. Up P barbed harpoons may improve efficiency by working way into wound [more likely, they help immobilize a large wounded animal for further attack.] Hunters like Aleut who use atlatl for marine hunt, prefer bow for terrestrial game. Atlatl may not be as accurate as bow. For large game, Paleo folk maybe reverted to hand spear [Not likely from Up Pal and SW arch evidence], or used disadvantaging techniques. Changes in weaponry prob reflects changing conditions or needs more than technological advances.

### **Churchill, Steven E.**

2002 Of Assegais and Bayonets: Reconstructing Prehistoric Spear Use. *Evolutionary Anthropology* 11:185-186.

[Responding to Kortlandt 2002] Assumes that thrusting spears were used underhand like bayonet based on muscular advantage, military use, and lack of ethnographic details. Ethnog suggests both overhand and underhand use, and preference for thrusting rather than throwing. Underhand thrust allows better withdrawal for multiple thrusts, and better defensive posture.

**Churchill, Steven E., Robert Franciscus, Hilary McKean-Peraza, Julie Daniel, and Brittany Warren**

2009 Shanidar 3 Neanderthal Rib Puncture Wound and Paleolithic Weaponry.  
*Journal of Human Evolution* 57:163-178.

Shanidar 3 adult male, one of 9 Neanderthal skeletons in cave, has well-preserved ribs with partly healed injury to L 9<sup>th</sup> rib. Below C14 dates around 50 kya uncal. Baradostian (early Upper Paleolithic) at Shanidar not until 35 kya; timing of modern human arrival in area not clear. Possible assoc of early moderns with projectile weapons after 50 kya elsewhere; would have been competitive “edge.”

Parallel sided (but wider inside than out) wound on top of 9 rib, small injury to bottom of 8 at same place. Healing, but point could have remained in wound; decayed if wood, lost if stone. Probably injured lung, but healing shows 2 weeks to 2 months survival.

Experiments: kinetic energy most important measure of projectile impact. Dart velocity ave 24 m per second [around those I got in Whittaker + Kamp 2007], so KE (.5 x mass x velocity squared) 8-51 Joules, mostly 26-28 J in experiment literature. Thrust experiment (Schmitt et al. 2003) spear velocity 1.7 m/sec, KE = 42J. This experiment used pig ribs, calibrated cross-bow, stone tipped spears with 3 pts: Mousterian, Levallois, and long L. Spear + pt mass ca 530 gm, velocity 13.4 mps at 31 kg draw weight (KE low end range of heavy thrust spears) and 7.8 mps at 15 kg (KE in low end of dart range). 7 “stabs” [but actually launched spear at close range] with high KE, 11 with low KE, also comp to 26 goat ribs from another experiment. High KE much more damage to ribs, including not just incisions, but fracture, crushing, removal of fragments, and hinged fragments. [But they overlap, so differences are NOT diagnostic]. Penetration depth low, usually less than 90 mm [that’s not much, suggests problem with experiment].

Conclude: Shanidar injury probably low KE because most damage to one rib, not adjacent ribs, no fracture, just incision. Consistent with dart or knife, accident or aggression. Downward wound on L suggests right handed attacker [only if it’s a thrust]. Assuming that a heavy Neanderthal hand thrown or thrust spear should have made high KE type wound, wound is “most consistent” with light-weight, long range (low KE) projectile weapon, implying conflict between Ns and modern humans.

[Interesting, but much less conclusive than they claim. They admit the uncertainties but still reach the conclusion they want, despite artificial conditions of experiment, samples that are far too small, wound features that overlap, too many assumptions about velocity and weight of projectiles, insufficient evidence of N-modern overlap.]

**Clarkson, Chris**

s

2011 Points of Contention: Experimental testing of TCSA/TCSP as archaeological measures of projectile effectiveness. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

“Several recent articles have argued that Tip Cross Sectional Area and TCSPerimeter are valuable measures of projectile performance that may help differentiate the use of simple and complex projectiles in the archaeological record. Proponents of this view have also argued that TCSA / TCSP are relevant to identifying the origins and spread of complex projectile technology by modern humans. The logic and strength of these arguments will be examined and ethnographic data on Australian projectile technologies will be presented that questions any firm association between TCSA/TCSP and projectile type. New experimental evidence presented here calls into question the value of these statistics as measures of projectile effectiveness, at least in terms of penetration. An alternative approach to determining projectile type is developed using experimental data on impact fracture size for three different diagnostic impact fracture types. This approach, while found to be valuable, also presents problems for archaeological identification of projectile technologies.”

Problems with TCSA: N. Am. not a good fit with rest of world, Australian thrown points are too large to too small, ethnographic analogs not appropriate because of multidirectional evolution from past, and experiments don't support TCSA: poor predictor of penetration.

But complex projectiles are usually high velocity, produce larger impact scars on points. Exper: 154 pts, obsidian + flint, on arrow, thrown spear, atlatl darts, and thrust, into carcass. Impact fracture types: bending spin-off + flutes, lateral chip, burin spall. Spin-off and fluting most common. Obsidian overall suffered larger scars, found no difference in fracture length between weapon type, but burin fractures were longer with higher velocity. Many complicating variables make recognizing projectile type difficult – need multiple lines of evidence, TCSA is not very good, fracture size may be helpful, need large samples, not just individual points.

**Clausen, Carl J., H.K. Brooks, and Al B. Wesolowsky**

1975 The Early Man Site at Warm Mineral Springs, Florida. *Journal of Field Archaeology* 2(3):191-213.

Underwater excavations in sinkhole, human remains deposited into water-laid levels [but see Cockrell and Murphy 1978], mention of possible shell atlatl hook.

**Clement, E., and J. D. E. Schmeltz** x [plates missing]

Ethnographical Notes on the Western-Australian Aborigines, by Clement, with a Descriptive Catalogue of a Collection of Ethnographical Objects from Western Australia, by Schmeltz. *Internationales Archiv für Ethnographie* 16(1 + 2):1-28.

NW Australia, W of Kimberley along coast and inland. Eight tribes. p2: Emus and kangaroos speared from ambush at waterholes, 15-20 yards distance. [Plates missing from copy]. p4: flint and glass spearheads [Kimberley type] roughly shaped by striking, finished with serrations by pressing against edge of broken kanga bone (sketch). Empty bottles... “are eagerly picked up by the Blacks and

traded into the interior where they are highly prized... Telegraph insulators form splendid material for spear-heads... and it is not uncommon that these are knocked off the poles and thus interrupt communication.” Spear-heads fastened to shafts with gum obtained by burning green Spinifex, mainly used for fighting. Wooden fighting spear heads multi-barbed, hunting only one large barb. In tribal duels, spearing in legs is only allowed. Hunting spear shafts 10-15 feet long, wooden heads attached by double-bevel joint. Leiden Museum collection includes lots of spears, Kimberley points and manufacture material, several mihra or woomera, flat, elongate broad leaf shaped, gum at handle, incised ornament.

### **Clottes, Jean, and Jean Courtin**

1996 *The Cave Beneath the Sea: Paleolithic Images at Cosquer*. Harry N. Abrams, New York.

C14 dates show 2 periods of use: ca. 27,000 BP, hand stencils and finger tracings, Aurignacian or Gravettian; ca. 18,500 BP, animal paintings and engravings, about 100, Solutrean related. Two hearths, numerous charcoal bits, 6 flint tools with butchering wear, but no habitation evidence. Animals mostly horse, bison and auroch, ibex/chamois, some cervids, megaloceros, feline, and “killed man.” Also 3 auks, some indeterminates, possible seals [not as recognizable as other species], possible fish, poss jellyfish. Numerous abstract signs. Barbed or feathered lines often intersect or cross animals, possibly indicating spears or wounds. Comp with Lascaux, here too a man is falling backwards, assoc with barbed signs (and wounded bison) so these are weapons. “Killed Man” [very crude, engraved outline on back with leg up, long arm w poss hand, crossed by two lines one of which has a “feather” line and a “barb” line attached - originally considered a seal.] It is not naturalistic, represents idea of killed man, but is “unambiguous” [hardly!]. Compares to several other images of wounded humans in other caves. If we have several wounded men theme pictures, then they must have been common. Alternate explanations: lines of spiritual force, carried weapons. Could be destructive magic, exorcism, or commemorate an event

### **Clubb, Leni**

1994 Guinness Record Holder... *The Atlatl* 7(1):8

Wayne Brian (Mesa AZ) modern distance record, now claims primitive record of 475'3" (144.9 m)

### **Clubb, Leni**

x

1999 The Resurgence Of The Atlatl And Dart - How It All Began.

*Calumet: Newsletter of the Indian Peaks Chapter of the Colorado Archaeological Society*, January 1999. Electronic document, accessed 3/5/11, URL:

<http://www.indianpeaksarchaeology.org/Calumet/Archive/1999/Calumet9901.html>  
.html

Rod Laird 1980 started teaching kids in his classes, "Kids World Open Atlatl Contest." 1981 adopted by Saratoga Historical + Cultural Soc, attended by Bradley, Stanford, Frison, Wedel, others. Brian Benson (11 yr old) beat Bradley for champ. Laird published booklet. LC attended 3<sup>rd</sup> in 1983, began prosletizing CO Arch Soc, organizing events. "In 1988, at the Third CAS Encampment near Woodland Park, CO, the first meeting of WAA was held with ten members. Bill Tate was elected President; Leni Clubb, Vice President; Charlie Lilly, Secretary/Treasurer."

**Cockrell, W. A. and Larry Murphy**

1978 Pleistocene Man in Florida. *Archaeology of Eastern North America* 6:1-13.

Brief info on Warm Mineral Springs, Pleistocene sinkhole now filled with water, excavations on ledge produced flexed burial dated 10,319 B.P., earlier material below. Associated with burial is shell artifact "atlatl hook" [drawn, not described, see Purdy 1991:197 for photo].

These layers deposited when hole was dry. [Disputed by Clausen et al. 1975 - if deposited into spring, associations not good - if good assoc in dry deposit, and correct ID of artifact, then this is a very early date for atlatl in Americas]

**Coe, Joffre L.**

1964 The Formative Cultures of the Carolina Piedmont. *Transactions of the American Philosophical Society* 54(5).

Atlatl weights found at Doershuk (NC) site in lowest level associated with Stanly stemmed points (triangle with stem bifurcated or concave based). Mostly unfinished pick forms. Estimated date 5000 BC. At the Hardaway site, 1950s excavations in midden 28 inches deep. Again, mostly pick or lunate forms, 172 unfinished and 65 finished from surface, mostly broken. One antler hook. One semilunar pick form from Stanly level, others are judged later. Only a few illustrated. At the Gaston site, small hollow oval atlatl weights [boatstones] and grooved ovals, associated with Vincent pottery. Estimated date after 500 A.D., earliest pottery, possibly bow and arrow as well.

**Coffin, Edwin F.**

s

1932 *Archaeological Exploration of a Rock Shelter in Brewster County, Texas*. Indian Notes and Monographs No. 48. Heye Foundation, Museum of the American Indian, New York.

[A weak job even for its day.] Continuing work of M. R. Harrington. Some scrappy rock structures, very little pottery near surface, lots of perishables. P. 61: "Although many fragments of notched arrowshafts were found, there was no trace of a bow. [Ignoring several miniatures, probably offerings.] The occurrence of the atlatl and the notched arrow, in deposits indicating no great range of time, would seem to suggest that the throwing-stick and the bow had been used

contemporaneously.” [The excavation was probably not good enough to make fine stratigraphic distinctions had there been any, although they did recognize floor surfaces.] P. 28: “Four fragments of atlatls, all from the end in which the nock of the arrow or spear rests, lay in the same levels as notched arrows. The upper sides of three of them are flat, while the upper surface of the fourth slopes slightly toward the center. The grooves are round. The under sides are all convex. Two of the specimens had been severed from the rest of the implement, probably after accidental damage to the prongs, by cutting or sawing part way through from either side and breaking the remaining fibers.” [That’s all. No pics. Presumably Basketmaker form, but are “prongs” the hooks?]

P. 27: “Among objects of unknown use are 5 lengths of wood, round, and with one end cut like a tennon....” [Photo shows these are waste from notching foreshafts, but no measures given or scale in photo, so could be either arrow or dart, probably arrow.]

### **Coggins, Clemency Chase, and Orrin C. Shane**

1984 *Cenote of Sacrifice: Maya Treasures from the Sacred Well at Chichen Itza*. University of Texas Press, Austin.

Pictures and short descriptions of: P 46 almost complete wooden atlatl, [Peabody Museum, Harvard] straight, groove and integral hook, two finger holes with narrow septum in between [probably the loops were integral carved, now broken off] supposed to be one of 9 found by Thompson. Should have had lobed fur decoration shown in reliefs like Temple of Jaguar [more likely feathers, also she claims reliefs show fending stick in left hand - but all the warriors have is 4 or 5 darts, apparently with stone pts and fletching (Fig 5). Atlatl resembles Aztec ones in basic form]. P 47 long wooden foreshafts and associated corner notched chert (or triangular with flared stem) atlatl dart points and sheet gold effigies thereof. P100 more delicate atlatl points with corner notches, from cache in Platform of the Eagles. P103, 104 hook ends of 2 serpent atlatls or atlatl/scepters of wood, with hook isolated by carving in deep groove, carved snake decorations with holes for inlay. P 108 fragment of shell finger loop carved with snakes.

### **Cole, George S.**

1972 The Bannerstone as a Spear Weight. *Michigan Archaeologist* 18 (1): 1-7.

Center drilled bannerstones probably spear weight - give added impact, weights not help if on atlatl. [Nonsense!]

### **Cole, Sally J.**

### **B o s**

1990 *Legacy on Stone: Rock Art of the Colorado Plateau and Four Corners Region*. Johnson Books, Boulder.

Subdivides Anasazi: San Juan River (SE UT) and Canyonlands (E Central UT). Dating in part thru sim images on pottery. Early BM with large shoulders, static



shoulders, static but decorated anthros, atlatls + darts, trophy (?)heads, birds + bird headdresses. Later BM less elaborate, more active anthros, birds and bird headdresses, solid triang body anthros, stick figure flute players. Birds + feathers important cultural elements. BM also plant forms, static solid anthros w elab heads, paw prints, abstract linears. And small stick figure anthros often as twins or processions, assoc with pendant circle motif perhaps relating to kiva or pithouse or origins. Flute players usually not humped, assoc with broad shoulder women, and sometimes with hunters or warriors holding atlatl + dart [ In other words, lots variability, temporal overlap, unclear chronol implies of many forms - this stuff is not easy to date stylistically]

**Coles, John**

o

1973 *Archaeology by Experiment*. Charles Scribner's Sons, New York.

[Classic compilation of early experimentation]

p 127 summarizes Browne, Peets, Hill, and Kellar, concludes that atlatls useful at short range, ambush, and against herds.

**Collins, Henry B.**

x

1959 An Okvik Artifact from Southwest Alaska and Stylistic Resemblances Between Early Eskimo and Paleolithic Art. *Polar Notes* 1:13-27.

Carved bone object with Old Bering Sea/Okvik designs described [at tedious length]. Similarities between Paleo, Esk, and Shang China art [pretty thin]. Mention and [poor] drawing of "bone atlatl with Okvik decoration from NE Siberia". [Deep V-shaped shaft cross section, spatulate handle without holes, pins, or finger depressions visible, hook not visible.]

**Coltrain, Joan Brenner, Joel C. Janetski, and Shawn W. Carlyle**

o

2007 The Stable- and Radio-Isotope Chemistry of Western Basketmaker Burials: Implications for Early Puebloan Diets and Origins. *American Antiquity* 72(2):301-321.

[Calibrated AMS dates apply to some burials with atlatls: Sayodneechee Cave (produced atlatl weight) dates from ca 400-200 cal BC. Kinboko Cave I (Cist 10 male burial with atlatl) dates ca BC 350-AD 50. White Dog Cist 27 Male with atlatl darts 405-204 cal BC. Cave 6, and Broken Flute Cave, and Battle Cave in C del Muerto (BMII, evidence of violence, unprovenienced skeletal material 355-44 cal BC).]

Bone chemistry shows BM reliance on maize agriculture early, by 400 B.C. as much as P II and P III farmers in same area. This supports a model of migration for spread of maize, rather than gradual adoption by Archaic hunter-gatherers.

**Comstock, Paul**

1992 Throwing darts with the Baton de Commandement. *Bulletin of Primitive*

*Technology* 1(4):38-42

Pierced “batons” with cord used as spear thrower. Some archaeological evidence of possibility. [Clever and plausible, needs better instructions]

**Conrads, T. J.**

o

2003 *The Traditional Bowhunter's Handbook*. TBM Inc, Eagle, ID.

p. 125 “A study done of wounding losses by members of our local club from the mid 1970s to the mid 1980s using all types of bow and arrow combinations showed that over 70% of game shot at over 30 yards were lost. But when those shots were under 30 yards, the recovery rate was better than 75%. The study further showed that tracking distances of wounded animals was cut more than half when the animal was shot under the magical 30 yard distance.”

**Cook de Leonard, Carmen**

x

1956 Dos Atlatl de la Epoca Teotihuacana. In *Estudios Antropologicos Publicados en Homenaje al Doctor Manuel Gamio*. pp. 183-200. Dirrccion General de Publicaciones, Mexico D.F.

Cuautla, Morelos. Two atlatls, made of single pieces of hard wood, 48.4 and 50 cm long. Both have long rod handle (about half length) without grip or loops. Distal half is flat blade or paddle, which turns up slightly at hook. {These are like nothing I have seen anywhere else, certainly not like the typical Mesoamerican form}.

**Cordell, Linda S. and Maxine E. McBrinn**

o

2012 *Archaeology of the Southwest, 3<sup>rd</sup> edition*. Left Coast Press, Walnut Creek, CA.

[Solid overview fairly well detailed and up-to-date, generally readable. But lithic drawings are all pretty poor (Marjorie Leggitt), atlatl diagram over simple and bad, and many typos and sloppy statements like “Paleoindian spears are believed to have been thrown with an atlatl or spearthrower, which provides extra leverage and increases the power behind the throw, rather than having been thrust javelin-style into an animal at close range, which would have been extremely dangerous.” (111). Discussion of pre-Clovis is naïve, citing discredited info on Sandia and Pendejo Caves, both of which are rubbish, even with the disclaimer that they are “disputed.” P. 156 “Appearance of smaller stemmed or side-notched projectile points at about 500 CE signals the arrival of bows and arrows... more efficient than atlatl for ambush hunting in wooded areas.” Annoyingly pc in places: use of CE dates, stupidly sunny view of NAGPRA.]

**Corliss, David W.**

o

1980 Arrowpoint or Dart Point: An Uninteresting Answer to a Tiresome

Question. *American Antiquity* 45(2):351-352.

Response to Thomas 1978. Point neck width can be a useful attribute marking temporal or cultural change whether or not it indicates anything about hafting.

**Cosgrove, C.B.**

x

1947 *Caves of the Upper Gila and Hueco Areas in New Mexico and Texas*. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University 24(2). Cambridge.

Info on arrows, notching technique for foreshaft manufacture. Atlatls and darts: pp 48-58. 1) Ceremonial Cave (Hueco Mts, just across border from SE NM in TX). Proximal frag with finger loops of "sinew" [looks like twisted sinew fibers in photo] lashed on above + below finger notches, marks for missing stone weight, V-shaped trough runs whole length from above grip [more like Aztec atlatl than BM type]. 2) Ceremonial Cave. Complete 24.25" but missing finger loops. Well made, rounded end, hook with a ridge, groove about 1/2 length, no wts, but 4" sleeve of hide sewn over middle [repair or held charms?], small decorative flutings + zigzag under distal end. 3) Chavez Cave (SE NM). [Unusual form - like Baja CA?] straight stick almost round cross section, 19.25" with no finger notches or loops, distal end raised to sharp edge with spur, shallow groove 1/3 of length. 4, 5, 6) Cerem Cave, small flat prox handle frags. 7) Peabody Mus collections, from Coyote Burial Cave Coahuila, Mexico [not illustrated] split hardwood sapling 21", flat face, rounded under, rounded ends, spur with ridge, shallow groove, no notches or loops.

From Hueco area, **1 full length dart** and 159 foreshafts + frags. Sotol stalks, and light wood with pith for shafts, oak or other hardwood fores. Shaft diams 1/4 - 3/8 inch prox, 7/16-3/4 distal. Complete sotol shaft Ceremonial Cave L = 61.75", others 53-67". Fletching with 3 large feathers lashed on. Some painted decoration. Foreshafts tapered to fit in socket without mastic, L 4.25-7.5" diams 5/16-3/8", some with nocks for pts, one with incised decoration.

From Upper Gila area, **1 full length dart** and 31 frags. Shafts all peeled wood with pith center, diam 1/4-3/8" prox, 1/2-5/8" distal. Fletching 3 feathers 7-8" long lashed on. Complete specimen without foreshaft 65.5 inches long. Foreshafts hardwood, some nocked for pt, a few decorated, some bunts, L 3.5-5 5/8", diam 5/16-1/2".

Grooved fending sticks from same sites, including 2 complete from Ceremonial Cave.

**Cotcher, Janice**

x

2007 Atlatl Lessons Grades 4-12. Resource Room at Math Central webpage, electronic document, accessed 8/31/09, URL:

<http://mathcentral.uregina.ca/RR/database/RR.09.07/cotcher/atlatl/index.html>

Atlatl used to illustrate radial velocity, and in other exercises for math and social

studies lesson. [Correctly explained as lever, but treating atlatl as if hook moved in circle is not accurate.] How to throw explanation with short video clip, instructions for simple stick atlatl making.

**Cotterell, Brian, and Johan Kamminga**

1990 *The Mechanics of Pre-Industrial Technology*. Cambridge: Cambridge University Press.

Includes section on atlatl and spear mechanics with physical formulae.

“When a spear is thrown by hand, about half its velocity comes from a final wrist flick... and shoulder velocity is less than 15% of the spear’s velocity.” (164)

“Because it lengthens the throwing lever, casting a spear with a spearthrower requires less wrist action than if it were done by hand.” Angular velocity of wrist with thrower is ca 1/5 of that needed in hand-throwing. (166)

“To cast spear 100m requires a velocity greater than 31 m/sec.” (168)

Atlatl should not bend, or it is inefficient - energy of throw is lost in bending the spearthrower. (168)

“Whatever purpose the bannerstone served, it had nothing to do with mechanical advantage. As can be seen from our analysis, a heavy spearthrower is inefficient. (169).

Spear should bend, but within predictable limits. “the butt end of the spear has to deflect sideways from its intended flight path.” [Photo of two aborigines throwing shows this - sideways because of a partly side-arm throw, but deflection is parallel to the atlatl, as it should be., not “sideways”.] “Spearthrower’s max length is governed by the need to limit this sideways deflection.” It is not limited by strength of thrower’s wrist, because long thrower remains in contact with spear longer [through longer arc of throw?] so acceleration is inversely proportional to length of atlatl, thus wrist moment, (product of force and length of spearthrower) is independent of length of atlatl. [What they must mean is that a slower motion over a longer time gives same acceleration and requires same force as faster, shorter atlatl - but in practical use a longer lever arm still requires more force than a shorter, at least to reach flight speed for a dart.]

If spear is rigid, butt is pulled down, angular velocity is imposed on butt of spear, and it tumbles (hooking). For perfect flight, spine of spear should match atlatl, so deflection returns to straight at time of release from hook.

**Couch, Jeffrey S., Tracy A. Stropes, and Adella B. Schroth**

1999 The Effect of Projectile Point Size on Atlatl Dart Efficiency. *Lithic Technology* 24(1):27-37.

Point size makes no difference in throwing distance. [Weak experimental design (small sample human throws) and dubious theoretical orientation (Perkins) but conclusion correct. However human variability in throws should be expected to outweigh difference in points, and the real useful info here is the demonstration that all point sizes work about equally, so point size is not necessarily a good

marker of atlatl vs bow]

**Coulam, Nancy J. and Alan R. Schroedl** o

2004 Late Archaic Totemism in the Greater American Southwest. *American Antiquity* 69(1): 41-62.

Split twig figurines, 2 types: Grand Canyon and Green River. [Represent ungulates that would have been hunted with atlatl.] Discuss ethnographic hunter-gatherer totemism, identify two types for figurines: “social totemism” (clan symbols) with finds in habitation sites, and “increase totemism” (sympathetic hunt/fertility magic) with finds in shrine caves, some pierced by twig spears.

**Cowan, Jay**

1988 At Long Last, An Atlatl of Your Very Own. *Sports Illustrated* Nov 14, 1988, no pages given. From web URL: <http://web.lexis-nexis.com/universe/> accessed 1/24/1998 but does not occur as claimed in print version of that issue of *Sports Illustrated*.

Modern atlatl for experiment and sport, Leininger and Perkins featured.

**Cowley, Marjorie** o

1994 *Dar and the Spear-Thrower*. Clarion Books, New York.

Juvenile novel. In Magdalenian (Upper Paleolithic) France, young Dar becomes a man, trades his sunstone (iron pyrite fire kit) for carved atlatl from another tribe, reconnects with family. Emphasis is on human relations and moral lessons rather than archaeological detail, but prehistory is reasonably accurate – and Dar has to practice long and hard to master spear-thrower.

**Cowley, Majorie** o

1998 *Anooka's Answer*. Clarion Books, New York.

Juvenile novel. Epipaleolithic girl is determined to have a different life involving her discovery of clay as sculpture, despite family resistance. People hunt with spears, and bows are just being introduced, but curiously no spear throwers appear in this story.

**Crabbe, Ad** x

2007 Boy, 7, Gets First Deer with Rare Spear. Lancaster [PA] New Era, November 13. Lancaster Online, December 2007.

Private preserve, 15 yards, equipment not described. Mentions PA attempts to legalize. Video posted on youtube attacked by PETA et al. antihunters and hunters who feared bad rep.

[See Guthrie, Russell 2007: Video shows boy throwing, deer hit, apparently it ran

a bit, but then shows steel broadhead on wooden dart went clean through, both lungs hit, dart broken in deer running, apparently two other shots to finish it off. Good shots of cleaned carcass to show wound.]

**Cressman, Luther S.**

1944 New Information on South-Central Oregon Atlatls. *The Masterkey* 13(6): 169-179.

Plush Cave site described, atlatl from looter backdirt. Simple Basketmaker type atlatl, missing its loops, groove + hook, no evidence of weight, 19mm wide, 54.5 cm long, [pictures poor] . Associated dart parts and basketry.

**Cressman, Luther S.**

**x**

1977 *Prehistory of the Far West: Homes of Vanished Peoples*. University of Utah Press, Salt Lake City.

p 105 “earliest archaeological record of spear-thrower” in New World is hook from Fort Rock Cave probably dating ca 8500 years ago, and 2 spurs from Five-Mile Rapids on the Columbia River, and others. Compound atlatl (attached spur) preceded simple atlatl (integral spur). Compound atlatl along W coast, associated with boatstone weights. Simple form farther east into Gt Basin. Replaced by bow around 2300 years ago in Gt Basin. Photo of McClure atlatl with stone weight, C14 dated at  $1470 \pm 140$  BP, “so fragile it hardly seems possible it could have been used.” [Last statement wrong, date is very late if accept his replacement arguments]. Long period of bow and atlatl overlap at Lovelock cave etc, suggests bow not just difused, but learned by trial and error. Mechanical principles are different.

**Cressman, Luther S. and Alex D. Krieger**

**x**

1940 Atlatls and Associated Artifacts from South-central Oregon. In *Early Man in Oregon: Archaeological Studies in the Northern Great Basin*. L.S. Cressman, H. Williams, A.D. Krieger eds, pp 16-52. University of Oregon Studies in Anthropology No 3.

2 complete atlatls and two fragments from Roaring Springs Cave.

Lower levels mostly large points, upper levels large + small points, arrows and bows and darts and atlatls apparently together [but possible mixing of deposits] .

Two atlatls together in cach, similar, one large, one small.

Both mountain mahogany, convex wide [inflexible] boards with ridge on underside, integral wood hook, deeply notched grip, no weight, painted with ochre.

L = 70 cm, 53 cm; Max W = 7 cm, 5 cm; small photographs.

Plush Cave atlatl mentioned, Basketmaker form. World distribution of atlatl types discussed. Compares RS atlatl with Lovelock Cave and BM types.



correctly explains atlatl in terms of lever arm. Australian anecdotes, Aztec darts “pass through armored man”, Frison experiment on elephants. Beginnings of fire use also discussed. Possible human causes of Pleistocene extinctions.

**Cross, John R.**

1999 “By Any Other Name...”: A Reconsideration of Middle Archaic Lithic Technology and Typology in the Northeast. In *The Archaeological Northeast*. M. A. Levine, K. E. Sassaman, and M. S. Nassaney, eds., pp. 57-73. Westport: Bergin and Garvey.

Technological and typological basis for Mid Archaic (ca. 8000-6000 B.P.) stemmed bifaces in the NE, Annasnappet Pond site. Stanly, Neville, Morrow Mt, and Stark points, all broad triangles with short narrow stems with concave bases, usually rhyolite. At Annasnappet Pond, associated with other lithics, full-grooved axe, winged and cylindrical atlatl weights. Oval feature with calcined skull frags, ochre, 3 Stanly/Neville pts and 1 drill, 2 winged atlatl wts, and 1 chipped slate knife perform, uncalibrated date  $7570 \pm 150$  BP. Points aligned with weights, shafts estimated at 125-135 cm long. Large pts often snapped and either half could be reworked; variants are mostly result of such. These are probably atlatl pts, and knives. Morrow Mt/Stark pts are thicker, narrower, sharp, with convex base of stem, different stone, less formal, rarely resharpened, probably thrusting spear tips.

**Cruxent, Jose M.**

o

1979 Stone and Bone Artifacts from Taima-Taima. In *Taima-Taima: A Late Pleistocene Paleo-Indian Kill Site in Northernmost South America, Final Reports of 1976 Excavations*. Edited by Claudio Ochsensus and Ruth Gruhn, pp. 77-89. South American Quaternary Documentation Program.

[Mastodon kill, C 14 dates 12,980-14,200 BP (uncal) on twigs assoc with skeleton - Bryan and Gruhn] El Jobo point midsection in cavity of R pubis of young mastodon. Probably used as dart point with atlatl. A second frag also in pelvic cavity of mammoth, and another surface find [illegible photos only]. Pressure retouch, knife use as well as point use likely. Two flake tools with bones, one on surface. “Tools of expediency” of limestone embedded in layer of limestone pebbles [apparently very crude damaged edges interpreted as retouch, he claims “expert eye” but it doesn’t sound convincing, no illustration.]

**Crystal, Breck**

o

2009 Buffalo Penetration Test. *Bulletin of Primitive Technology* 37:89-90.

65 lb bow, killed with dacite point which stopped on inside of opposite rib; steel point and antler point also made shots that would kill.

**Culin, Stewart****x**

1898 An Archaeological Application of the Roentgen Rays. *Free Museum of Science and Art (University Museum), Bulletin* 1(4):180-183. University of Pennsylvania, Philadelphia.

[maybe the first x-ray investigation in archaeology?] Cushing predicted turquoise “heart of fetish bird” concealed under wrapping on Basketmaker atlatl from Mancos Canyon, CO [which has chert biface and predator tooth visible]. Photos. Four stone beads revealed by rays. C. L. Leonard at Pepper Clinical Lab, also looked at mummies from Uhle’s work in Peru.

**Culin, Stewart****x**

1898 American Indian Games. *The Journal of American Folklore* 11(43):245-252.

Games originated as divination. Variations on dice games, recorded among 61 tribes. Pits, stones, disks, staves, sticks used as dice, from 3-13 with 4 most common number, relating to 4 directions, seasons etc. Zuni use 4 split cane, according to Cushing derived linguistically and in morphology/decoration from arrow shafts. One is called “a-thlu-a” or “all sender” laid across fingers, others on top of it - represents atlatl. Banded markings on some pieces represent “crossed wrappings for attachment of finger loops.” [Penn BM atlatl specimen shown]. Similar in other SW tribes. Origin of the game then “may be definitely fixed in the country of the reed arrow and the atlatl... the arid region of the SW US and N or central Mexico.” Mexican codex god holds atlatl and three arrows.

**Cundy, B. J.****o**

1989 *Formal Variation in Australian Spear and Spearthrower Technology*. BAR International Series 546, Oxford.

[Actually covers only Central Australia and the northern half of the Northern Territory so some important types and variation not included. A very good study although marred by many typos and almost no illustrations of spearthrowers and spears. One of the best sources on spearthrower mechanics and physics, but the explanations are not always clear. I’ve translated into English as much as I can.]

1. Intro: Variation should be explained by technological and functional factors as well as cultural differences.

2. Technological comparison and performance: Compares to hand thrown spears. Tasmania had no spearthrower, hand thrown spears 40-70 yards, maybe up to 100m, typically spears 4m long, .6 kg. [He discounts shorter distance records as non-comparable, but these Tasmanian ones seem exaggerated, when javelin record is 98m.]

Spear thrower records: Falkenberg (1968) measured throws in Northern Territory of 90-125m, one 180m, but special gear – small reed spears. Thomson (unpub) recorded 49-105 m in Arnhem Land. Mountford (unpub) got 50-91 m.

Consider 70 m as a “rule of thumb” average max distance, so not really better than hand thrown.

Accuracy is hard to compare from ethnographic accounts, but usual max accurate range 20 m. At moderate size targets, comparable accuracy to bow, but atlatl accuracy decreases more rapidly as target gets smaller or more distant. So why atlatl? Perhaps reduces necessity of learning throwing skills, i.e., it’s easier than hand throwing, both in skill and effort, freeing hunter to invest in other skills and activities. [I think he understates the improvement possible with spear thrower.]

3. Aerodynamic factors: “Vacuum model” of throw considers only gravitational and projection force, not aerodynamic factors, and predicts 45 degree angle for maximum distance throw. But drag (air friction) greatly reduces theoretical maximum. Spears unlikely to have much lift. Center of pressure must be behind center of gravity to keep straight flight, either by having most of the weight forward, or adding drag to rear of shaft, as in fletching. Most experiments suggest center of gravity should be between .25-.33 length on unfletched projectiles. Compares modern javelin, weighted and shaped to glide maximum distance but still land point first. “Range but not in-flight behavior equaled” by Australians. Palter (1977): 293 spears, center of gravity at .25-.48 length, thus many would stall if thrown for distance, but this was of secondary importance in their use.

4. Wound Ballistics: Penetration depends on motion and shape of projectile. Motion measured by kinetic energy, momentum, power, mass, and velocity, with most favoring kinetic energy. ( $\text{Mass} \times \text{velocity squared over } 2$ ). Because of drag from the material penetrated, heavier projectiles penetrate deeper than lighter higher velocity ones. Shape and size of missile affect drag. Surprisingly little energy is needed to penetrate skin and flesh.

5. Propulsion: Body levers in timed sequence, with slow but powerful (trunk, thighs) first, then faster but weaker joints (hands, arms), so each contributes its maximum. For light projectiles, skill (timing of muscle sequence) more important; for heavy, strength more important (e.g. baseball vs javelin). Mason (1884) and Howard (1974) use impulse model (atlatl increases time of thrust on spear). Howard’s model is unlikely on mechanical grounds, and predicts that spearthrower length is of little importance. Most analyses use lever model, seeing atlatl as lengthening arm. Atlatl is not a lever, but can be analyzed as part of lever system. [A confusing and unnecessary quibble. As subsequent discussion makes clear, atlatl and wrist do in fact act as lever and fulcrum.] Rotating short end of atlatl at wrist by applying strong force moves the long end a greater distance in the same time, thus faster, thus increasing velocity of spear. Analyzes 1970 ethnographic film of throwing. Motion is similar to conventional overhand throw, a sequence of 1) forward body motion, 2) shoulder rotation 3) arm rotation, and 4) wrist rotation [flexion]. Spearthrower increases length of resistance arm of any body lever in the same plane. If used more horizontally [side-arm], emphasizes shoulder + body rotation, if vertical, emphasizes arm and wrist. Stronger individuals may tend to use more vertically. Most of the gain in velocity is from wrist action in last .1 second of throw.

If spearthrower load is too great [too heavy, too much wind resistance] then velocity reduced. If too light, high acceleration reached at expense of power development.

Longer spear thrower increases linear velocity at tip (and spear) but increases load about the wrist faster because proportional to square of length between wrist and center of gravity of atlatl.

#### 6) Spear and Spearthrower Articulation

At rest, atlatl weight bends wrist back, spear weight counters this, bends forward. Bannerstones may help balance, but not used in Australia.

As wrist flexes to lever spear thrower, and spear stays in line, the tail of the spear must rise, so spear must flex a distance proportional to the length of the atlatl. The flex also stores energy that can be converted into kinetic energy later, and add to spear velocity, but spear detaches from atlatl before that is complete, so some of the energy stored as flex remains, resulting in wave-like shaft vibration. If shaft does not store enough energy by flexing, it will be tipped toward the ground; too much and it may buckle.

Thrower must overcome inertia of spear and atlatl tip. Longer atlatl has higher velocity, but rapidly loses advantage because inertia is function of length squared, so doubling length quadruples inertia. Shorter atlatl, lower possible velocity, but can throw heavier spear. Different spear and atlatl combinations optimize for either high velocity with low energy (light spear), or high energy with low velocity (heavy spear). [Of course, but how then do Australians use combination of long (and heavy) atlatl with very long and heavy spear? Even with my lighter spears, their woomearas are too long for me. Tables show some spears 400-500 gms, 4 x what mine weigh.] Can make atlatl lighter as gets longer, but then need to increase rigidity because energy stored as atlatl flex will only be released at end of throw as lateral movement of spear shaft.

7) Structural relationships. 1. Positive correlation between mass of atlatl and mass of spear. 2. Inverse relation between length of atlatl and mass of spear. 3. Inverse between length and mass of atlatl. 4. If optimizing for high velocity, atlatl inertia may be reduced by concentrating mass about the wrist pivot, in which case mass and length may be positively correlated. Test on specimens from Northern Territory, 5 types of spearthrower, but can't match individual spears to atlatls, uses sample means. Expectations generally confirmed.

#### 8) Spear and Spearthrower forms.

Central Australian: Leaf, paddle, or scoop shaped, lashed on hook, resin lump at handle, often with inset stone flake. [What most people think of as Australian "woomera."] Form linked to manufacture from cambium of mulga tree, and secondary uses as tray, club, musical instrument, etc. Appears inefficient – wind resistance of wide shape, but used either flat or edge-on.

**Cunnar, Geoffrey, William Schindler, Anne Underhill, Fengshi Luan, and Hui Fang** o

2009 Hunting with Talc? Experiments into the Functionality of Certain Late Neolithic Ground Projectile Points from the Site of Liangchengzhen, People's

Republic of China. *Ethnoarchaeology* 1(2):185-211.

Longshan Period (2600-1900 BC Neolithic), points of flaked chert (small triangular) and ground chlorite schist and talc schist (larger, elongate triangle with stem). All worked in replic exper shot into ballistic gelatin, but talc very soft, broke easily, cs better, chert most effective. Shattering of soft ts pts may be intentional in war, perhaps for infection or carry poison. Some ethnog comparisons [but fragility makes them ineffective against any armor and impractical to carry, distribute etc]. Size variation suggests some arrows, also spear, atlatl dart, but crossbow not evidenced until later [and NO evidence at all for atlatls – no reason to suggest them here]. Green color of symbolic importance, imitating jade for lower status folk.

[Interesting but small N experiment, talc pts really poor functionality, no context evidence such as burials offered.]

### **Cushing, Frank H.**

1895 The Arrow. *The American Anthropologist* 8(4):307-349.

[Fascinating early article by one of the first experimental archaeologists.]

Arrow was invented before bow.

Study specific for general laws of man's development. Good quotes on above, personal and individual nature of anthro, philosophy of study and need for replication. His discovery of arrowmaking. Arrows described (SW example). "Knapping" - direct, indirect, pressure described. Arrow making - includes straight and smooth w/stone, grooved grinder for foreshafts, wrenches. [Wild] speculations on human and arrow beginnings. Proposes development of spear thrower through some weakly documented [and often dubious] forms of spear sling, spear palm, etc. - short throwers with rope for end. Springy atlatl of cliff dwellers - claims his works, and that he experimented with Maya forms too. Reconstructs a stringed "spear crook or flinging bow" [combination atlatl and bow] from Zuni war paho, and "bow crotch" [an even more absurd idea], from which derives reflex bow. [I have tried a spear crook made by Richard Lyons - it does work, poorly, as a hooked atlatl, not with springing action. Cushing's scheme is an attempt to develop an evolutionary sequence for bows, based on incorrect notion of springing action of atlatls.]

### **Cushing, Frank Hamilton**

o

1897 Explorations of Ancient Key Dwellers' Remains on the Gulf Coast of Florida. *Proceedings of the American Philosophical Society* 35(153):329-448.

Describes at length the project and various remains.

Atlatls: two types - 1. Double holed, 18" long, slight curve, originally springy, with groove and spur, flared handle end. 2. Single holed, 19", more curved and thicker and wider, short groove, spur is tail of carved rabbit, handle turned down

volute. Suggests that some shark-tooth "swords" were also atlatls [but hard to evaluate from his descriptions and poor drawing].

(See Gilliland 1975, Kolianos and Weisman 2005)

Cushing's original description reads (1897: 43-44):

"It was significant that no bows were discovered in any portion of the court, but of atlatls or throwing sticks, both fragmentary and entire, four or five examples were found. Two of the most perfect of these were also the most characteristic, since one was double-holed, the other single-holed. The first ... was some 18 inches in length, delicate, slender, slightly curved and originally, quite springy. It was fitted with a short spur at the smaller end and was unequally spread or flanged at the larger or grasping end. The shaft-groove terminated in an ornamental device, whence a slight crease led quite to the end of the handle, and the whole implement was delicately carved and engraved with edge-lines and when first taken from the muck exhibited a high polish and beautiful rosewood color. The other .... was somewhat longer, slightly thicker, wider shafted, more curved, and as I have said before, furnished with only a single finger-hole. At the smaller end was a diminutive but very perfect carving of a rabbit, in the act of thumping, so placed that his erect tail formed the propelling spur. This instrument also was fitted with a short shaft-groove and was carved and decorated with edge and side lines, and the handle-end was beautifully curved down and rounded so as to form a volute or rolled knob, giving it a striking resemblance to the ornate forms of the atlatl of Central America; a resemblance that also applied somewhat to the double-holed specimen, and to various of the fragmentary spear-throwers. Arrows about four feet in length, perfectly uniform, pointed with hard wood, the shafts made either of a softer and lighter kind of wood or of cane, were found. The nocks of these were relatively large. This suggests that certain curved and shapely clubs, or rather wooden sabers - for they were armed along one edge with keen shark-teeth - might have been used not only for striking, but also for flinging such nocked spears or throwing-arrows. .... [then describes shark tooth clubs] ... Now the little cusp or sharp-edged spur at the end of the back-groove was so deeply placed in the crease of the knob that it could have served no practical purpose in a striking weapon. Yet, it was so shaped as to fit the nock of a spear, and since... the handle could be grasped not only for striking, but by shifting or reversing the hold, for hurling as well, I inferred that possibly the instrument had been used in part as an atlatl, in part as a kind of single-edged maquahuitl or blade-set sabre."

**Dale, George A.**

**x**

1970 Nambikuari Bow Makers. *Bow and Arrow* 8(5):22-25.

On tributary of Bolivian Amazon. Crippled hunter now bow maker. Bow 7 foot long, 2" W at grip, piuva wood, self-bow, twisted fiber cord, >50 lb pull. Long bamboo arrows with hardwood foreshafts and points - blunts for birds, barbed for monkey, lanceolate for hunting [actually look like my Yanomamo arrows, and not bamboo]

**Daniels, V. and W. A. Oddy**

x

1993 Analysis of Red Pigment from Aztec Spear Thrower. unpublished ms.

Under gilding on British Museum atlatl AM5226 is white gypsum gesso and red [clay]. Red pigment contains carminic acid, so from cochineal insect.

**Darwin, Charles**

1909 *Voyage of the Beagle*. Harvard Classics, P. F. Collier and Son, New York.

pp. 457-458, entry for January 12, 1836, near Bathurst, southeast Australia: “At sunset a party of a score of the black aborigines passed by, each carrying, in their accustomed manner, a bundle of spears and other weapons. By giving the leading man a shilling, they were easily detained, and threw their spears for my amusement... In their own arts they are admirable. A cap being fixed at thirty yards distance, they transfixed it with a spear, delivered by the throwing-stick with the rapidity of an arrow from the bow of a practised archer.”

**Davenport, J. Walker**

1943 Some Experiments in the Use of the Atlatl. *Bulletin of the Texas Archaeological and Paleontological Society* 15:30-37.

Very accurate and powerful, not as much as bow but good (motion - overhand, wrist snap to extend atlatl adds power).

**Davidson, D. S.**

x

1934 Australian Spear-traits and their Derivatives. *The Journal of the Polynesian Society* 43: 41-72; 143-162.

Continent-wide typology. Classification by means of propulsion is meaningless for tracing history of development because only difference is the indentation in butt for spear thrower; there are no spear types that cannot be thrown by either method. [Maybe, but that would be because Aust uses relatively heavy spears with atlatls]. Hand-spear prevails where heavy spear used, and peripheral areas, like Tasmania and Melville and Bathurst Islands where thrower not used. Functions of different types are not consistent among different tribes, and don't reflect spear structure, so must classify by physical traits alone. [Nevertheless, he divides each type into 2 varieties, one “for use with spearthrower” and one not, so it might very well be possible to find some patterning.] Main types: 1. Plain Spears: one-piece, plain with oval or flattened point, plain with spatulate head. 2. Composite Spears: some with wood shaft but mostly with reed - 2-pc with spatulate head, stingray spines varying in number, long heads with only short tail piece of reed, “death spears” with stone chips in gum head (S), Kimberly stone-headed spear (N). Both these two best suited for use with spearthrower, rely on sharp point rather than weight. New Guinea reed arrow probably developed from

reed spear after those diffused to Aust. 3. Spears with barbs cut in solid [he means a head, which must be used with a reed shaft - his typology is confused, mixing between types and attributes]. 4. Detachable barbs. 5. Bone barbs. [These last 2 he means barbs lashed on to side of tip or forming tip + barb.] 6. Death Spears [alread included under composites] - formerly distrib all along S coast, use glass since Euro contact, probably early type because assoc w plain spears. 7. Stone-headed spears, found only N part of Aust, with flake point more E and Kimberly pt more W. Small distribution with continuing diffusion shows late type, stone heads substituting for wooden ones. Kimberly always with long wood foreshaft on cane shaft. Reed spears of little value without spearthrower, prob originated later [so he contradicts earlier comments about lack of difference between thrower and hand spears.]

**Davidson, D. S.**

x

1936 The Spearthrower in Australia. *Proceedings of the American Philosophical Society* 76(4):445-483.

In historic Pacific confined to Yap, Palau, parts of New Guinea and Australia [His interest is in tracing diffusionary patterns]. Maybe originated in Asia, but no evidence, spread to Europe in Upper Paleolithic 20,000.

Probably not too old in Australia, but 1000s of years. But lacking in Tasmania and some parts Australia, so not fully diffused, so not too old.

All but couple possible exceptions are "male" type hooks, which need socket in spear. Hand thrown spears usually too heavy too, and some areas had elaborate carved barbs on wooden spears - reasons not to change to spearthrower.

Overlap of spear weights, but hand thrown spears generally heavier. Heavier spear with thrower needs shorter thrower.

Maps distribution: most of Aust except SE - lacking in "peripheral" areas so recent intro, slow spread. Probably from New Guinea [no evidence]. Reed spears with wooden heads only where spearthrowers, but only in part of spearthrower range, so a later development of spear to go with throwers.

Area of "negative distribution" (E-central) defined by Graebner, Radcliffe-Brown - but actually patchy presence there, little info.

Three types defined, distributions mapped, spread speculated:

- 1) Broad leaf-like (W + interior) wood slab, gum knob handle, often with stone adze flake inset, some with incised decoration, different regional varieties.
- 2) Lath-like (S + W coast, North) flat strip of wood, grip often gum, peg hook. Queensland subtype (N-E) [should be separate type, quite different], lath is vertical, not flat, no flex at all, little wind resistance, shell + gum handle, peg hook.
- 3) Stick-like (N + SE). N has tasseled handle, some gum handles, peg hooks, some integral carved hook, often very simple. SE types bulge or paddle-shaped.

**Davidson, D. S.**

x

1947 Fire-Making in Australia. *American Anthropologist* 49 (3): 426-437.



with chunky, but could adapt well as a modern atlatl game.]

**Deem, James M.**

**x**

2001 Kwaday Dan Sinchi: North American Iceman. Mummy Tombs webpage, URL:  
<http://www.mummytombs.com/mummylocator/featured/naiceman.news.htm>  
 accessed 9/13/06

Announces destruction of this find: cremated by tribes. DNA samples reportedly taken, no results announced yet. [Doesn't say if artifacts destroyed too.]

**de Heer, Rolf (director)**

**o**

2006 *Ten Canoes*. Palm Pictures, Australia.

Film (DVD) of Northern Territory Aboriginal story. Young man covets one of elder brother's wives, brother tells story of a similar situation that led to mistaken killing and "pay-back" ritual in which men of the victim's tribe throw spears at killer. A slowly unfolding narrative about the balance and beauty of aboriginal life and the importance of tradition. The "present" story is shown in black and white to mimic Thompson's 1930s ethnographic photos that inspired it, while the embedded "old" story is in color.

Throughout the film men carry and use spear thrower and spears. Spears are long, wooden, most with wooden "shovel nose" blades, although that used in killing has stone blade point, and that used in goose hunt has 2 or 3 barbed points. Woomera is the flat northern Arnhem Land/Gros Eylant type. We also see it used to paddle bark canoes. In the payback scene, a line of men throw spears in relatively high arc. Even with slo-mo the details are blurry, never get a real close look at spear throwers or throwing. Can see spears flexing as they pass over camera on way to target.

[This is a wonderful film, although as an anthropologist I would have liked the camera to linger over more detail of the activities the people are doing. The "making of" feature is also good, shows canoe making but no info on atlatls, and describes how much of the traditional life shown was reconstructed from Thompson accounts and some memory. So it should not be assumed that the atlatlists were adept, although the scenes appear realistic. Canoes and 300 spears made, some shown using modern tools. Problems and pleasures of working with local community described.]

**Dell'Amore, Christine**

**x**

2009 Photo: Oldest Art in Americas Found on Mammoth Bone? *National Geographic News*, Electronic document, URL:  
<http://news.nationalgeographic.com/news/2009/06/090610-oldest-art-mammoth-picture.html>

Vero Beach Mammoth image, see Picat 2009

**de Mortillet, Adrien**

x

1891 Les Propulseurs à Crochet: Modernes et Préhistoriques. *Revue de l'École d'Anthropologie de Paris* 1 :241-248.

[Hooked Spearthrowers, Modern and Prehistoric, in French] Probably preceded bow, retained by primitive people like Australians who never knew bow, or who don't have good bow material, like Eskimo. True arrow points appear in Neolithic. Australia: many forms [three illust, S and W forms]. Equatorial America: Amazon [unlikely illustration of a one-hole form] and Ecuador [one that might be Peruvian form]. Elaborate examples known from Mexico. Arctic America: cites Mason. W Europe: specimen from Laugerie Basse excav by Lartet and Christy, reindeer antler shaft with hook, engraved with cervid, reindeer, and probably a fish, incomplete, but 30 cm long [illust], several others mentioned. Like Eskimo throwers, for harpoons as found in Magdalenian sites.

**de Mortillet, A.**

x

1910 Le propulseur a crochet chez les anciens Peruvians. *L'Homme Préhistorique* 1910: 235-243.

[Hooked Spearthrowers among the ancient Peruvians, in French.] Some Amazon tribes did not know bow, used atlatl, eg Jivaro [obviously wrong illustration of use with hand not gripping properly and in middle, forefinger in hole close to hook - impossible form] "Estola" 70 cm long, longitudinal groove, hook at one end, hole for index finger. In Mexico, called atlatl [cites Nuttall]. For Peru, Michel 1898 describes, and painted vases from Peru show. Example illustrated from Trujillo [Moche? stirrup vessel] with flying masked warrior carrying mace, shield, spears, and hooked atlatl with bird head at base to prevent hand slipping [typical Peruvian form] M. Berthon [looting in Peru] found 2 specimens of atlatl at Niviera, near Lima [good engraving of one] 59 cm long, bronze olive-shaped hook, lashed on 75 mm from prox is perpendicular anthropomorph of antler, not quite in same plane as hook. A bit diff from Trujillo pic. Mentions Uhle but doesn't cite.

**Demoulin, Emmanuel**

2002 Les Faons aux Oiseaux. *Le Propulseur* 4/5:1-5.

[In French] Of about 100 Upper Paleolithic European spearthrowers, 7 from France represent the "fawn with birds" motif [a hornless ungulate peering backward over its shoulder at the hook, which is usually interpreted as showing a bird pecking at a fecal pellet emerging from the anus.] All are from Pyrenees and dating to the middle Magdalenian, C14 dated 15,340-13,280 BP. There are two complete (Mas d'Azil and Bedheilhac) and five partial. The facial and back markings indicate *Rupicapra* [Chamois], not fawns or wild sheep, although they lack the small horns of chamois. The bird interpretation has never been

convincing [very true!]; the hooks actually resemble hooks on other spearthrower forms, and Bandi (1988) has convincingly argued that they represent a birth. Perforations and traces of resin suggest additional decoration.

The fragmentary specimens seem to be the same as the two whole, but the quality of representation varies, so they are not the work of one artist. The similarities here and in other Paleolithic art show strong cultural rules producing stereotyped representations. Only spearthrowers have the birthing chamois motif, and if we have 7 surviving, there must have been many.

All are male type spearthrowers, and all are carved of reindeer antler. Only Mas d'Azil is complete enough to show how a wooden handle might have been attached by three perforations, and since it is only 30 cm long, there must have been one, since ethnographic spearthrowers average around 69 cm. Replication experiments show that a lot of time was required, although with practice one gets better with stone tools. Soaking the antler in warm water makes it easier to work. Burins and other stone tools can leave a smooth finish, or the antler can be polished with fine sand or ochre, which is visible on the Bedeilhac specimen. The pieces studied are relatively heavy, around 60 gm, and perhaps helped counterbalance the spear. However, they also seem fragile, especially those with perforations separating the legs, and may have been less functional than decorative or ritual. [Strength is hard to estimate, and may not matter too much if the spear is not too heavy. Emmanuel is one of the modern French using replicas of Mas d'Azil with heavy spears. Pascal Chavaux is another, and says he has broken some throwers.]

### **Dennell, Robin**

x

1986 Needles and Spear-throwers. *Natural History* 10:70-78.

Middle to Upper Paleolithic transition not just flakes to blade technology and Neanderthals to fully modern *H. sapiens*. Ca 35,000 ya, first bone points, if on throwing spears, more effective hunting. Better hearths, first artistic representation. But little change in way of life. Ca 27,000 ya, full modern humans, much more change. Maybe bow + arrow (Parpallo small points), certainly spearthrower and harpoon between 17-15,000, also needles imply warm clothes, huts, probably sledges, stone drill points imply fire drill, artistic depictions imply cultural contacts and sociality.

### **Dennell, Robin**

x

1997 The World's Oldest Spears. *Nature* 385:767-768.

“complete, unambiguous throwing spears 380,000-400,000 years old” at Schoningen coal mine in Germany. In river channels of Reinsdorf Interglacial. Directly assoc w horse bones. Related peat deposits have possible wood handle for stone tools, and .8 m long sharp at both ends “throwing stick”. Three complete spears, ca 2 m long. Horse bone w butchery marks, possible hearth.

Implications: definite effective hunting, planning and manuf skill (each from trunk of 30 yr old spruce tree, tip at base hardest wood, same proportions w center gravity at 30% from tip). Help explain early colonization of Europe. [See Thieme 1997].

**Dennis, Rob** x

2010 Fremont Hosts Prehistoric Weapons Contest. *The Oakland Tribune* Sept 5, 2010. Electronic version, accessed 9/27/10, URL:  
<http://www.insidebayarea.com/fdcp?1285707311711>

Coyote Hills ISAC, Chris Smith, Richard Baugh, Bruce Weidman, Mark Dellinger quoted. "The atlatl ate my brain" = obsession.

**Diaz, Gisele, and Alan Rodgers** o

1993 *The Codex Borgia: A Full-Color Restoration of the Ancient Mexican Manuscript*. Dover Publications, New York.

In Vatican library, probably painted in Puebla (Mixtec rather than Aztec) a bit before conquest. Numerous representations of deities with atlatls. Atlatls are stylized, most appear to be 2-hole type with heavy feather decoration. Often a shield with 3 or 2 darts is carried, sometimes that alone appears to represent atlatl or warrior and armament. Several depictions of deities, Venus and directional, striking others with dart on atlatl. Darts shown fletched, with large triangular heads.

**Dibble, David S. and Dessamae Lorrain** s

1968 *Bonfire Shelter: A Stratified Bison Kill Site, Val Verde County, Texas*. Texas Memorial Museum Miscellaneous Papers No. 1.

Rock shelter under cliff, includes bison bone beds associated with sequence of Archaic points. Upper level, the "Fiber Layer" has organics, including atlatl fragment, p61. Three conjoining pieces of distal end, warped and scorched. Shallow parallel groove .3 cm deep, 1.0 W, 15.8 cm long to incomplete hook. Max shaft width 3.4 cm, max T 1.0 cm, aboriginally cut off just proximal to end of groove. Unidentified soft wood. [Photo, looks like a crude and clunky version of SW form.] Dates on charcoal p 57 from 2 hearths in Fiber Layer 1400 ± 130 BP, 1690 ± 80 BP [uncalibrated, and only loosely associated with atlatl]. Points in FL are Castroville-like [broad triangular barbed and basal notched] and large side-notched Archaic dart forms.

**Dickel, David N.** x

2002 Analysis of Mortuary Patterns. In *Windover: Multidisciplinary Investigations of an Early Archaic Florida Cemetery*. Glen H. Doran, editor. Pp. 73-96. University Press of Florida, Gainesville.

Mostly primary, flexed, staked down in peat. Several traumatic injuries, only one definite violent death: adult M with antler tine point in pelvis, no healing, extended (unusual) and lacking skull. 30 F, 40 M, 40 subadult. Antler atlatl handles 1 w F [table 4.5 but in text says “none”], 5 w M, 1 w subA. Atlatl cup w spur: 0 w F, 4 w M. Antler flakers: 1 w subA. Antler point: 1 w F, 2 w M, all possibly in body.

Photos of “atlatl handles” - ovoid, drilled transversely [they look like bannerstones, and there is no explanation of why they are called handles, can’t see from photo where on shaft they are.] Ends battered, and have one inset with carnivore tooth, others hollowed. Tool? - suggest club. [I suspect knapping tool - tooth or antler insert for pressure, battered end in photo looks like knapping damage.] 4 bifaces - 3 of them large stemmed pts. Photo of assemblage with Burial 90 (11 yr old + neonate) shows shaft wrench, bone rods, and a harpoon pt or atlatl hook of different form from others, and biface knife.

### **Dickson, D. Bruce**

1985 *The Atlatl Assessed: A Review of Recent Anthropological Approaches to Prehistoric North American Weaponry. Bulletin of the Texas Archaeological Society* 56:1-36.

[Thorough review, good references, some mistakes.]

Seems to accept theory of lengthened contact with spear rather than lever or spring. Most experiments show weights are no help.

Atlatl survived for advantages in aquatic hunting and warfare.

### **Dickson, Don R.**

1991 *The Albertson Site: A Deeply and Clearly Stratified Ozark Bluff Shelter*. Arkansas Archeological Survey Research Series No. 41. Arkansas Archeological Survey, Fayetteville.

Lots of projectile points, one atlatl hook from Middle Archaic levels he dates 6000-5000 B.C. Short antler hook with beveled tip, mortise and tenon grooves on bottom, lashing groove across top.

Late Woodland small points mark bow and arrow around 800 A.D.

### **Dickson, Don R.**

2002 *Prehistoric Native Americans in the Ozarks*. Ozark Resources and Historical Publications, Fayetteville.

p. 41 Part of a “sophisticated compound atlatl” found at Albertson Shelter in context dated 7800 ± 80 BP. [apparently new dates since 1991, important because makes this one of earliest dated atlatl pieces]

p. 81 Dalton points rarely show impact fractures, so are more likely knives than dart points.

**Dickson, Jim**

2001 Aleut Throwing Board. *The Dart: Ohio Atlatl Association Newsletter*.  
March 2001: 4-5.

Instructions for making rigid rectangular board with inset male hook, shaped handgrip. Traditional measurements by hand size.

**Dinnis, Rob**

2011 Bladelet cores as weapon tips? Residue and micro-wear analysis of carinated burins from the Aurignacian of Les Vachons, France. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

“The interpretation of certain Upper Palaeolithic carinated lithic artefacts as discarded cores from the production of micro-lithic bladelets is now well-established, good evidence to support. Present in many Upper Palaeolithic cultures, espec Aurignacian – the culture of Europe’s first *Homo sapiens*. Relationships between lithic typology, technology and function are complex, problems arise when prehistoric activities are inferred from lithic assemblages. Micro-wear and residue analyses of three bladelet-core “carinated burins” from late Aurignacian level of Les Vachons, France. remains of birch pitch adhering = evidence that they were hafted; first time pitch identified on Aurignacian artefacts. Micro-wear traces are consistent with hafting. Thus, form suggests discarded bladelet cores, other analyses indicate function as hafted tools. Unlike other Middle and Upper Palaeolithic industries, the Aurignacian is not thought to include (non-bladelet) lithic weapon tips. Use-wear on two of the artefacts suggests that this was their most plausible hafted function. Even if correct, it is unlikely that a large number of large lithic weapon tips lie unrecognised in Aurignacian assemblages.” Because most burins like these couldn’t be points. [A couple sharp burins got used as points – not too surprising.]

**Discovery Channel**

2011 *Weapon Masters*. DVD. Discovery Communications LLC.

Mike Loades (weapons expert of unknown background) and Chad Houseknecht (engineer, geek, comic relief) host TV documentary featuring different weapons each week (10 shows), including atlatls. The usual schtick is a bit of history and demonstration from Loades, traveling to sources and interviewing experts, while Houseknecht re-engineers the weapon with modern technology to understand how it works and improve it. Atlatl segment featured a number of notable atlatlists, especially Bob Perkins.

ML: “So this is a spear thrown with a lever” “Without it man wouldn’t have got to the moon” “It’s the first human force multiplier” Perkins: “This is the weapon that propelled us to the top of the food chain.” Perkins hits a car hood with stone pointed wooden dart, making smallish hole and bouncing off. Then

Loades cites Bernal Diaz claiming atlatl could penetrate Spanish armor – “can the atlatl you build penetrate Spanish armor?” ML compares to modern recurve bow. Perkins “Pretty much darts are just arrows on steroids.” Slo-mo shows dart + arrow flex “see it kick off the atlatl.” Perkins: “that’s the key to the system is the flexibility of the dart storing energy and pushing itself away from the launching platform.” [but in the slo-mo it looks to me like the dart is clearly flexed when it leaves, not jumping straight.] ML: once the dart is launched all that energy is just wasted in oscillation. Perkins: without flex, not clean powerful launch of either dart or arrow. Loades: “What’s the physics of that?” Perkins: Record distance 258 m. [Then he draws “science” stuff on blackboard, but flashy frenetic camera conceals it, which is probably just as well, since it is nonsense.] P: “This is a spring mass system. The dart tip resists acceleration. It forces the dart to store spring energy to be released against the spur of the atlatl.” Chad “So the whole purpose of the spring of the dart is to effect a clean release from the spur of the atlatl.” It “boings” away.

BP and ML making dart in the woods [it’s implied that that is how Perkins makes his atlatls] while CH is in the shop making modern version capable of beating world record and penetrating armor. Explains  $Force = Mass \times Acceleration$ . A branch and handaxe are shown, and the branch becomes an atlatl, but steps not shown or if stone is really used. Antler hook put on with sinew. Unpromising branch straightened for a dart, but the shaft that is then scraped is probably not the same branch. Test shows ML hitting hay bales with new gear. Perkins: “Of course it works, I’m Atlatl Bob.” Meanwhile Chad makes aluminum atlatl with dart rest and a horizontal wire spur so it will take an arrow nock, [implying that these are his inventions, although since they must have talked to lots of atlatlists, they probably are not.] Aluminum tubing dart gets bent, so goes to Easton Archery where they shoot arrows from a fixed modern compound bow through chronograph to see “what goes fastest and penetrates farthest.” 245 feet per second, carbon arrow faster than aluminum, larger diam shaft not penetrate as far even though it was heavier and thus had more kinetic energy. So for distance + penetration want small diameter as heavy as possible [not quite that simple].

CH tests different shafts, throws a mop with long 2-hand atlatl “it’s just totally unflingable” His test atlatl is very long, aluminum, horizontal arrow nock, rest, held with 2 hands, uses darts about 2 m long, first “tumbles end over end” finally gets 217 feet throw.

ML goes to Valley of Fire to look at petroglyphs with BP: “this was the first true weapon system that we developed. This is the weapon that took the human race from scavengers [images of a ground squirrel, not a scavenger at all] to full-blown big game hunter. BP: atlatl allowed people to get lots of game, thus leisure for art, “truly brought us to where we are today.” As many types as “stars in the sky” - shows a poor “Basketmaker” replica and a bogus “Aztec ceremonial” with a snakey carving. “Apart from Antarctica, everywhere in the world.”

CH + ML with Scott van Arsdale “You mean there actually is a World

Atlatl Association?” go to airport in NV for distance throw, add Latrell Frederick, college champ javelin thrower. 155 m max throw, blame it on Chad’s darts, a couple of which broke or bent in throwing.

To test armor penetration, to WAA annual meeting in NY with SvA. 4 atlatlists with stone points: Mark Bracken, atlatlist I don’t recognize, Scott, and Bob Berg. Several dents, but no penetration of steel breast plate. Scott then hits dummy in the eye. Mike Loades: “This is clearly a terrifying sight, I mean, you just see the power of the atlatl. But you know, it didn’t do so bad against the breastplate... None went through, but by golly they made some severe dents. If you are a conquistador and you have these things raining down upon you, the atlatl in the right hands is a terrifying weapon.”

Chad tries metal tips, thrown by Mike Waters, at archery targets, measured with speed gun. 49 “atlatls per second” [he must mean fps] Max shown 52 fps, penetrates foam with stone tip on large foreshaft 4-5.5 inches. Modern darts get up to 67 fps. Traditional darts ave 43.2 miles per hour, moderns 58.5 mph, but less penetration with broadhead and field points. [Lighter darts, but weight info not given. It is not always clear if they are measuring fps or mph.] So Chad mounts a bang-stick type device on the dart to fire a bullet as it hits, and penetrates armor [quite irrelevant]. [Greg Nunn is thanked in credits – did he make stone points?]

[Overall, horribly hokey, but good publicity for atlatls and WAA, ok basic info for public despite incorrect Perkins ideas and overstated “terrible weapon” – the skillful atlatlists make it obvious that atlatls can be powerful and accurate. The experiments are incompletely documented, but make one important point: stone tipped dart does not penetrate steel plate armor. That was always obvious, and in fact Garcilaso de la Vega didn’t say it did - in Swanton’s translation, it is “mail.” The distance trial is useless, but the incomplete velocity data are good. The armor piercing bullets at the end are just dumb. I find it amusing that CH with all his modern tech was unable to make a better atlatl than we already have.]

### **Diters, Charles E.**

**x**

1977 *Norsaq : The Throwing Board, Regional Variation in One Element of Eskimo Material Culture*. M. A. thesis, unpublished, Brown University.

Regional variation discussed from some 188 specimens. Terminology and typology expanding on Mason 1885. Some arch info. Availability of raw material and specific use patterns most affect design.

Spear thrower almost always assoc w kayak, hunting seals and sitting waterfowl. But lacking in some areas of kayak use, like Netsilik, Nunamiut, Copper Eskimo. Advantages over early guns, bows – resist wet, one hand use, retrieval of game.

Atlatl study hindered by lack of common vocabulary – he gives useful terms for parts of Arctic forms. Archaeological record: cites a couple dozen finds, describes a couple, but oldest are ca. 2000 yr old, Okvik-Old Berring Sea and Thule cultures. Origins unclear – could be from Asia Up. Pal. or indep invention or develop late from N. Am spear throwers, probably the last.

**Dixon, James E.**

o

1999 *Bones, Boats, and Bison : Archeology and the First Colonization of Western North America*. University of New Mexico Press, Albuquerque.

Argues for relatively early entry into Americas by a coastal route. Good summaries of sites and other info.

Paleoindian atlatl use attested by hooks from Warm Mineral Spring, Marmes Rockshelter, and Fort Rock Cave, and fracture patterns of points (Hutchings 1997). Crude drawing of use. Darts should have had bone foreshafts with harpoon-like head holding stone pt. Photo shows one from OH [no info on age or site, see Stanford 1996]. Similarity of Clovis hafting [a BIG leap from that poor evidence] to marine harpoons supports his coastal migration theory.

**Dixon, James E., William F. Manley, and Craig M. Lee**

o

2005 The Emerging Archaeology of Glaciers and Ice Patches: Examples from Alaska's Wrangell-St. Elias National Park and Preserve. *American Antiquity* 70 (1): 129-143.

Background refs. GIS modeling to focus examination of ice patches. Abundant and diverse faunal remains. Arrowshafts, barbed antler arrow points with native copper end-blades (missing), AD 500s-1500s calibrated C14. Two dart or spear shaft frags and one foreshaft w stone point (photos), mean calibrated C14 dates AD 833, AD 1335, and 795 BC (wood) to 1052 BC (sinew). [Note apparent atl/bow overlap, longer than Yukon suggests].

**Dold, Catherine**

o

2003 The Neighborhood Bonebed. *American Archaeology* 7(2): 32-38.

Bison kill site, CO, ca. 3000 BP. Painting reconstructs hunt with atlatls. [Shown adequately, but unfortunately captioned "used prehistoric spears called atlatls".]

**Dold, Catherine**

o

2004 Prehistory Defrosted. *American Archaeology* 8 (3): 20-26.

Yukon ice-sheets with caribou dung, remains of different animals, hunting gear spanning 9500 BP – 100 BP. Over 40 dart shafts, a few stone points, some in foreshafts. Darts wood, spliced, ave 78" [198 cm]. Around 700 AD shift to bow and arrow, with antler points. Suggest about 100 yr overlap, rapid transition.

**Domenick, Jeff**

o

1999 Paleolithic Passion Grips Ligonier Man. *The Atlatl* 12(3):2-3. (from *Pittsburgh Tribune-Review* September 14, 1998).

Chuck Butorajac profiled: 56 yr old, atlatl elbow, half-beard, artist. Sells atlatls

with custom grips of crushed walnut shell + epoxy, rivercane darts. Promoting atlatl hunting in PA, future Olympic sport.

**Donnan, Christopher B.** **s**

1985 Archaeological Confirmation of a Moche Ceremony. *Indiana* 10:371-381.

Kutscher 1958 described and named “ceremonial badminton” from 3 vase paintings, reconstructed as throwing “staff” into air with atlatl, staff carries feather “flower” with string and peg attached. String wound around staff unwinds in flight and flower drifts down. Elite ritual practiced on pyramids. Characters and paraphernalia also assoc with ritual race depictions.

Burial excav 1972 at Pyramids, Moche include adult male with “staff”, 170 cm long, wood partly sheathed in metal. Short cross pieces inserted through holes at each end. [Agrees they would not have rotated, but doesn’t give diam of shaft, drawing shows it as 2-3 cm - would it have been flexible enough to throw with atlatl?] Assoc with copper spatula, tweezers, disk on face = headdress element in race scenes, 6 pots including one depicting race [but NOT atlatl].

**Donnan, Christopher B.** **o**

2004 *Moche Portraits from Ancient Peru*. University of Texas Press, Austin.

Depictions include fine line paintings of bird hunt with atlatls, warriors carrying atlatl and darts, but in combat use maces. Atlatls are Peruvian style, seem to have elaborate hooked handles and distal hooks (spurs), warriors consistently carry 2 darts, which are depicted without fletching, either plain sticks, or barbed pts.

**Donnan, Christopher B.** **o**

2007 *Moche Tombs at Dos Cabezas*. University of California at Los Angeles Cotsen Institute of Archaeology, Los Angeles.

Large Moche site. Cleaning up after looters at pyramid uncovered several unlooted tombs. Tomb 2 was high status male 18-20 years old, 181 cm tall (unusual size), buried with human and llama sacrifice, many objects including head dresses of gold placques on basketry, pottery, and weapons. Bundled in elaborate cloth (not preserved). At right side: Spear thrower - simple straight round stick [was there a grip piece, as on most Moche atlatls, that did not preserve?], 49.2 cm long, with gilded copper bands, and hook cast [copper?] in form of upright lizard with inlaid eyes. Two barbed copper spear points, 32.5 cm long, presumably hafted into cane shafts [seems like a heavy point on a light shaft?]. Round [basketry?] shield covered with gilded copper plates. Under these were copper chisels in hand, 3 copper tumi knives, wooden war club, hollow rattle scepter in form of war club. Under legs another atlatl, plain wood, 51.2 cm, with simple copper hook. Four socketed conical copper spear points. In a separate compartment was a copper figurine with miniatures mimicing tomb goods including clubs, shields, darts and atlatl.

Tomb 3 had another adult male 18-22, 175 cm tall, in bundle, with sacrificed child and woman. Outside bundle were 9 copper dart points (11.4 cm) and a simple atlatl with copper hook. Goods similar to T2 but fewer, no more atlatls.

Tomb 1 adult male, large 183 cm tall, age 21, with sacrificed woman, not in bundle, atlatl under L arm with copper hook, shaft ca 42 cm L and 2 cm diam. No darts. Headresses, pottery, similar to T3.

C14 dates calibrated 310-635 AD. Numerical symbolism in some object clusters of 5, 10, 20, 40, use of oppositions, each tomb with small mimicing figure in other compartment.

**Donnan, Christopher B. and Carol J. Mackey** o

1978 *Ancient Burial Patterns of the Moche Valley, Peru*. University of Texas Press, Austin.

Catalog of burials of all periods (Chavin, Salinar, Galinazo, Moche, Chimu), [some very sketchily presented, others with better info.] Burial M-IV 11 (pp. 154-158) is the one discussed in Donnan 1985. Staff with cross pieces measures about 200 cm long and 2.2-2.5 diam from scale in drawings [making it unlikely to be an atlatl dart. Notably, there is no atlatl or parts that could be atlatl, with this burial, nor with any of the others of any period, including Moche period burials with similar pots depicting the race, warfare, warriors, etc.]

**Donnan, Christopher B. and Donna McClelland** o

1999 *Moche Finesline Painting: Its Evolution and Its Artists*. UCLA Fowler Museum of Cultural History, University of California, Los Angeles.

Chronology of painting styles on stirrup bottles and other vessels, some individual artists identified. Color photos and roll-out drawings of designs, splendid illustrations. [Atlatls appear often, but are not commented on at all, even when they are important in actions depicted, and part of the style differences that distinguish individual artists. Some stock scenes use atlatls: Some warrior processions, some weapon bundles, and some battle scenes, and a few of the complex burial rituals show them, but war emphasizes maces instead of atlatls. They are often seen in Deer Hunt scenes, although sometimes the deer has been speared but atlatls not depicted. A common scene described as “Ceremonial Badminton” is some kind of atlatl event, with darts shown as having bars across and flowers attached, and multiple atlatlists, often with bird or animal heads. The atlatl form is Peruvian, often with a bird head at handle, sometimes a mammal (canid or deer?). Darts appear unfletched, but fletching may be indicated in one case. Darts may be plain or with barbed points. Warriors often carry two or three extra, and often darts appear with warriors or shields when atlatl is not depicted. See Whittaker 2006]

**Dopp, Katherine E.** o

1906 *The Later Cave-Men*. Rand McNally and Company, New York.

[A children's text book novel in her "Industrial and Social History Series," promoting the idea that learning is best when there are hands-on exercises and connections between many subjects of study. Story follows fictional Upper Paleolithic tribe. Episodes are trite and naive, with a lot of silly explanations of accidental invention and old-fashioned views of prehistoric folk. Illustrations are nice, but the artist doesn't understand prehistoric technology any more than the author. So we have spear throwers invented by "hurling one spear by resting the butt against the barb of another" p 145 (idea from Cushing 1895), with illustration of absurdly short throwing stick. Real Paleolithic atlatls not illustrated; they had only recently been recognized. The old idea of "baton de commandement" is taken seriously, etc. "Things to do" suggestions range from ok to wildly impractical: "If you can strike off a large flint flake...make it into a knife-saw-file" (with no usable instructions on how to knap, no likely source of material etc!) or "See if you can find a way of making a glacier in your sand-box." or "Tie a slip-knot at one end of a string and show how to set it for snaring birds." This book defines "Quaint."]

**Dopp, Katherine E.**

o

1912 *The Early Sea People*. The Rand McNally Press, Chicago.

[Another in the series, this one based on Mesolithic folk of Danish shell middens. Lengthy but sketchy and inaccurate account of bow and arrow making. Things to do: "Collect stones in your neighborhood and sort out those which are good for arrows." Improbable invention of pottery from clay linings of "boiling baskets and roasting trays." P. 80 drawing of "Some people threw arrows in this way instead of with a bow" which is a direct plagiarism of Cushing's (1895) hypothetical spear-crook, but plays no part in the story. The artifact illustrations are especially ludicrous - didn't the artist at least look at a stone tool? Dopp's works are good examples of 19<sup>th</sup> century thinking about artifacts and prehistory.]

**Doran, Glen H.**

s

2002 Introduction to Wet Sites and Windover (8BR246) Investigations. In *Windover: Multidisciplinary Investigations of an Early Archaic Florida Cemetery*. Glen H. Doran, editor. Pp. 1-38. University Press of Florida, Gainesville.

E Florida, bodies in peat pond. C14 8120-6980 BP or 8522-7421 BP cal. MNI = 168, ½ <20 yr old, equal M/F. Often wrapped in cloth, with goods. Adult M have most antler tools, all carnivore radius awls and antler atlatl cups/hooks, almost all lithics. Relatively little use of shell or coastal resources = argument against earlier PaleoInd coastal adaptation - doesn't develop until Mid Archaic. Shark and other dental cutting tools more common than stone. Bottle gourd *Lagenaria siceraria* direct date 7290 BP uncal. Brain masses in some skeletons provide DNA and albumin phenotypes, which show not closely related to any living Native Am.

group.

**Doucette, Dianna L.**

o

2001 Decoding the Gender Bias: Inferences of Atlatls in Female Mortuary Contexts. In *Gender and the Archaeology of Death*, B. Arnold and N. L. Wicker eds., pp. 159-177. Altamira Press, Walnut Creek, CA.

Do burial goods accurately reflect life roles of individual? Interpretations of atlatls at Indian Knoll, KY, and Annasnappet Pond, MA, both Archaic.

Indian Knoll – 6100-4500 B.P., over 1000 burials, of which 76 with atlatl components, including 13 females and 14 indeterminate. Early arguments about function of antler hooks and drilled stones: net hooks and sizers, hair ornaments, ceremonial banner stones on staffs. No gender interpretations – “it was not until these artifacts were identified as hunting tools that they became problematic as grave goods in female burials.”

Webb identified as atlatls, and checked association of parts, but did not dig much beyond body, so can't tell if darts were with them. Webb saw as partly ceremonial because “it is hardly to be supposed that women would have had any practical use in life for an atlatl.”

Annasnappet Pond, Archaic component cremation with 2 weights aligned with 2 large points, date 7570 B.P. Pit was large, and cremation could have been offering with perished unburned individual. Sexing not possible. Atlatls may have been articulated with darts. Position of points in pit suggests 125 cm darts, shorter than most expect, and not requiring much upper body strength.

Critiques: Winters (1968) did not want to see women as atlatl users, but his interpretations are based on ethnocentric gender biases. Lots of ethnographic cases where women hunt. Atlatl makes spear throwing easy regardless of body size.

**Drake, David and Jim Kjelgaard**

o

1990 *The Hunter Returns*. Simon and Schuster, New York.

See Kjelgaard 1951.

**Drass, Richard, and Robert Brooks**

1984 A Boatstone and Atlatl Hook from Central Oklahoma. *Newsletter of the Oklahoma Anthropological Society* 32(2):7-10.

Found in grave with M, F, juvenile - near R arm of adult male.

Limestone weight, antler hook - Indian Knoll type.

Possibly late - site is Woodland, but bones not dated [so no reason to believe it is not earlier Archaic grave].

**Dunbar, Jim**

x

1997 Atlatl Replicate Study. *Aucilla River Times* 10(1) Aucilla River Prehistory

Project webpage accessed 10/12/2006, URL:  
[http://www.flmnh.ufl.edu/natsci/vertpaleo/auquilla10\\_1/auquilla.htm](http://www.flmnh.ufl.edu/natsci/vertpaleo/auquilla10_1/auquilla.htm).  
 Reprinted in *The Dart*, April 2011: 17-20.

Testing breakage on Clovis era ivory rods used as foreshafts. Used 2 atlatls - modified Key Marco form with 2 holes, European Upper Paleolithic form. Oak dowel spear 1.8 m long, 227 grams. Silicified coral point and ivory foreshaft made by C Van Orter, wooden + alligator bone foreshafts. Driven into palm trunk 50 times, points and foreshafts survived, lashings failed. Need more exper to test breakage. [Impressive durability of both pts + shafts].

**Dunham, Mike**

o

2002 Art of the Ancients. *The Atlatl* 15(2):1-2. (*Anchorage Daily News*, 12/17/01).

Yukon River Yup'ik still hunting spotted seal with motorboats and "nuqat" atlatls. Flat "throw board" with finger hole, 4 foot small harpoon with feathers and ivory or brass head. Multiple boats and hunters include young folk. More effective than rifle because better recovery of seal. [A bit gee-whiz, and little atlatl detail, but ok].

**Durkin, Pat**

x

2005 Conservation Congress Continues to Make Questionable Decisions. *Oshkosh Northwestern*, March 13, 2005. URL [http://www.wisinfo.com/northwestern/sports/stories/sports\\_20208982.shtml](http://www.wisinfo.com/northwestern/sports/stories/sports_20208982.shtml) accessed 3/17/05.

Columnist criticizing state conservation advisory board scorns among other things their support for legalizing atlatl hunting.

**Durkin, Pat**

x

2009 Atlatl, Darts Take Hunters Back to Roots. *Green Bay Press-Gazette*, April 9, 2009. Electronic document accessed 4/10/09 URL:  
<http://www.greenbaypressgazette.com/article/20090409/GPG0702/904090505>

Fish + wildlife hearings to discuss use of atlatl for small game, spurred by Riemersmas. Legal in AL, AK, CA, ID, IA, MO, MT, NB, OK, TX, SC.  
 [this time he sounds supportive instead of scornful - maybe Riemersmas educated him?]

**Dutour, Olivier**

2000 Chasse et activités physiques dans la Préhistoire: les marqueurs osseux d'activités chez l'homme fossile. *Anthropologie et Préhistoire* 111 : 156-165.

[Hunting and physical activity in prehistory : boney markers of activities in fossil

man. In French.] Reviews theory, literature. Modern javelin throwing is well documented, relevant to prehistory. Three phase throw: run-up ending on right foot, transfer of body weight from right to left foot with rotation of shoulders over hips, release and follow through. Elbow is particularly stressed, resulting in arthritic conditions of the epitrochlear muscle insertions on the inner side of the distal humerus. Archaeological example: prehistoric Saharan hunters – “Cromagnoids” from Neolithic lakeside sites with large fauna, microlithic industries, and bone harpoons. Two elbows with characteristic lesions (out of 38), suggest harpooners.

### **Dyer, Todd**

x

2007 The Atlatl and Bannerstone. Electronic document, Indian Artifacts and Fossils: The Midwestern and Southeastern Collections of Bill and Todd Dyer. URL [http://www.webdyer.com/artifacts\\_fossils/home.htm](http://www.webdyer.com/artifacts_fossils/home.htm) accessed 1/20/08.

[Carefully done, nice photos, info ok but some errors - oldest atlatls are not 25,000 years ago in N. W. Africa, and Perkin’s spring theories are not correct.] Bannerstones as atlatl weights, discusses manufacture and probable use as markers of identity in different areas.

### **Edgar, Blake**

2002 Chronicler of Ice Age Life. *Archaeology* 55(6):36-41.

Flattering article on Jean Auel, praising accuracy and detail of her fiction. Excerpt on atlatl use from *Shelters of Stone* “Holding the spear-thrower horizontally in his right hand, with his thumb and index fingers through the two front loops, he quickly slapped a spear into the groove. He slid it back so that the hook of the thrower, which also acted as a backstop, fit into the hole in the fletched butt end, and without hesitation he launched the spear. He did it so quickly, many people hardly noticed the way that the back end of the thrower raised up while he held on to the front with the aid of the loops, effectively adding the length of the spear-thrower to the length of his arm and thereby gaining the advantage of the additional leverage.”

Photo of Auel “demonstrating proper atlatl form.” [Unfortunately, she isn’t – couldn’t possibly get a good throw with elbow low, wrist forward. Maybe the photographer’s fault, but like much of her books – good story, lots of researched detail, but a bit off the mark as a depiction of prehistory. Here there’s an implausible emphasis on speed (also seen in her descriptions of slings), and it’s plainly the wrong kind of atlatl! She’s describing something like a SW “Basketmaker” form – late, N.American. The Upper Paleolithic spear throwers that we know had no groove, and no evidence survives for finger loops.]

### **Edge-Partington, J.**

1903 Notes on the Weapons of the Dalleburra Tribe, Queensland, lately presented to the British Museum by Mr. Robert Christison. *Man* 3(19):37-38.



**Engel, Frederic**

x

n.d. Paracas: Cien Siglos de Cultura Peruana. Juan Mejia Baca, Lima.

[In Spanish, 2 pages xeroxed only, with photos of Peruvian estolicas with carved handle pieces, one with its dart, also a sling.]

**Engvall, David P.**

1995 The Dynamics of: The off-Axis-Forward-Nock Spear vs The On-Axis-Aft-Nock Spear as Thrown with an Atlatl Spear Thrower. *The Atlatl* 8(4):4-5

His world record: 848' 6 5/8" 7/15/95.

FNS = nock 1/4 length from butt, different motion, similar atlatl to ANS.

ANS: spur moves almost in straight line, spear flexes up or down.

FNS: spur follows curving path, spear flex is concave down, transforms into axial motion to give greater launch velocity. [But no info on equipment details like length of atlatl and dart!]

**Environment Canada**

2003 Rare Artifacts Melt Out of Ice. The Yukon News, Your Yukon Column 200, <http://www.taiga.net/your Yukon>, accessed 2/14/03.

Atlatl foreshafts with stone points pictured, dates 4,300 to 6,800 BP, bows and arrows show up 3-4000 BP. Melting and loss rapid now. Archaeologist Greg Hare.

**Erlandson, Jon M., Torben C. Rick, Todd J. Braje, Molly Casperson, Brendan Culleton, Brian Fulfroost, Tracy Garcia, Daniel A. Guthrie, Nicholas Jew, Douglas J. Kennett, Madonna L. Moss, Leslie Reeder, Craig Skinner, Jack Watts, and Lauren Willis**

2011 Paleoindian Seafaring, Maritime Technologies, and Coastal Foraging on California's Channel Islands. *Science* 331: 1181-1185.

Early sites, contemporary with Clovis/Folsom, 13000-11000 cal BP. One exploiting birds, other shell midden. Variable Paleo adaptations. Small Channel Island Barbed points assoc with bird and perhaps fish or sea mammal hunt, also Amol pts (unbarbed, serrated version of these stemmed forms) and finely worked crescents, abraded bone tools and sawn pc of ochre. Very different from inland fluted point traditions, link to Western Pluvial Lakes Tradition inland, and NE Asia and Pacific NW, to stemmed pt tradition of S America. [news coverage suggests without attribution that the small points could be arrow points, meaning earlier bow.]

**Evans, Mary Anna**

o

2003 *Artifacts*. Poisoned Pen Press, Scottsdale.

Novel, murder mystery. Excavations on Florida islands uncover murder. [Not a bad novel, but irritating to an archaeologist. Heroine Faye is archaeologist, but makes precarious living looting sites and selling artifacts, driven to this by desperate need to protect old family home, but despite betraying her principles here, we are supposed to believe that she is also driven by sense of duty to investigate murder. At the end, her professional mentor declares her looting ok because she kept good records. This is just the looter's common fantasy - that they do good archaeology too, so their destruction of sites is justified. Evans doesn't understand archaeology, the academic world, or atlatls: Faye's Indian friend Joe makes one, "an archaic type of spear that was thrown by slinging its hinged spearthrower in a whiplash motion." It has "a stone weight and a shell trigger..." Acknowledgements say she talked to Craig Ratzat, but she must not have listened.]

**Evans, Oren F.**

**x**

1957 Probable Use of Stone Projectile Points. *American Antiquity* 23(1):83-84.

Testing large points (4-5", 14-40 gm) on unfletched arrows. Accuracy increased [how he measured it is not explained] as added weight, so large points work well on arrows. Bow probably invented many times, he saw a child make a toy bow by accident.

**Evans, Oren F.**

**x**

1959 The Development of the Atlatl and the Bow. *Bulletin of the Texas Archaeological Society* 30:159-162. Reprinted in *The Plains Anthropologist* 6(13):200, (August, 1961).

[Mostly speculation, but a pioneer in trying atlatls.] Stick with nail atlatl, willow sapling dart 5.5 feet long. "After practicing a few times, a target a foot in diameter could be pierced at 20-30 feet about four out of five times." You guide spear with left, throw with right. "If movement of atlatl is carried too far forward and downward, it throws the butt of the spear down.." [Sounds like he was using a heavy, rigid dart, and a throw (see Howard) that didn't flip the atlatl.] "... in the hands of primitive man who used the throwing stick almost constantly, the atlatl and spear were probably quite accurate and efficient."

**Fadala, Sam**

2000 Before the Bow. *Primitive Archer Magazine* 8(4):35-40.

[Poorly written gee-whiz from archer's viewpoint.] Features Ken Wee.

**Fagan, Brian**

**s**

1987 *The Great Journey: The Peopling of Ancient America*. Thames and Hudson, New York.

[OK, readable, reliable, even-handed on controversies, skeptical about some of the “pre-Clovis” material, covers important stuff briefly, sometimes too briefly. A bit too much irrelevant material on early humans elsewhere and late Indians. Stop-action sequence drawing of atlatl throw (180-181) by Simon S.S. Driver has problems: Clovis man is holding the atlatl with fingers wrapped also around the dart, dart doesn't flex in throw, and is over head in next to last, then suddenly down in front for final frame, and the dart point is not Clovis. Still, it does convey idea of a throw with flip of atlatl, but is unfortunately starting to be copied by others, e.g. Plog 2008.] Frison experiments: Clovis weapons could “have inflicted severe wounds on mammoth” but probably not killed easily; Judge argues that many “kill” sites represent wounded animals lost with points in body.

**Fagan, Brian** s

2004 *The Great Journey: The Peopling of Ancient America*, 2<sup>nd</sup> ed. University Press of Florida, Gainesville.

[Generally readable text, fairly up to date on recent finds and theories. Pretty much same material on PaleoIndian period as 2005. Same poor point illustrations but different atlatl pic: p 180 Driver's stop-action drawing of atlatl throw.

**Fagan, Brian** o

2005 *Ancient North America: The Archaeology of a Continent*, 4<sup>th</sup> ed. Thames and Hudson Ltd, London.

[Best available text coverage of N. Am. prehistory, reliable, readable, detailed, well illustrated, although projectile point illustrations throughout are often crudely drawn and inaccurate. Optimistic p.c. view of NAGPRA.]

P 381 Archaic hunter throwing with Indian Knoll type atlatl, drawing by Thomas Gatlin from Jeffries 1987 [not too bad but not quite right either, dart and arm are well above head and dart is not flexing.] In SE, change from side-notched to corner-notched points may reflect change from thrusting spear to atlatl (J. Chapman idea) ca 7000 BC cal, or p 111 notched pts ca. 8000 BC at Thunderbird in VA. P 412-13 Green River culture (Indian Knoll) atlatl parts illustrated.

**Farmer, James D.**

1997 Iconographic Evidence of Basketmaker Warfare and Human Sacrifice: A Contextual Approach to Early Anasazi Art. *Kiva* 62(4):391-420.

Pervasive war images in SW: trophy heads, scalps, dismemberment, and weapons, both real and depicted, probable connections to Mesoamerica [not so convincing]. Lots of references to atlatls in Mesoamerican and SW art, burials with atlatls or killed by darts in SW.

[Some of his evidence and interpretations are weak, too many unsupported interpretive stretches, oversimplified inaccurate drawings of rock art].

**Farmer, Malcolm F.**

1955 Awatovi Bows. *Plateau* 28 (1): 8-10.

Two bow types in murals: 1) self-bow (similar to archaeological material from Tularosa Cave) 2) double-curved, similar to plains and Athabascan groups in historic SW, could be later introduction to Hopi by these groups.

**Farmer, Malcolm F.****x**

1994 The Origins of Weapons Systems. *Current Anthropology* 35(5):679-681.

Origins of bow in late Paleolithic or Mesolithic, but what is precursor? Spearthrowers in archaeology by Magdalenian, similar mechanics of spring and flexing projectile. Atlatl weights serve to time separation of dart from thrower [This is all wrong. Atlatl flex does not add to dart velocity and has no functional or ancestral similarity to bow flex].

Similar distributions of early bow and spear thrower: NW Africa, W Europe, Mid E, so probably both originated in Maghreb, where spearthrower appeared in Aterian Culture 40,000 b.p. [No evidence offered, dubious conclusion - Aterian has stemmed projectile points, but no evidence of atlatl, see Bruchert 2001, Iovita 2011; and I don't know of any NW Africa spear throwers either in prehistory or ethnographic times]

**Fawcett, William B.**

1998 Chronology and Projectile Point Neck-Width: An Idaho Example. *North American Archaeologist* 19(1):59-86.

Neck-width provides more continuous, simpler chronological indicator than point type. From published data, derives formula for dating points by neck-width. N-W decreases through time, partly because change from dart to arrow, but suggests long overlap between 2500-1500 B.P. [He documents and discusses the trend, but there is too much variability in his data to believe his formula accurately predicts the date of any point.]

**Feder, Kenneth L.****o**

2008 *Linking to the Past: A Brief Introduction to Archaeology*, 2<sup>nd</sup> ed. Oxford University Press, New York.

Textbook, pretty good. Photo of student using atlatl, others on accompanying CD.

**Fennell, Jim****x**

2010 Our Towns: A College Team Takes Aim. *Parade Magazine* May 30, 2010. Online version: <http://parade.com/news/our-towns/2010/0530-a-college-team-takes-aim.html> accessed 5/1/11.

New Hampshire, Franklin Pierce Univ. “Hurling Ravens” Bob Goodby, Anthro prof advises. U VT is only other college team to compete with them.

**Fenenga, Franklin**

1953 Weights of Chipped Stone Points: A Clue to Their Functions. *Southwestern Journal of Anthropology* 9(3): 3-09-323.

Weighed 884 points from 16 sites in CA plus 1 NV Anasazi, 1 NB 18<sup>th</sup> C Apache, 1 ND protohistoric, 1 SD protohistoric, 1 MO Archaic, 1 MO Hopewell. Finds bimodality: less than 3.49 gm, and more than 4.5 gm (only 33 = 3.7% fall between). Suggests small point tradition reflects bow and arrow, late sites, while large point tradition is atlatl, earlier sites. Notes contradictory evidence: Browne 1938 and his own experiments with atlatl show small points, no points, large points all work on both arrow and dart. Late metal arrow points also heavier, but early ones fit pattern. Some sites with both sizes may have atlatl and bow coexisting. [Widely cited, perhaps a good rule of thumb, but no more than that. Would like to know what else he tried with atlatls.]

**Fenenga, Franklin, and Robert F. Heizer**                    **o**

1941 The Origin and Authenticity of an Atlatl and an Atlatl Dart from Lassen County, California. *American Antiquity* 7(2):134-141.

Atlatl of willow, simple stick, slightly curved, with slight finger notches, groove and integral hook, 75 cm long. Cane dart, hardwood foreshaft broken off, 115 cm long, weighs 35.2 gm, v-shaped nock like arrow, 3 radial fletchings. Authors made and tested models, cast 150-250 feet.

Origin: Owned in 1910s-20s by “Charlie Paiute,” Maidu, who claimed to hunt with it. His daughter and others deny, as do ethnographic California groups in culture trait studies, although several archaeological specimens are known from the area. Could be conservative survival, fake or experiment by CP, who may have known about SW atlatls, or found a specimen and reinvented use. Authors favor last explanation.

[see also below and Heizer 1945, apparently it was diffusion from an archaeologist!]

**Fenenga, Franklin, and Robert F. Heizer**                    **o**

1941 Further Notes on the Susanville Atlatl. *American Antiquity* 8(1):120-122.

George Evans, son-in-law of Charlie Paiute, worked with M.R. Harrington at Lovelock Cave and others, made and experimented with atlatls after seeing SW types found at Council Hall Cave, NV, and is responsible for the Lassen County one above.

**Fenenga, Franklin, and Joe Ben Wheat**                    **o**

1940 An Atlatl From the Baylor Rock Shelter, Culberson County, Texas.

*American Antiquity* 5(3):221-223.

From looted cave, associations described.

Basketmaker type complete except missing loops, mesquite?, 438mm L, 25 mm W, groove + flush hook, gypsum weight in middle, incised decoration distal end. Chronological questions discussed [now outdated].

**Ferg, Alan and William D. Peachey**

1998 An Atlatl from the Sierra Pinacate. *Kiva* 64(2):175-200.

Found 1976 in small lava tube "Ten January Cave", Sonora, Mexico, in pile of rock and guano, perhaps offering. Hardwood, 55.3 cm long, 1.2 cm thick, 2.0-1.5 cm wide (hook to grip). Reworked to have notched grip with marks for loops, polished, painted red. C14 AMS date ca. 1500 B.C. = beginning of San Pedro ("Early Agricultural" = Late Archaic).

Comparative survey of SW atlatl types: Ten January atlatl closest to SW Anasazi in general form, but elevated spur and red paint are southern traits. In final form, had Anasazi type grip, but maybe replaced southern type straight sides with lashed-on shell loops.

From nearby caves 14 possible atlatl foreshaft blanks.

Current location unknown, documented in '80s by J. Hayden.

**Feriz, Hans**

x

1958 Demonstration of a South-Peruvian Arrow Throwing-Stick. *Proceedings of the Thirty-second International Congress of Americanists* pp.441-444.

Munksgaard, Copenhagen.

Burial find near Cayango, with Nasca III ceramics, cloth [archaeological find or looted?]. On L breast of mummy. L = 48 cm, diam = 1 cm, for light arrows, too light for "lances". Copper "arrow-support" [he means hook] in form of long-beak bird with ball at end of beak, spoonbill or Mochica trophy head or unknown mythol? [As near as I can tell from poor photo, the head faces distally, and the other end of the bird has the actual hook]. Handle projection is inlaid ivory in form of anthropomorphic snake head [maybe - then some discussion of snake and animal/human symbolism with odd references to similarity to S.E. Asia.]. "Artful workmanship" shows it must be ritual or display [rubbish!].

**Fields, Ronald C. D.**

2002 Atlatls: Ancient Missile Launchers. *El Palacio* 107(2):24-25.

Research on Mera's (1938) specimens of Basketmaker types from New Mexico (3 specimens) briefly described, and apparently N. Chihuahua (2?) not described.

Photo of loops on grip of northern Chihuahuan atlatl - fiber bundles coated with black material studded w white blobs (shell?). [Not enough info on any of this.]

**Fields, Ron** x

2005 New Mexico Atlatl Research Continues Sponsored by NMAC. New Mexico Archaeological Council webpage, URL <http://www.nmacweb.org/AtlatlFinal3.pdf>, accessed 3/16/06

Three atlatls from Mera excavs - Little Pine Cave #1, LPC #2, Rock Fall Cave. Research continuing, C14 dates LPC#1 cal 790-410 BC, RFC 1140-920 BC, dates for 5 other SW specimens from 500 AD to 1700 BC. Ca 70 SW specimens known, possible geographic signif to form of groove in SW, possible late survival alongside bow discussed. [useful beginning to full study of SW atlatls, 3 NM specimens still not enough described or figured].

**Fields, Ron** x

2006 Atlatl Variation During Basketmaker II Occupations at Canyon del Muerto and Canyon de Chelly, Apache County, Arizona. Unpublished ms.

Several atlatls from Earl Morris excavations, now in U Colorado Mus at Boulder. Useful detailed description.

**Figueredo, Alfredo E.** x

2010 Nota ilustrada sobre los ganchos de tiradera en la arqueología de Cuba. *Cuba Arqueologica* 3(1):36-43. Also available in original and English translation at <http://www.worldatlatl.org/AtlatlNewsletter.html>

[In Spanish. “Illustrated note on atlatl spurs in Cuban archaeology.”] Recognized first in Antilles (Skinner 1925) and Antigua (Nicholson 1980), [and other Caribbean refs]. Types compare to California “snakehead” type, flat “folioforme” type [flat with hole, possibly hafted in slot in shaft], others “more or less tabular” with some simple, some sculpted with high projecting anthropomorphic faces. [I wonder if these last are not handle parts as on Peruvian atlatls, rather than hooks.] Folioforme types can be rounded or flat, calls all “peltamorphos” [shield shaped]. Some elaborate forms (Puerto Rico) are birds gripping prey or head, = head hunting as well as atlatl use. Dates for these ca 500 BC - 150 AD.

Discusses distance and accuracy info from other sources. Nicholson says useful for war or aquatic hunting; Aztecs came with bow but adopted atlatl at lake in Valley of Mexico. Easier to use in canoe, water harms bow. But many examples of bowmen in canoes. Atlatl dart better for harpoon with line.

Loven suggests diffusion from Colombia, Nicholson notes could be Paleoindian, but little data. Too early to say much about chronology, but they appear to go from aceramic times to late, with the carved forms consistent with classical Taino art.

Harrington (1921) illustrated “arrow” 1.2m long, wood point, could be dart. Could have had points of stingray spines, stone, or wood. Taino bows and arrows from E Cuba were very poor, range probably 50 m, only slightly better

than atlatl; other Caribbean bows much better. In Cuba, atlatl may have been preferred to bow.

**Figueredo, Alfredo E.**

**o**

2011 Illustrated Note on Atlatl Spurs in the Archaeology of Cuba. *The Atlatl* 24(2): 8-12.

Translated and abridged from the above.

**Finkel, Michael**

**x**

1996 Watch Your Backside, Fido... *Outside* March 1996: p?

Perkins sells atlatls, WAA holds contests.

**Finney, Kevin**

2001 Giant Ragweed Darts. *The Cast*, Spring 2001:2.

Not as strong as cane, but light and flexible, uses foreshaft and endshaft to strengthen, one has lasted 2 years. Prehistoric seed caches suggest if not grown as food, perhaps for darts. Cut in Fall after dried out but before rot.

**Fladmark, K.R., D.E. Nelson, T.A. Brown, J.S. Vogel, and J.R. Southon**

1987 AMS Dating of Two Wooden Artifacts from the Northwest Coast. *Canadian Journal of Archaeology* 11:1-12.

Fraser River club - ball-headed with zoomorphs, 1000±130 B.P.  
Skagit River atlatl (Taylor and Caldwell 1954, Borden 1969) [of the three articles, this one has best picture and most useful description].  
Carved with monster with inlaid eyes surmounting human head, and incised line decoration. Western Yew, short tapered grip with two finger holes, ca 41x1.0x4.8 cm but missing distal end. Carving ca 9x9 cm. Weathered, incompetently cleaned by finders. [Detailed description of carving given]. Fits NW coast conventions, probably "chief of the sea, keeper of wealth" as Borden suggests. Maybe non-functional - fragile [unconvincing], but yew = bow wood, suggesting wanted flexible strength to add throwing power. Carving would keep proximal end stiff. Date 1700±100 B.P. = Marpole phase, slightly later than Borden suggests.

**Flaskerd, George A.**

**x**

1959 Minnesota Atlatl Weights. *Iowa Archaeological Society Newsletter* 30:8-9.

3 of 7 of catlinite, assoc with old sites on lakes

**Flenniken, J. Jeffrey**

**o**

1985 Stone Tool Reduction Techniques as Cultural Markers. In *Stone Tool Analysis: Essays in Honor of Don E. Crabtree*. MG Plew, JC Woods, MG



**Fogelman, Gary L.**

1997 *All About the Atlatl*. Turbotville: Fogelman Publishing Co.

Booklet size introduction to use, history, and variety of atlatl forms. [Good place for newcomer to start but too short.]

**Fogelman, Gary L.**

1999 Top of the World Ma! Top of the World: Atlatling 1998. *Indian Artifact Magazine* 18(1):6-10, 58-61.

Recounts his experiences at atlatl competitions, winning International Standard Accuracy Competitions for 1998.

**Fogelman, Gary L.**

o

2006 Results of the 2006 Finger Freezing Contest, Fogelman's, Turbotville, PA 1-7-06. *The Atlatl* 19(2):6.

Discusses efforts to legalize atlatl deer hunt in Pennsylvania, appearances on TV.

**Fogelman, Gary**

o

2009 Chuck Butorajac, 'Halfbeard' Passes Away. *Indian Artifact Magazine* 28(4):70, 76.

**Fogelman, Gary**

o

2010 Bone (Antler, Bone, Ivory, Teeth) Tools of the Clovis Culture. *Indian Artifact Magazine* 29(4):71-73.

Info from Bradley, Collins, and Hemming book, with his photos of artifacts. Evidence for Clovis atlatl use in atlatl hooks of extinct fauna bone, short bone points, impact damage on stone points. Photos include barbed harpoon, long and short bone/ivory points.

**Fogelman, Gary**

o

2012 Columbia Plateau (Oregon) Atlatl. *The Atlatl* 25(1):7

Two small photos of odd form: curved shaft with integral hook, long boatstone weight, and two peg grip. Made of oak, antler tine grip pegs, basalt weight. "Found over 40 yrs ago". But no further info, private owner [so who knows if it is real, fake, modern, ancient, OR or somewhere else].

**Fogelman, Gary and Bob Berg**

1998 Second Chance Boar. *Indian Artifact Magazine* 17(1):30-31, 69.

Boar hunt on NY preserve, GF, BB, and Chris Pappas. Two misses, 3 hits at 5-15 yards. Efficiency of atlatl with stone points, stone tool butchery.

**Foley, Vernard, George Palmer, and Werner Soedel**

1985 The Crossbow. *Scientific American* 252 (1): 104-110.

**Follett, Prescott H. F.**

x

1932 *War and Weapons of the Maya*. Middle American Research Series  
Publication No. 4. Tulane University, New Orleans.

Info from depictions. p384: atlatl sometimes shown without darts as at Chichen Itza ball court, therefore must have other uses than that of spear-thrower, ie symbol of command or scaling hook to help climb walls [Bizarre! Figures show warriors with atlatl, shield, and spear which could equally be dart]. Spear types classified from depictions [reading too much into them].

**Forsberg, Holly**

x

1996 To Build a Better Missile: Improving on the Ancient Art of Spear  
Throwing. *Desktop Engineering* March/April 1996: 47-50.

David Engvall - records for sling etc, now atlatl, using engineering software to design. [Bad description of atlatl as "spear attachment"].

Long atlatl, 53" spear, flexible,nock forward of end, circular rather than linear arm motion, achieved 848' 6 5/8".

**Foster, George, and Gabriel Ospina**

x

1948 *Empire's Children: The People of Tzintzuntzan*. Smithsonian Institution  
Institute of Social Anthropology Publication No. 6.

A good old-fashioned "complete" ethnography of a village on Lake Patzcuaro, Mexico. Fishing and pottery making important industries. Pp. 106-107 Fishermen (mostly Tarascan) also hunt ducks with punt guns and atlatl (phatamu in Tarascan), Oct to April. Typically made of palo azul wood, 65 cm L, with 12 cm handle, 2 holes for index and middle fingers. "Non-functional point" [hook] often carved in form of duck's head, shallow groove for spear with 1 cm point [spur]. Reed spear 3 m long, 3-prong iron head, supported by left hand for throw. Only thrown at sitting ducks. Oct 31, day before eve of Todos Santos, most fishermen gather, up to 1000 canoes each with several men. Concentric rings around ducks allow several shots, "the aim of skillful men is deadly, and literally thousands of ducks are killed on this day." Later more individual hunting. Atlatl survives gun because cheap. Some specially skilled makers, standard prices (given in pesos, 4.85 p = 1 US\$): atlatl 1.00-1.50, spear 1.00. Any implement in good condition, new or used sells for same price. Ducks sold boiled. One poor engraving of atlatl and spear, one tiny photo of use. [see also West 1948]

**Fox, Steve**

2001 Untitled letter. *Atlatl* 14(1):8.

Maruku Gallery in Australia sells Pitjantjatjara Aboriginal art, including spear throwers, still used in ceremony and contest but not for hunting. Mulga wood woomera type, “miru” with spinifex gum hafted adze on some, some decorated, some not.

**Frahm, Ellery**

1998 Hunting and Warfare of the Americas: The Physics of Atlatl Technology. Unpublished class paper, Physics Dept, Grinnell College.

Critiques most previous discussions of atlatl physics. Arm and elbow or arm and shoulder + atlatl can be modeled as lever whose effective length changes during throw. The lever action transforms greater force applied to one end of the atlatl lever into less force but more velocity applied to the other end and the dart, and initial dart velocity is proportional to the length of the atlatl. Flex of atlatl and dart should consider traits of wood and weather conditions, which also affect optimum angle for distance, between 40 and 47 degrees. Atlatl and dart flex and act as springs, but addition of weight to atlatl is unlikely to affect this. Weight adds to moment of inertia and stabilizes motion of atlatl during throw.

**Frahm, Ellery**

1999 Using Moments of Inertia to Determine the Positions of Atlatl Weights on a Throwing Board. Unpublished class paper, Anthropology Dept, Grinnell College.

Moment of inertia is the tendency of an object to maintain its path of rotation and increases with the mass of the object and the distance from the axis of rotation. Thus a weight on a swinging atlatl stabilizes its motion and should increase accuracy. The greater the weight and the further from the handle, the more the effect, but the force necessary to swing the atlatl also increases.

Using 5 prehistoric atlatls found with weights attached, moments of inertia can be calculated, finding a narrow range. This "optimal" range of moment of inertia can then be used to model the most likely position of weights of other forms and sizes on atlatls.

**Frazer, David W.**

x

1981 Body Size, Weapon Use, and Natural Selection in the European Upper Paleolithic and Mesolithic. *American Anthropologist* 83 (1): 57-73.

Brues (1959) model of spearman vs archer body build relationship to offensive weapons tested with data from lineally related populations. Brues (1977): spear depends on max velocity of hand at release, bow on stored energy proportional to pounds of pull exerted by arms, so people of “linear build” w long limbs do better with spears, “lateral build” people with short limbs better with bow. But consider other factors: nature of prey, distance. Spear more dangerous, requires closer approach. Atlatl increases to 18-27 m (Spencer 1974); bow much better, so body

size and robusticity should decrease as these weapons come in use. Up Pal hunted large game with hand spears early, atlatl by Solutrean, bow prob early Mesolithic, with smaller less aggressive animals.

Reduction 4-9% in limb measurements between Up Pal and Meso, both M and F, but little change between early and late Up Pal. Arm segment proportions and relation to stature change little: “there is little to support a relationship between arm proportions and the use of either spears or bows in the UP or Meso.”

Body size may relate to prey, but other factors, like climate, poss also involved, but large bodies nutritionally expensive, so expect an adaptive advantage.

### **Friis-Hansen, Jan**

**o**

1990 Mesolithic Cutting Arrows: Functional Analysis of Arrows Used in the Hunting of Large Game. *Antiquity* 64(244): 494-504.

Width is most important dimension – cuts shaft free for penetration. Cutting efficiency index based on width and penetrating ability, ratio of head width/shaft circumference = wound width; ratio cross section of head/ cross section of shaft indicated penetrating ability. Cutting arrows are just as effective as pointed arrowheads. Hafted arrows illustrated.

### **Frison, George C.**

**x**

1965 Spring Creek Cave, Wyoming. *American Antiquity* 31(1):81-94.

Late Middle Prehistoric [Archaic] material from a cave, including corner-notched dart points, and a C14 date of A.D. 225 ± 200. Organic artifacts include 5 atlatl fragments of *Rhus trilobata* and shaft fragments. Atlatl distal fragment has integral hook with groove like SW Basketmaker. Proximal (4) fragments have a narrowed handle with opposed projections, possibly had loops, and notches ca 1/3 of way from handle prob for attach weight. Nine distal shaft ends have conical sockets with grooves and some sinew wrapped, some red painted, varying in diameter from 1.2-1.6 cm. Sixteen proximal shaft ends have shallow cup-like depressions, vary in diameter from .6-.7 cm. No evidence of fletching noted on shafts but several cut feathers appear to be fletching debris. Thirteen foreshafts have tapered proximal ends with spiral rasping, nocks made by groove-and-snap, vary in length from 5.1-27.3 cm, diameters .8-1.1 cm. No adhesive on sockets. Two have corner notched points held in nock with sinew only. [Drawings of atlatl material, no photos].

### **Frison, George C.**

1968 Daugherty Cave, Wyoming. *Plains Anthropologist* 13 (42) pt 1: 253-295.

Late Middle Prehistoric and Late Prehistoric materials. Ten dart foreshafts, some notched for point by tenon method, tenon wastes also found. Conical proximal ends, spiral abrading. Three possible atlatl fragments of *Rhus trilobata*, similar to Spring Creek specimens, only one figured appears to be proximal end. Associated

with medium corner-notched points. Two broken bar atlatl weights. Also some arrow and a bow fragment from upper level.

**Frison, George C.**

o

1978 *Prehistoric Hunters of the High Plains*. New York: Academic Press.

Detailed summaries of many sites, espec kill sites, including Paleoindian. Colby, Hanson, Agate Basin, Casper, Horner, Finley sites. Cultural chronology and projectile points. Photos Late Archaic (200-500 AD) atlatl and foreshafts from Spring Creek Cave. Comments on hunting and butchery with stone tools and bone expedient tools. Lots of experiments with stone points and foreshafts, but mostly with thrusting spears. [Atlatl experiments mentioned in passing, and he seems to feel that Paleoindian hunting would be with thrusting spears].

**Frison, George C.**

o

1989 Experimental Use of Clovis Weaponry and Tools on African Elephants. *American Antiquity* 54(4): 766-783.

Clovis points used on culled elephants, observations on hafting and effectiveness, herd behavior and strategy. Hafted on wooden foreshaft socketed into mainshaft, spear weight 358-432 grams [very heavy for atlatl - were they flexible or more like harpoon?], but heavier got better penetration. Penetration ends when larger shaft reaches hole, so long foreshaft better, but longer breaks more easily. A taper to socket fit for foreshaft worked well if tight; shoulder + plug broke, taper + plug ok but hard to make. Sinew and pitch in slotted foreshaft held points well, tight fit reduces breakage. Hafting needs to be thin for entry; Clovis flutes help. Points survived remarkably long use, one of five did not break (12 shots), others damaged and repaired. Tip damage most common. *Rhus trilobata* atlatl, with groove and integral hook, 62 cm long, rigid, no weight, 225 gm. Claims “3 decades of experimentation with atlatl and dart,” but reports problems with accuracy and trajectory in this experiment. [Wish he would write up his other atlatl experience.]

Atlatl thrown spear proved capable of inflicting mortal wounds on elephants: multiple successful hits, although lots that would not have killed too. Successful penetration of rib cage, 9-12 mm thick hide, into lung cavity at 15-20 m. Thrusting spear also successful. Hunter movement necessary in atlatl use might startle animal; other hunters to distract would help.

Butchering with biface thinning flakes. Main effort is cutting hide, quartzite more durable than chert. Dismembering is easy and may leave no marks on bone. Elephant family groups are formidable; cooperative stalking of individuals most likely.

**Frison, George C.**

o

1991 *Prehistoric Hunters of the High Plains, Second Edition*. New York: Academic Press.



has argued that microliths were not demonstrably associated with hunting or killing but functioned as knives, drills awls and scrapers in many different tasks; and only rarely as spear tips or barbs. Small backed artefacts (microliths) found with an Aboriginal burial at Narrabeen (Sydney, Australia) certainly indicate death by spearing. Breakage and use-wear on most artefacts indicate use as barbs or ‘lacerators’, although some had traces suggesting other functions. The evidence for weaponry is reviewed and the traces of use on microliths from southeastern Australia are compared with a recent functional study of microliths from northwestern Australia.” Body abandoned on ancient beach ca 3500 BP, many microlithic points in or near bone, some with impact damage on tips and burinated barbs. Interpreted as about 7 spears, each with a microlith tip and barb.

**Gabriel, Richard A., and Karen S. Metz**

**x**

1991 *From Sumer to Rome: The Military Capabilities of Ancient Armies*. Greenwood Press, New York.

Chapters on organization, weapons and lethality, wounds, medical care. [Interest in quantifiably comparing weapon systems, but lots of dubious info used, e.g. they accept at face value ancient casualty counts which cannot possibly be accurate, and use the Illiad to provide statistics on the relative lethality of different wounds, one of the most awful scholarly abuses of ancient literature ever. Their experiments are not described in enough detail, but I doubt they attained any real expertise with the weapons.]

Introduction: describes empirical tests of weapons: Replica weapons used to determine speed, for impact energy calculations. Speed of wielding measured by high-speed strobe photography. Subject male 6’ tall, 180 lbs. Energy = weight of weapon times velocity of strike squared, divided by 64 (the gravitational constant). Bow used was modern compound [does that mean pulley bow, or laminated?] but doesn’t matter because “penetrating power of arrow is function of its weight and speed of acceleration. Regardless of the weight of the bow, an arrow cannot be propelled faster than 196 feet per second. [That is nonsense.] This limitation is due to a number of factors, including air resistance, friction of stabilizing vanes, and propensity of arrow to flex....” Killing power of weapons also specified by calculating area of wound. Test against armor, 2mm brass and iron plates on 4 mm leather jerkin. Standard comparison was 100 lb bow shooting 553 grain arrow with iron tip 196 fps, at armor: 2 inch impact area = 47.4 foot-pounds energy. Some penetration of brass and leather to body depth no more than .75”, never got through the leather under iron armor. Calculate need at least 75.5 foot-pounds to penetrate armor to killing depth. Accuracy with bow: from 100 to 250 yds could hit all shots in infantry formation sized box, only 50% at 300 yds, the limit of bow. Simulate chariot by pick-up truck, hit 80% of human silhouette targets at 10-20 yds.

Chapter “Weapons and Lethality”: [Lack of real understanding of ancient weapons is suggested by fixation on “obsidian pointed” Neolithic spears and idea that axe was only invented in Bronze Age. No atlatls, but sling info.] Bronze did





**Garnett, Justin, and Devin Pettigrew**

o

2011 A Unique Naturalistic Petroglyph of a Basketmaker Atlatl. *The Atlatl* 24(2):1-2.

Valley of Fire, NV. Atlatl length 63 cm, dart 131 cm, with fletching and curved as if in throwing. Life size. [outside usual range but comparable to Utah depictions - see Whittaker et al. 2008]

**Garrod, Dorothy A. E.**

1955 Palaeolithic Spear-Throwers. *Proceedings of the Prehistoric Society* 21:21-35.

66 specimens, Magdalenian, 2 or 3 complete, 6 antler part complete but intended to have wooden extension.

Most hooked (male type), 1 or 2 groove and hook, 1 doubtful female type.

Most (41) plain "stick" type of antler, 21 "weighted" by sculpture on a palm of the antler, which incorporates hook.

Horse most common motif (29), also reindeer, deer, bison, ibex, mammoth, birds, fish, feline, musk-ox, chamois. Shaft often curved so contacts spear only at hook and handle. Some carvings may serve as weight balancing spear. Complete specimens 28-34 cm long, but hole in proximal end may be for peg to hold on wooden handle, or wooden cross bar grip - now need experiments.

Brief individual descriptions, line drawings.

**Gaudzinski-Windheuser, Sabine**

s

2011 Hunting lesions in Pleistocene and Early Holocene Faunas. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

“For most of our past, the hunting way of life determined our behavioural repertoire, but we actually know little about hunting strategies, techniques employed or social implications. The study of hunting lesions offers a perspective to approach this important topic. The paper presents direct evidence for hunting lesions in European Pleistocene faunas with reference to the Early Holocene.

Results of experimental studies on indirect hunting lesions are referred against the archaeological context - why hunting lesions are only scarcely identified in Middle and Lower Palaeolithic faunas.” Examples: Grotte du Bichon bear and hunter (Morel 1998), Stellmoor Germany Up Pal Ahrensburgian, lesions + flint tip arrow (Bralund 1990). Um el Tlel (Boeda) damaged ass vertebra not convincing, taphonomic problems? [Others in audience strongly disagreed].

Boxgrove perforated horse scapula, round hole, 500 kya = heart shot with wooden spear. Problems with early stuff: lots carnivore activity, high rate of bone damage, equifinality of damage causes. Bone fragmentation from projectile experiments mimics marrow extraction.

**Gay, Malcolm****x**

2010 Like Great-Great-Great-(Etc.)-Grandpa Did It. *The New York Times*, September 25, 2010. Online version, URL:

<http://www.nytimes.com/2010/09/26/us/26huntspearshort.html?emc=eta1>

Reprinted *The Atlatl* 23(4):18.

Focus on hunter Arron Hendershott of MO Dept of Conservation, and legalization for deer in MO. Quotes J Whittaker, R Madden, R Mertz, Gene Morris (spear hunter).

**Gear, Kathleen O’Neal and W. Michael Gear****o**

2004 *People of the Raven*. Tom Doherty Associates, New York.

Novel, imagining story of Kennewick man. Atlatls figure in story, but not detailed. Good story of warfare and morality with interesting characters as usual from the prolific Gears, but paleoindians were not organized like later NW tribes, nor do “Caucasoid” features of K skull mean other “Caucasian” traits as imagined.

Typically, they use the prologue to comment on archaeological politics. This time they re-imagine the Kennewick controversy - a Native American anthropologist attempts to study the skeleton, but is arrested for violating NAGPRA. They rather courageously point out the racist idiocy and unconstitutional imposing of religious views inherent in NAGPRA, and the law’s effect of “geographic genocide... killing the history of a continent.” Unfortunately they accept the discredited view that K represented a Caucasoid early population, which undermines their points.

**Gear, W. Michael and Kathleen O’Neal Gear****o**

2005 *People of the Moon*. Tom Doherty Associates, New York.

Novel. Chaco is collapsing [ca 1150 AD] and its hegemony falling apart as the climate worsens and subject peoples can no longer support their rulers. At “Pinnacle Great House” (Chimney Rock Pueblo), the suppressed locals rebel against their Chacoan masters. [This is a vision of Chaco as a theocratic, fascistic state, enslaving local populations and suppressing dissent with warriors and cannibalism - plausible, though many archaeologists would disagree. Good story, a few chronological slips: the katsina cult is coming as a “heresy” - most evidence suggests not until 1300s; the Chacoans use bows but their Moon People subjects use atlatls - no good evidence for such late survival of atlatls, see Whittaker 2008. But in the story, bows have advantage in war, except that atlatls have long heavy projectiles and can be used when the fingers are cold...]

**Geertsma, Nicolas****o**

2008 Dutch Atlatl? *The Dart*, March 2008:13-14.

Red deer antler segment with hole like shaft-hole hammers but with no good hammer end and a small hook is proposed as possible atlatl hook. Photos, reconstruction. [Possible but not conclusive, and need dates.]

**Gehlbach, D. R.**

2002 Hourglass Bannerstones of the Mississippi Valley. *Indian Artifact Magazine* 21(3): 46-47, 79.

Brief, reviews function theories, describes, usually made of quartz, nice color photos, warns of fakes.

**Gehlbach, D. R.**

o

2004 Counter-Balanced Banded Slate Bannerstones. *Indian Artifact Magazine* 23 (4): 74-76.

Ordovician slate easy to use, colorful. Probably more than atlatl weights – questions raised by “excessive weight, lack of balance, and material destruction.” Symbolic, jewelry, status. Examples of “counter balanced” [he means symmetrical] winged forms, including prehistoric repairs.

**Gehlbach, D. R.**

o

2008 Many Bannerstones are ... Curious Artifacts. *Indian Artifact Magazine* 27(2):6-7.

Mentions theories of use, photos of several types.

**Geib, Phil R.**

o

1990 A Basketmaker II Wooden Tool Cache from Lower Glen Canyon. *Kiva* 55 (3): 265-277.

Donut Alcove (near Sand Dune Cave). Artifacts in pit. C14 2320 BP + 80 = 760-200 B.C. on piece of juniper bark matting. Digging stick, complete + frag of S-shaped “fending” stick. Frag has battering wear indicating re-use as rabbit stick, complete specimen (and comps) lack, so not originally used as rabbit sticks. Assoc elsewhere with atlatls, suggested use fending off darts “I can attest from personal experience” that it works. Disappear from BM sites with intro of bow and arrow, too fast to fend, in BM III.

**Geib, Phil R.**

o

1996 The Early Agricultural Period: Transition to Farming. In *Glen Canyon Revisited*, edited by Phil R. Geib, pp. 53-77. University of Utah Press Anthropological Papers No. 119.

Early dates on SW corn, some from preceramic sites - maize not in northern Colorado Plateau until first centuries AD, up to 1000 yrs earlier southern CP, and

Glen Canyon area fills gap, with southern part using maize by 300 BC, assoc with White Dog Phase Basketmaker II culture, northern part not until 100 AD, assoc with preceramic Fremont culture. So early farming BM intrusion in S, while terminal Archaic adaptation in N of GC, possibly with competition, territorial defense and markers, and warfare in BM sites.

BM and Elko series dart pts similar but potentially distinguishable, side + corner notched forms. White Dog BM generally curvilinear lanceolate profile (see Sand Dune Cave Cache 1 pts), Elko straight edged, triangular. BM wide deep notches, tight bind to foreshaft, often break across notch, but that prevents foreshaft damage and leaves reworkable point.

Northern earlier bow and arrow represented by Rose Spring or Rosegate pts and arrow shafts at Cowboy Cave by 100-250 AD, but atlatl continues in southern, represented by many finds of dart pts, foreshafts and atlatls but lacking arrow pts in Basketmaker II sites. [The shafts at Cowboy are most important, but he says not directly dated - I consider points alone poor evidence.] Sunny Beaches site in center GC area, close to sites with BM remains has arrow pts early 1<sup>st</sup> mil AD. [They are small, but in form look sim to what he calls Sand Dune Cave pts (Archaic) - long ovoid to triang w wide side or corner notches]. Suggested atlatl = BM, early bow = ancestral Fremont, but other finds suggest arrow pts also assoc w Obelisk Grey (BM) pottery and turkeys. [So still not clear what's what.]

S-shaped fending sticks, photo of 2 from Donut Alcove, refs, suggest ritualized warfare.

**Geib, Phil R.**

o

2002 Basketmaker II Horn Flakers and Dart Point Production: Technological Change at the Agricultural Transition. In *Traditions, Translations, and Technologies: Themes in Southwest Archaeology in the Year 2000*, S. H. Schlanger ed., pp. 272-306. University of Colorado, Boulder.

Experiments and microwear show that horn rod "gaming pieces" in Sand Dune Cave cache are actually knapping punches for manuf of dart pts. SDC cache included hafted and unfinished pts.

**Geib, Phil R.**

o

2004 AMS Dating of a Basketmaker II Hunter's Bag (Cache 1) from Sand Dune Cave, Utah. *Kiva* 69(3):271-282.

A.D. cal 80-330, late BM II AMS dates on dog skin, prairie dog skin, and yucca fiber from bags. Cache includes dart points, some hafted on foreshafts, unfinished points, knapping tools including mt sheep horn punches.

**Geib, Phil R.**

pdf

2010 *Foragers and Farmers of the Northern Kayenta Region: Excavations Along the Navajo Mountain Road*. University of Utah Press, Salt Lake City.

From Archaic to Pueblo, 33 sites along N16 in AZ and UT. Cultural chronology and overview. Chert types and sources.

Atlatl Rock Cave - shelter with oversized atlatl petroglyph [no picture], damaged by looters. Early Archaic, BM, and Pueblo occupations.

Mountainview - open site, transitional Basketmaker II - III, pithouse, midden, outdoor hearths. Six AMS corn dates 220-350 AD. Plain brownware pottery, arrow-sized points (early for BMIII) and one atlatl weight.

p. 281-284: Increasing evidence here and elsewhere that small arrow points indicating bow and arrow appear in some BMII sites in first centuries AD, prior to conventional date of BMIII around 500 AD. At Mtview, 3 finished pts 3-3.8 cm long, sequence of pressure flaked broken preforms for making arrow points. Also dart points and preforms made differently: by indirect percussion on larger blanks. From The Pits site, small stemmed/cornernotched arrow-sized pt from floor of pithouse, assoc with maize dated 160 BC-90 AD cal. But most of the late BM sites lack small points, have expected corner and side - notched dart forms. Pottery also appears patchily and earlier than expected: different groups adopted new technologies at own rate according to their own needs and calculations.

p 160 Obsidian hydration dates for Archaic sites worked very poorly, OHD not a reliable dating technique.

**Geib, Phil R. and Peter W. Bungart**

1989 Implications of Early Bow Use in Glen Canyon. *Utah Archaeology* 2(1):32-47.

Usual view = Glen C occupied to AD 400 by Basketmaker II using atlatl, only in 7 C AD did BM III start bow and arrow. But - Sunny Beaches site etc have early b+a evidence (Rose Spring pts).

Suggest late Archaic/proto Fremont occup, using b+a earlier than any Anasazi, who stuck with atlatl, perhaps because intergroup competition prevented technological transfer.

[but a handful of points is rather weak evidence for arrival of bow and arrow]

**Geib, Phil R., and Kimberly Spurr**

2000 The Basketmaker II-III Transition on the Rainbow Plateau. In *Foundations of Anasazi Culture: The Basketmaker-Pueblo Transition*. Paul F. Reed, ed., pp. 175-200. University of Utah Press, Salt Lake City.

UT/AZ border S of Glen Canyon. Sand Dune Cave dates on twined bag from Cache 1 with foreshafts and points should not be used to argue for BM II cultural survival after 700, other chronological issues on sites with BMIII dates but no pottery. Assoc of atlatl with BMII may be partly because BMII now seen as dating back to 1<sup>st</sup> mill BC; in later part in 1<sup>st</sup> centuries AD, some evidence of bow - mostly small points with unclear dating. At Mountainview site, 3 dates on maize AD 145-375, with arrow sized pts and preforms, as well as atlatl weight +

dart points. Bows seem to arrive a bit before pottery. [Geib wants early bows. This suggests a logical transition point a bit earlier than usually suggested. Why, whence not discussed.] Maize, pottery, turkeys, bow all show variation in chronology of adoption - earlier than previously thought, but spotty, in a II-III transition in first centuries AD.

**Geiselman, Kevin**

2003 *Atlatl From Outer Space. The Atlatl* 16(3):1-2.

Fictional Klingon weapon “chetvl” appears to be based on atlatl, and preferred to bow against large or armored opponents. Atlatl with bannerstone resembles Klingon warship. [A nice example of why I don’t take Hall’s atlatl symbolism too seriously.]

**Gibson, Mel (director)**

o

2006 *Apocalypto*. (DVD 2007). Buena Vista Home Entertainment/Touchstone.

Lavish thriller set among pre-Columbian Maya. Young hero’s village is raided for sacrificial victims, he escapes and kills bad guys in extended chase through forest. Various weaponry featured: 1. Obsidian knives with carved handles - blades usually pretty crude looking, but in part of heart sacrifice scene, appears to be fine blade for a bit, but later same knife looks cruder. 2. A sort of macahuitl, which is really Aztec anyway, and here usually has an eccentric of some sort hafted as blade. Implausibly, victims are decapitated with a single blow of such a tool. 3. Self bows with long arrows. 4. Staff slings, probably unknown in New World. 5. Atlatls - you never get a good look, but they look like highly decorated SW types with weight or fetish near grip, fairly flat and thin. Dart looks to be 5-6 feet, fletched, large stone point, shaft a bit thick, but seems to be flexing in flight. As in all films of early warfare, weapons are shown as absurdly effective when it suits the story - here a long distance, high angle throw hits a moving target.

On disk, the “Becoming Maya: Creating Apocalypto” extra has section on weapons. Done by Simon Atherton. Studio claims that they are “absolutely accurate historically... These are the weapons the Maya had. Here they are being used on screen for the first time...” Arrows and darts whizzing by hero are actually being tossed from a cart following him. A better macahuitl is shown, but the fake obsidian blades that form the edge have fake bifacial scars, rather than being real blades, and you can see that all the knives are crude facsimilies of flaked stone with vague flake scars. The other macahuitl forms were invented because they needed a weapon that could stun as well as kill. “Obsidian is a glass mineral. You would think the glass would shatter but it doesn’t.” Doubt he’s tried the real thing.

Jungle scenes filmed in Catemaco, Mexico. City set built in Veracruz. Over 700 extras, some 250 make-up people etc - the scale of the enterprise was enormous. I wish Hollywood would hire me to recreate an ancient culture. Richard Hansen was the archaeologist consulting.

**Gilliland, Marion Spjut**                      **disk**

1975 *The Material Culture of Key Marco, Florida*. University Presses of Florida, Gainesville.

Artifacts from F.H. Cushing's excavations in 1895-1896, described and illustrated with old photos, new photos, and water colors from expedition artist. Several atlatls and parts. One 32 cm x 2.2 cm, wood, central finger hole in handle, hook is tail of carved rabbit, handle turns down in carved volute like violin. At least three others with double finger holes, handles flared scoop shape. [Not adequately described, old photos not great either] See Cushing 1897.

**Gilliland, Marion Spjut**                      **o**

1989 *Key Marco's Buried Treasure: Archaeology and Adventure in the Nineteenth Century*. University of Florida Press, Gainesville.

Account of Cushing's Florida work compiled from documents, notably journals and letters of Cushing, Sawyer his illustrator, Gause his chief digger, and Mrs. Collier landowner's wife. Atlatls mentioned several times among the finds, but no details and it is never clear how many were actually found. C14 and pottery now suggest dates from 750-1513 AD. Atlatls thus a late "holdover" here used along with bow and arrow, continued in use until Calusa met Spanish.

**Gilsen, Leland**                                      **o**

2011 Miniature Atlatl. *Bulletin of Primitive Technology* 41:66-69.

Par-Tee site in Oregon has at least 23 bone atlatls [parts]. Photo shows 14 "whale bone atlatl handles" [which appear to be the proximal end, a flat paddle for fingers, with a very narrow neck above that might have integral loops or added loops - appears to imply split finger grip rather than usual northern form with hammer grip and finger hole.] "Miniature" is fragmented but essentially complete, whalebone, spatulate shape with paddle proximal end but thick grip [implying hammer grip?] groove the full length, and integral hook. About 21 cm long [from scale in photo] and .83-.56 thick. Bob Kitch made wooden replica, Jim Gnapp threw at ISAC target, felt comparable to his usual atlatl [not described, and his scores are poor, only 12 hits for 19 throws at 15 m.] Many harpoon pts also at site, short atlatl could be child's or for heavy harpoon.

**Gjerdrum, T., P.L. Walker, and V. Andrushko**                      **x**

2003 Humeral Retroversion: An Activity Pattern Index in Prehistoric Southern California. *American Journal of Physical Anthropology* 36 (Supplement: Seventy-second Annual Meeting Program): 100-101.

[Abstract of a poster, so limited info.] Measurement of angle of distal humerus in baseball pitchers' dominant arms compared to 28 Channel Island California

Indians. Prehistoric males show asymmetry (R arm differs from L) and comparable to pitchers, but later Mission period (no atlatls) do not. A suite of features apparently relate to habitual throwing.

**Gladwin, Harold S.**

1937 Independent Invention versus Diffusion. *American Antiquity* 3(2):156-160.

[Noted diffusionist defends his position.] Among examples he thinks prove cross-ocean contact he includes spear-thrower, boomerang or curved throwing stick, bull-roarer and scaffold burial as occurring in both Australia and Texas.

**Glover, J. P.**

x

1875 Curious Australian Implement. *Nature* 13:27.

1 paragraph letter + drawing of simple thrower for light reed spears

**Godehardt, Erhard, Jerzy Jaworski, Peter Pieper, and Hans Schellenberg** o

2007 The Reconstruction of Scythian Bows. In *The Cutting Edge: Studies in Ancient and Medieval Combat*, edited by Barry Molloy, pp. 112-133. Tempus, Stroud.

Composite bow info [poorly written] on manufacture and tests. Penetration studies using different points against Roman scutum shield (plywood construction with leather) and Persian shield (cane with leather): long oval points best, would break structure of shield after a few hits and cause wounds, bodkins next, 3-bladed did not penetrate well.

**Gonzales Morales, Manuel R. and Lawrence Guy Strauss** o

2009 Extraordinary Early Magdalenian Finds from El Mirón Cave, Cantabria, Spain. *Antiquity* 83:267-281.

Old excavs = large areas, so many finds but poor records. Modern = fewer finds, better documented. EMC - large cave, deposits Mid Pal to Medieval. Early (no harpoons) Magdalenian levels 17-13,000 BP. Repeated residential occupations, ungulate + salmon bone, lithics, bone tools, hearths. Art finds: red deer scapula engraved with red deer and bovine, flat spatulate hooked object (15500 BP), slate plaque with horse image. Hook is probably spear thrower hook, made of antler cortex, ground flat with beveled end, some decorative line markings. 89 mm L, 18 W, 5 T. Comparable to other atl-atl hooks from Magd France (Cattelain 1988). Represents cultural continuity over wide area outside region.

**Gordon, George B.**

1916 The Double Axe and Some Other Symbols. *University of Pennsylvania Museum Journal* 7(1): 46-68.

cited by Holmes 1919 as suggesting banner stones represent northern American whale symbolism (quoted in full in Moorehead 1917).

**Gotthardt, Ruth, G.W. Kuzyk, D.E. Russell, R. S. Farnell, P. G. Hare, and E. Blake**

x

1999 In Pursuit of Prehistoric Caribou on Thandlat, Southern Yukon. *Arctic* 52 (2): 214-219.

1997 discovery of ice patches with caribou feces, dart or arrow shaft with C14 date 4360 B.P.  $\pm$  50. Fletched w 3 split feathers lashed on w sinew, prox end missing, small, prob only 50 cm long. Size = arrow, but early date, atlatl not in S Yukon ethnog, but whip-slings using arrow or small dart and whip action of string attached to throwing stick are known for S. Tutchone + neighbor Tlingit.

**Gould, Richard A.**

1970 Spears and Spear-Throwers of the Western Desert Aborigines of Australia. *American Museum Novitates* No. 2403, American Museum of Natural History, New York. (Quotes and abstracts reprinted in *The Cast* Spring 2001:8-13.)

Dish-shaped slab mulga [an Acacia] wood, with resin lump hafting flake at handle, mulga male hook at distal end. Av. 30" long, 2.5-5" wide, av. 14 oz. ["woomera" type]

Boys learn to make by imitation starting very young, play non-competitive target games, at 10-12 fathers make good small set, by 14-16 circumcised, make own real set, but no formal instruction ever. All men make own sets, but some considered more skillful. Sharing common among kin.

Long composite or one-piece throwing spears of wood, with wood point and barb, av. 117 inches long, av. weight 18 oz [297 cm, 560 grams, long and enormously heavy by our standards], take 4-5 hrs work, straighten by heating and bending. Manufacture of spear and thrower with stone tools briefly described.

Men consistently hit 2x2' target at 110-130 feet [34-40 m, pretty good shooting with heavy spear], normal hunting distance some less, in 1966-67 majority of some groups used spear to hunt, and fight quarrels, trying to spear others' thigh. Use in social events to signify peace or hostility.

Functions beyond spearthrowing: 1. friction saw for firemaking 2. mixing tray, 3. work wood with adze flake in handle, 4. percussion music, 5. scraping/digging, 6. spirals, zig-zags etc designs = mnemonic map with sacred designs representing landscape features - so only men make or use decorated throwers or understand designs.

Individual variations in throwing style. Extra hook carried in septum of nose. Spinifex resin glue-making described.

**Gould, Richard A.**

1980 *Living Archaeology*. Cambridge University Press, Cambridge.

Briefly same info as in Gould 1970. Also: spear thrower replaced every 2 years or so, spears dry out, replaced about every 3 weeks. 1 adze flake lasts for final shaping of one spear thrower, or 2 spear shafts, plus other tasks, so man averages 23 adze flakes per year. Not usually used for butchering etc.

**Gould, Russell T.**

1987 A Possible Atlatl Weight from Northwestern Owyhee County, Idaho. *Idaho Archaeologist* 10(1):13-15.

Isolated survey find, oblong boat shape with tapered ends.

**Graham, Matt**

o

2007 Observations with Primitive Hunting Tools. *Bulletin of Primitive Technology* 33: 73-78.

Atlatl very accurate, hit squirrel 10 yds, good for fishing. Bow replaced because less movement to scare fast game like rabbit. Darts durable and harder to lose than arrow. Basketmaker style atlatl (diagram) with split finger grip, fingers not all way through holes or lose power.

Bow and hunting boomerang also discussed.

**Gramly, Richard Michael**

1984 Kill Sites, Killing Ground, and Fluted Points at the Vail Site. *Archaeology of Eastern North America* 12: 110-121.

Clovis points used on thrusting spears, not atlatl darts. Specimens less than 24-25 mm wide do not have ground basal edges, thus are unfinished and discarded because they were too narrow to fit haft. Thrusting spears should be about 25 mm diameter, but not much more; dart shafts much less, so Vail paleoindians using thrusting spears. [See Hutchings 1997: shaft size should be reflected by flute, not point width.]

**Grange, Roger**

x

1952 Wooden Artifacts, In *Mogollon Cultural Continuity and Change: The Stratigraphic Analysis of Tularosa and Cordova Caves*, by Paul. S. Martin, John Rinaldo, Elaine Bluhm, Hugh Cutler, and Roger Grange. *Fieldiana: Anthropology* 40: 331-451. Chicago Natural History Museum.

Atlatl used pre-pottery times through Georgetown Phase, with bow introduced during San Francisco Phase and increasing, with simultaneous use in SFP. But arrows possibly GP, Pine Lawn P, and pre-pottery, so maybe bow earlier, not really accepted until SFP. [Stratigraphy is problematic, so this may be mixing].

Six frags of SW type atlatls, all of oak, most pre-pottery: 3 distal ends w integral hook and groove, miniature prox end, larger prox end w notches but missing loops, one central frag. Plus 3 frags may be unfinished atlatls. Photos,

measurements.

Mainshaft frags, all of willow: 2 central sections, 44, 49 cm L, 1.1 cm D; 2 distal end frags w sockets 1.1 cm diam, 4 cm deep; 7 prox ends w nock, taper to diam at nock .7 cm, nock depth .3-.6 cm. No fletching, but 2 w sinew lashing that could have held fletch.

Foreshafts: 8 slotted, of which 4 have stone pts, all Mt mahogany, L ranges from 6-20 cm, diam ca 1 cm, slots 1-1.5 deep. Four bunts, 1 pointed wood, several either broken or manuf discard, including a couple show groove + snap slot manuf. None decorated.

Some bow fragments, arrow shaft and foreshafts.

### **Grant, Campbell**

**x**

1968 *Rock Drawings of the Coso Range, Inyo County, California*. Maturango Museum Publication 4. China Lake, CA.

[Xerox excerpts only]. A “sheep cult” propitiating spirits of the most important game animal. Anthropomorphs with bows or atlatls. Pp 48-55: “sequence of hunting weapons” No evidence of Clovis atlatl. [Basic description and review of other archaeology ok], “held alongside the shoulder and in action provided an extra joint to the human arm as it lifted the spear high and forward on the thrust. Considerable accuracy and great force were possible at short ranges” (49). Three types from rock art depictions. 1: oldest + most common, hooked line with one or two large circles, apparently weights. 2: similar, but with single small loop at handle, 1-3 weights. 3: rare, more realistic, his 3 examples show hooked line with double finger loop, no weight, ditto with large weight, and broader unweighted with double loop and notched grip.

At Lovelock Cave, bow appeared 500 BC, supplanted atlatl ca 1BC, coming S from Asia, spreading into SW early centuries AD.

Only 3 areas N. Am. where atlatl in rock art: W Texas Pecos R., San Juan R drainage in SE Utah (2 recorded instances), desert ranges of SE California and S Nevada, espec Coso Range [we know a lot more now].

Made replica of Basketmaker atlatl and 5' darts. Longer distances achieved when 2 oz weight removed, but more thrust at close range; weights mostly for charms. Ten throws of 2.25 oz dart av. = 195', max 240'. From 50-75' “astonishingly accurate” [no details]. This is distance for sheep hunting from blinds to canyon floor where game passed.

Estimate bow arrived sometime after Lovelock Cave dates, so in pecked rock art, atlatl depictions 200 BC and earlier, transition period of atlatl + bow 200BC -300 AD, bow depictions 300AD to destruction of sheep bands + migration around 1000 AD. Hiatus, then painted rock art with bow around 1700-1900.

[Photos of some rock art, including a panel with many atlatls].

### **Grant, Campbell**

**o**

1978 *Canyon de Chelly: Its People and Rock Art*. University of Arizona Press, Tucson.

In NE AZ, nice readable popular archaeology of important area with focus on an early rock art study.

p 164 site CDM-214 Atlatl Cave has painting of atlatl “the only known representation of a weapon in C de Chelly BM rock art.” [but later shows darted sheep, darted flute player, and possible dart that he dates “modified BM” and p 191 a panel with 2 darted sheep and BM figure w atlatl in hand, and others, including a clear atlatl he identifies p 194, and p 211 but which he dates to “Great Pueblo” on 194 - I think the stylistic distinctions do not produce clear chronology, and Grant failed to recognize lots of atlatl imagery] Turkey and other bird motifs so common in CdC he considers mostly “after BM” [but there are bird headed BM figures too, which he dates p 210 as modified BM and notes they associate with atlatl at Trail Creek in Glen Canyon and at Natural Bridges National Monument].

### **Grant, Campbell**

x

1978 The Occurrence of the Atlatl in Rock Art. *American Indian Rock Art* 5: 1-21. San Juan County Museum Association, Farmington.

Invention = “man’s first efficient hunting weapon” much better against formidable prey such as ‘wooly rhinoceros’ [a wonderful typo: apparently early man hunted the “noselizard”].

Upper Paleolithic antler atlatls may be models of full-scale wooden ones. p 6 difficulty of recognizing stylized atlatl depictions. World wide distrib, but atl only in rock art in N. Am., Australia, and one site in Mexico.

US 5 regions: Inyo Co, CA; S tip NV; 4-corners UT/AZ; S TX; SE MN. [Lists sites, illustrates examples. Finger loops and weights appear common all over] Only 4 examples in SE Utah, including Butler wash with ‘medicine bag.’ [We know a lot more now]. Good illustration of BM atlatl in use. Why are bows more common in rock art? Conservative traditions?

### **Grant, Campbell**

1979 The Spear-Thrower from 15,000 Years Ago to the Present. *Pacific Coast Archaeological Society Quarterly* 15(1):1-17.

Nice summary, nothing new, emphasis on rock art, California and W US, several drawings, summarizes ethnographic evidence.

Grant experiments with Basketmaker replica: 200', accurate 30-50', weights give more power at close range, don't help distance.

### **Grayson, Charles E, Mary French, and Michael J. O'Brien**

o

2007 *Traditional Archery from Six Continents: The Charles E. Grayson Collection*. University of Missouri Press, Columbia.

[Nice photos, catalogue of selections from collection. Introductory essays rather general and bland, overall not enough info for price. No atlats.]

**Grayson, Donald K.** **s**

1993 *The Desert's Past: A Natural Prehistory of the Great Basin*. Smithsonian Institution Press, Washington D.C.

p251-253 point chronologies: Gatecliff + Elko points tipped atlatl darts, are earlier than Rosegate and Desert series points on arrows. Fig 9-7 shows two foreshafts with obsidian pts of indeterminate type hafted [with sinew lashing *over* the barbs as well as around stem.] Rosegate pts mark intro of bow and arrow in Great Basin, first in E (ca AD 300), later central and W (ca AD 700), so replaced atlatl by 1300 years ago.

**Grayson, Donald K. and David J. Meltzer** **x**

2003 A Requiem for North American Overkill. *Journal of Archaeological Science* 30:585-593.

Martin's model of Clovis extermination of Pleistocene fauna does not work because timing coincidence not as clear now, evidence of possible pre-Clovis, Americas were a continent, not an island where extinctions might be expected, mechanisms not clear, Old World megafauna survived humans for millenia but also died out at end Pleist. Martin's claim that we should expect no evidence of kill sites is non-scientific. [Generally good but some problems in G + M arguments too: they claim only mammoth + mastodon assoc w Clovis in kill sites, while lots of human associations with many fauna in OW - but OW sites are actually habitation, not kill sites, so comparison is deceptive, and there are in fact other faunal associations in Clovis sites.]

**Green, John W.** **x**

1966 A Preliminary Survey of the Atlatl Pictograph Site in the Sierra de Kilo, Chihuahua, Mexico. Transactions of the Second Regional Archeological Symposium for Southeastern New Mexico and Western Texas. *Midland Archeological Society, Special Bulletin* No. 1: 9- 23.

Other atlatl images in Samalayuca Mts 20 m N of Sierra de Kilo (= Candelaria Mts). Arid L. and U. Sonoran zones. Red pigment, granite erosional shelters, 22 groups of pictos, figures w atlats or darts most common. Often hold atlatl, sometimes engaged w dart in one hand, 2-4 darts in other. Atlats may have weight. Darts fletched, barbed or triangular points, longer than humans. Sheep most common animal, some impaled by darts. Possible fending or rabbit stick [doesn't look like it to me]. Some superimpositions, no bows, little pottery, probably old but nothing to date. Nearby shelter with different pictos looted by his informant; small points found. [Illustrations show style very different from BM, but parallels in motifs].

**Grey, George** s

1841 *Journals of Two Expeditions of Discovery In NorthWest and Western Australia, During the Years 1837, 38, and 39...With Observations On the Moral and Physical Condition of the Aboriginal Inhabitants...* Boone, London.

cited in Akerman and McConvell as source of word 'woomera' and others

**Griffin, James B.**

1983 The Midlands. In *Ancient North Americans*, Jesse D. Jennings ed., pp. 243-301. W. H. Freeman and Co., San Francisco.

p. 255: "bannerstones dissappeared, to be replaced by birdstones and boatstones during the Late Archaic and Early Woodland" He dates LA 4000-1000 BC, EW 1000-100 BC. [But MW Hopewell also has boatstones].

**Griffin, Peni R.** o

2004 *11,000 Years Lost*. Amulet Books, New York.

Youth novel, generally well done. Eleven year old Esther is attracted to an archaeological dig, and accidentally goes back to Clovis times and is adopted by a group of mammoth hunters. The social life is plausibly portrayed and the technology follows current archaeological knowledge. Esther is an engaging character, who does the best she can with the limited knowledge of a child, although perhaps a little too astute about human relations. She knows that eventually the mammoths will be extinct and the world very different, troubling concepts to her new family, but she can't explain why, or what could be done about it. To Griffin's credit, she does not flinch from the "Ick, gross" aspects of Clovis life that Esther encounters, raw insects, spoiling meat, fleas and lice, sickness and death, while making the prehistoric families sympathetic and believable. Everyone carries a Clovis point as spear or knife, and the men hunt with atlatls but these are not described in detail. The only real gaff is having Esther learn to knap without difficulty.

**Grosscup, G. L.**

1960 The Culture History of Lovelock Cave, Nevada. *University of California Archaeological Survey Reports No. 52*. Berkeley.

Considers Great Basin atlatls like Lovelock to be "more like Eskimo atlatls than those of the Basket Makers." [Wrong]

**Guernsey, E. Y.** o x

1940 The Problem of the Atlatl. *Proceedings of the Indiana Academy of Science*, Vol 49:17-21.

“additional lever or toggle-joint by means of which combination the propulsive force applied to the spearshaft is greatly increased.” “We have scratched the surface of an intriguing field of research....and prolific literature.” [Already! and mentions experiments - personal? - but no descriptions]. Problems: origins, symbolic significance. Green River sites, Webb’s conclusions about bannerstones (he regards as poor analogy to Guernsey + Kidders SW atlatls which had only small “charms” attached). Lists Moore’s objections to Webb, notes many “hooks” too fragile for atlatl parts, many points would require too heavy a shaft. Also unlikely to be atlatls because occur in juvenile + female burials. Also antler hooks much more restricted distribution than bannerstones. [None of these are good arguments.]

**Guernsey, Samuel James**

x

1931 *Explorations in Northeastern Arizona: Report on the Archaeological Fieldwork of 1920-1923*. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University 12(1). Peabody Museum, Cambridge.

Work continued from Guernsey + Kidder 1921 in Kayenta area, Segi [Tsegi] Canyon etc. P 38, Broken Roof Cave, adult M in slab cist with 4 infants, atlatl, 3 foreshafts w stone pts, 7 coiled baskets, 2 twined bags, skin bags, 1 w paint, pair sandals. P 39 Amsden’s later work another cist, adult M w 2 infants, goods including 4 digging sticks, 7 coiled baskets, 8 sandals, 2 foreshafts w points, broken atlatl dart shaft, stone knife w wooden handle, 2 pts, 2 flaking horn punches, 2 pipes, etc. Basketmaker II.

P 73, plate 48, foreshafts from Cists 1 + 2 w stone pts attached w sinew, 3.75-6 inches. P 71, Plate 50 complete atlatl Cist 1 Broken Roof Cave, 3 views. Very thin slat, curved, elaborate loops of 3 ply folded skin w sinew lashing + sewing, 1 weight + nut lashed on at grip and 1 wt past mid shaft. Oak, 21” long, spur and groove, “beautifully finished”. Second atlatl from disturbed burial in Cave 3 shrunken, missing part of proximal, orig 22” long, spur + groove w decorative ridge, missing grips, marks for binding on weight, 2 loaf-shaped stone wts in assoc.

**Guernsey, Samuel J. and Alfred V. Kidder**

x

1921 *Basket-Maker Caves of Northeastern Arizona: Report on the Explorations 1916-1917*. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University, 8 (2). Cambridge.

Caves including Sunflower Cave on South Comb (early evidence of stratigraphic difference between Basketmaker and Pueblo), Goat Cave, White Dog Cave. White Dog: p 16 atlatl in cist under female burial in cist 24. In cist 27, 2 males with broken up dart shafts and grooved club on bottom of cist. In Cave 6, south Comb, in disturbed cist, frags of adult and child, atlatl, grooved club. In WD, two dog mummies of diff breeds, collie-like long haired, and terrier like smaller short

haired black and white. Atlatls, White Dog C: 1) complete but snapped, oak, 25 inches, up surface flat, under convex, integral hook in very short groove, notches, fingerloops of folded dressed hide. Three small stone weights of fossil mammoth tooth [really?] on underside close to handle. 2) complete, warped, smaller hook, longer shallow groove, 23.5 inches, grooves, simpler skin loops, small chipped stone weight. 3) fragment, with finger grooves and 3 attached weights, one a chipped stone pt, but signs of reuse as paho or ? 4) distal frag with hook and groove 5) prox frag with finger notches but missing loops and weights. Darts – 3 complete mainshafts broken to fit in graves, 52.5, 55, 1nd 55.5 inches. Straight slender branches of light wood with pithy center. Distal end drilled socket to fit foreshaft, reinforced w sinew wrap, proximal cup also wrapped. Fletched w 3 feathers trimmed but not split [odd], 7.5 inches long. Painted décor. Other frags reused as pins and handle of compound pressure flaker. Five foreshafts w points, tapered prox, slotted distal. Lengths 5.5-6.75 inches w points, 4.1-4.8 without, diam ca .5 inch. One bunt. Points are side or corner notched. Caches w burial in Sayodneechee cave and skin bag in WDC. Grooved club [“fending sticks”] assoc w atl or related gear.

**Guilaine, Jean and Jean Zammit**

o

2005 *The Origins of War: Violence in Prehistory*, translated by Melanie Hersey. Blackwell, Oxford.

“Throwing stick” introduced, poorly described p 62. . [Either the original writing or the translation is horrible throughout.] Origins in Upper Paleolithic, replaced by bow near end Up Pal. Lots info on European projectile injuries, later than atlatl.

**Guthrie, R. Dale**

x

2002 Paleolithic Atlatl Weights and Their Decoration: How Function Affects Fancy. *Anthropological Papers of the University of Alaska* 2(1):137-154.

[Interesting and involved, but relies too much on faulty ideas about atlatl and dart dynamics and ambiguous art.]

Typical atlatl has grip which often secures finger + thumb, shaft, hook, and often weight. Upper Paleolithic antler atlatl weights [with hooks] preserved. Semi-circular antler pieces as possible finger loops. Two depictions of atlatls show cross bars (La Madeleine engraved antler, Lascaux wounded bison scene.) [Both are plausible although other interps possible; the LM engraving shows human with “atlatl” carried over shoulder.] Depictions of fletched darts too. Weights smooth throw, store spring energy, and help tune flex of atlatl to spine of dart, tuning important [he relies on Vanderhoek, and too much on Perkin’s ideas]. Atlatls more decorated than other more expendible antler tools like harpoon pts. Throwing flexible spear by finger grip pushing from rear is predecessor of atlatl with some of same spring advantage [Cushing idea, and not really effective]. Throwing uses complex lever system, with wrist as weak but fast part adding

critical velocity, and atlatl also increases length of time force is applied to projectile. [He wants to combine all the theories!]

Atlatl slowly adopted because light thin projectile is counter-intuitive, and because accuracy is hard to learn. Beginning as a child helps, and child's play is source of innovations.

Weight at distal end increases velocity by flexing the atlatl further. Most breaks occur just proximal to weight/hook at thinnest, most flexed point. In Holocene compromised by fixing weight part way down shaft, where it could be adjusted for tuning. [He shows a N. Am. form.]

Atlatls usually depict game animals. Shaft straighteners similar, but also phalluses + nude females, + fish, but no mammoths or rhinos. So atlatls perhaps not used for fishing and more publicly visible. Both show male concern with hunting.

The famous "faune aux oiseau" atlatl hooks [with ibex kid looking backward] show development of a motif. Localized, more stereotyped than other images, odd position with feces + bird, young animal rather than the usual adult, smaller size than usual. [Demoulin calls these chamois rather than ibex and argues that it is a birth scene, not defecation. Guthrie's drawings make it look like defecation and he even feels he can identify bird on turd as woodpecker]. Design factors: horns etc are fragile, deleted by showing young animal, turning head eliminates weak neck, feces used as hook instead of weak tail. Feces + bird give ibex something humorous to look at. Some complete specimens show 25 cm long with hole for thong - so too short for adult. [Demoulin and Stodiek reconstruct these more plausibly as attached to wooden shaft.]

Projectile point design - too heavy makes shaft flex too much. Relatively small osseous points with glued on microliths. Sharpening of a Clovis pt could be balanced by thinning shaft to maintain tuning. [He makes way too much of "tuning"].

### **Guthrie, R. Dale**

o

2005 *The Nature of Paleolithic Art*. University of Chicago Press, Chicago.

[Elaborate and wide-ranging book with many interesting and original ideas, innumerable drawn illustrations, some too small.] Paleolithic art incorporates detailed ethological information from close observation of animals. Influenced by social status and sex of artists - lots of male oriented "testosterone events," sexuality, etc. Many images by undeveloped artists = young people. [Often disputable - over-interpretation of indistinct and ambiguous images - e.g. is a crude drawing unskilled, stylized, hasty, etc.]

[Atlatl info essentially the same as 2002 - some good ideas but misunderstandings of how atlatls work.] Bows not depicted in Paleolithic art - probably not present. Atlatls rare - two depictions, both with cross-bar grips. Fletched darts common, wounds and spear/darts in animals very common.

### **Guthrie, Russell**

s

2007 Deer Kill with Atlatl Nov 10, 2007. Youtube video posting, URL: [www.youtube.com/watch?v=uaEWhGHfCJA](http://www.youtube.com/watch?v=uaEWhGHfCJA) accessed 12/30/07.

[See Crable 2007. Private preserve, 15 yards hit by 7 year old boy. Video posted on youtube attacked by PETA et al. antihunters and hunters who feared bad rep, but looks like a clean kill.]

Video shows boy throwing, deer hit, apparently it ran "15 steps", but then shows steel broadhead on wooden dart went clean through, both lungs hit, dart broken in deer running, apparently two other shots to finish it off. Good shots of cleaned carcass to show wound. Equipment looks to be Thunderbird Atlatl model with dart rest, wooden darts.

**Gutierrez, Hector** x

1995 Record-breaking Hurler Really Puts Spear In Gear. *Rocky Mountain News* July 16, 1995.

Engvall record with modern gear 848' 6 5/8".

**Hackett, Cecil J.** x

1937 Man and Nature in Central Australia. *The Geographical Magazine* 4(4):287-304.

Laments destructive effects of railroad (epidemics) and overstocking (destroying vegetation) and pleads for common humanity of Janjundjadjara and Pitkandjara people. Exped with Tindale. Men armed with spear thrower and one or two spears, women carry digging sticks. Spears of tecoma bush shoot with hardwood point, 8' long, .75-.885" thick. "Almost every time a spear is thrown it is necessary to resharpen the point or remount the head." Trough-shaped desert form spearthrower with gum and stone flake at handle. Photo of manufacture with stone flake in handle as adze. Photos of game (cats, rabbits, lizard, grub, kangaroo, and men with spears + throwers. Thrower used as fire-saw. p. 299: boys play various spear games, as reach puberty, "takes to himself a spear and thrower, forsaking the women and following the men in the hunt, he is marked for initiation."

**Haddon, Alfred C.**

1912 *Reports of the Cambridge Anthropological Expedition to Torres Straits, volume IV, Arts and Crafts*. Cambridge University Press, Cambridge.

Papua New Guinea. Pages 196-198. Spears and throwers obtained from Cape York, Australia, and preferred to bow and arrow as "more formidable weapon" and more accurate. Competition observed: "The mark was a tree stump 125 mm (5 inches) in diameter, and the distance was about 40 paces (27.5 m). I reckon that about 10% of the javelins struck the stump, some being hurled with such force that the points projected through on the other side. The greatest distance thrown

was about 100 paces (about 98 m).”

Spears (“javelins”) for throwers were about 9 foot, compound shaft, bone or wood points. Throwing stick of Queensland type: rigid slat, shell handle, wood spur, 915 mm long.

**Haederle, Michael** x

2010 Gobar Warming: The Archaeological Frontier. *Miller-McCune Magazine*, October 20, 2010. Electronic document, URL: <http://www.miller-mccune.com/science-environment/global-warming-the-archaeological-frontier-23704/>

N. Am. ice patch research by James Dixon, Craig Lee, Greg Hare and others. Dart foreshafts from Yukon photo. Dixon has dart foreshafts and arrow parts up to 3000 yrs old from Alaska ice patches, pursuing his theories of coastal route for human entry to N. Am. with remote controlled sub off AL coast. CL has 10,300 yr old dart foreshaft from near Yellowstone. Exposure of ancient materials as ice melts as evidence of global warming.

**Hale, Fraser** x

1974 It's An Atlatl Of Course. *St. Petersburg Times*.

Clipping and original archive photo offered for sale on ebay, 8/1/11. Dr. Harlan Metcalf demonstrating atlatl. One paragraph brief description.

**Hale, Herbert M., and Norman B. Tindale** x

1933 Aborigines of Princess Charlotte Bay, North Queensland. *Records of the South Australian Museum* 5(1):63-103 (+ missing).

E edge of NE point of Aust, Mutumui, Walmbaria, Kokolamalama, and Barunguan tribes. p 98-103 Weapons: Walmbaria tribe, Flinders Island - ceremonial fights with spear follow a death. Photo shows baler shell Queensland type, method of holding. Flat of spearthrower used to divert spears in combat. Photos of manufacture, made by all the area tribes, but variations: Koko more slender than Walmbaria, coastals lack shell ornament, use shields in fight. Baler shells made only in Cape York, traded, also used as neck ornaments. Spears with bamboo shaft + wood point at ritual fights, but barbed or tipped with stingray spines for serious fight, sometimes poisoned. Spear photos [vicious clumps of stingray spines!] Women fight with yam [digging?] sticks or jab with short javelins.

**Hall, Andy** x

2006 The Last Spear Throwers. *Alaska Magazine*. URL [http://www.alaskamagazine.com/stories/0806/feature\\_atlatl.shtml](http://www.alaskamagazine.com/stories/0806/feature_atlatl.shtml) accessed 9/1/06

Hunting with Jimmy Okitkun on the Yukon delta, spearing seals with atlatl

because in fresh water they sink if you shoot them. Spear of driftwood with ivory or brass harpoon. Chasing seal with motor boat, repeated throws up to 100 feet before success. Graphic shows “nuqaq” simple Arctic form with paddle handle, one hole for finger, ivory hook [much like the one I made]. [Nice article].

**Hall, Andy**

o

2007 The Last Spear Thrower. *The Atlatl* 20 (2):1-3, 20.

Reprinted from above.

**Hall, Robert L.**

o

1977 An Anthropocentric Perspective for Eastern United States Prehistory. *American Antiquity* 42 (4): 499-518.

Symbol systems = anthropocentric, vs “geocentric” view of culture focused on ecology, economy, subsistence, ie materialist. A “cognitive archaeology” based on universal associative mental processes in language, magic etc and interdependence of cultural subsystems on these mental processes. “Using clues from the ethnog record and a broad regional, deep time perspective, ... it is possible to infer a structure of symbolic meaning from many archaeological remains.” Kennings, homeopathic magic, doctrine of signatures as examples of universal mental principles.

Calumet as ritual weapon. Vestigial customs - exchange of ritual weapons as disarmament. Technically, calumet is stem, not the pipe, symbolically connects to arrows. Flat stem pipes of Iowa and Prairie relate to Hopewell platform pipes. Flat pipe w flat stem = symbolic atlatl with effigy spur (eg Cushing’s Key Marco rabbit), and wrappings near mouth = wrapping for finger loops or fetish attachment on atlatl. Atlatl loops are also eyes, eg. on Aztec deities, and Mississippian bi-lobed arrow is sun + arrow or atlatl + dart. Atl root relates to water, atlatls assoc with wells and lakes. Hidatsa (Plains) Stone Hammer Society staff has perforated stone head near center, like bannerstone. Crooked staves and pahos of various tribes resemble atlatls. Symbolic weapons connected to water, sun, fertility, other life symbols, and serve to connect different cultural spheres. Symbolic atlatls survived in above forms after replaced by bow and function forgotten. Hopewell and other “great traditions” work by shared symbolism and ideology as well as economic exchange.

[I find it interesting that this article cites mostly different symbolic connections for atlatls than his later work. Often plausible, but hard to demonstrate - differences between articles show how easy it is to suggest connections of similar forms and vague symbology.]

**Hall, Robert L.**

o

1997 *An Archaeology of the Soul: North American Indian Belief and Ritual*. University of Illinois Press, Urbana.

[A major work on Native American symbolism. Chapter 14 is Atlatls, Courting Flutes, and Calumets, pp. 109-123.]

Atlatls are multifunctional tools with symbolism. Occur in child and female burials at Indian Knoll, so not just male hunt gear. Symbolism survived in other artifacts when atlatls no longer used.

Atlatl form mimicked in Mississippian maces. Mace form survived as tattooed marks of honor on Ponca girls [but Ponca call the marks "children"] symbolizing membership in society honoring night and female principle, thus atlatl = symbol of earth and path of sun.

Mexican glyph "ollin" (Earth, Earthquake, Movement) = atlatl handle with two loops, = bisected circle motif in Hopewell.

Birdstones as atlatl handles - some with 4 feet, originally Mesoamerican bird-crocodile as seen on atlatl handle from Cocle, Panama, = Earth (like turtle in N. Am.). Also similar to the movable block on courting flutes - which are symbolic atlatls - e.g. ceramic flute in form of atlatl from Vera Cruz. N. Am. flutes also associated with war bundles, call to war.

Pipes also associated with war, and with birth/adoption, and with maleness.

Tubular pipes could be held in hole in grip of atlatl, and some S. Am. cigar holders appear to retain atlatl form. Tube pipe in atlatl = model for platform pipe and flat stem of calumet pipe, some of which have bowls shaped like mace or the loops of atlatl grip - flute which passes air through stem is link, and has similar geographical distribution as calumet. Maya God K a related symbol.

[Interesting ideas, lots of possible connections, but ultimately not convincing - it is easy to connect vague symbolisms using major cultural themes and artifacts of superficially similar form. Some contradictions (e.g. atlatl = female, then later atlatl = pipe = cigar = penis), and actual evidence is pretty thin. See Whittaker 1998 for critique.]

### **Hambly, Wilfrid D.**

x

1931 The Preservation of Local Types of Weapons and Other Objects in Western Australia. *American Anthropologist* 33 (1): 1-15.

Field Museum collections. Isolation by aridity, innate conservatism toward borrowing, local woods, contacts, all affect preservation of distinct geographic types of whirlers, message sticks, spear-throwers, clubs, boomerangs, shields, and spears. Nice drawings of typical incised geometric decoration. Map of W A.

Spear-throwers: Kimberley type, long 90-17 cm, notched lath [northern] form of light wood]. Murchison type, elongate narrow oval, flat up, convex under, resin knob, 74 cm, very plain. Pilbarra/Ashburton type, broad teardrop with narrow grip, incised decor. Eastern district type (but also in Murchison area, S central), plain, broad oval with pointed ends, resin knob, flat surfaces. Mount Margaret [SE part of W A, but some also come from Murchison, S Central] type, long narrow oval, concave upper with incised geometrics, resin knob or plain wood, hard red wood. All types have attached hooks.

Spears, a variety of types [to which she assigns locals that do not correspond to

the throwers. Actually there is just a lot of unsystematic variation in barbs, just as her idea of local types is not supported by the locations she claims for the spear-thrower specimens - they appear to overlap greatly.] Spear specimen lengths given, mostly 240-270 cm long.

**Hambly, Wilfrid D.** s

1936 *Primitive Hunters of Australia*. Anthropology Leaflet 32, Field Museum of Natural History, Chicago.

[Exhibit guide, very general, little info]. p. 39 "Spear-throwers vary in pattern...many local types." [illustration of a few, mostly W + central, also Queensland.] "The object of the spear-thrower is to give greater range and precision. The spear-thrower follows the forward movement of the thrower's arm and so extends the time of control over the flight of the weapon."

**Hamerman, David** x

1989 The Biology of Osteoarthritis. *New England Journal of Medicine* 320 (20):1322-1330.

Cartilage is avascular - no blood vessels, hard to repair itself. Lots of biochemistry details.

**Hames, Raymond B.** x

1979 A Comparison of the Efficiencies of the Shotgun and the Bow in Neotropical Forest Hunting. *Human Ecology* 7(3):219-252.

Effects of intro steel axes studied, but not change in hunting technology. Sonnefield (1960) studied firearm intro among Eskimo - superior except for seal hunting where harpoon improves retrieval.

Ye'kwana and Yanamamo Indians of Amazonian Venezuela, South America, 1975-6 in Toki, a mixed village, but tribes mostly separate ways. Traditionally, Yekwana prefer blowgun with curare, Yano hunt more with bow. Only boys use blowgun now, Yek men have shotguns, but Yano men do not. Lances for finishing peccary, tridents for caiman from canoe. 91% Yekwana kills with shotgun, 94% Yano kills with bow.

Shotguns are poor condition modern single shot, reloaded shells with black powder and #4 shot. Yanomamo bows are self bow of D type ca 2 m long, palm wood, arrows ca 2.2 m long, 70-77 gm, cultivated arrowcane stalk, 2-feather fletching from currasow, bowstring of bromeliad fiber. 3 types point: broad lanceolate bamboo, harpoon point with bone barb for birds and small game, curare poisoned wooden splinter point for monkey, plus sometimes an ad hoc blunt. Usually carry one arrow of each 3 heads while hunting, pouch with more heads.

Bow is sluggish, not most efficient bow, but long heavy arrows effective and less likely to be deflected in forest. Effective ranges: for large animals,

blowgun 17, arrow 21, shotgun 25 m, for birds + monkeys 17, 25, and 43 m. Shotgun kills more effectively than wood tipped arrows. Hunter can only carry 4 arrows, long and hard to maneuver in forest. Bow silent. In war, can dodge arrow, but not shotgun.

Info on time spent hunting, success rates, differing kinds of animals taken, methods. In 216 days, over 800 animals all sizes killed, some 2900 kg. Yekwana kill more riverine animals including caiman because they have access to canoes, and more birds because they have shotguns, and overall killed more for less time hunted than Yano, because of superiority of shotguns.

Social effects of shotgun: Yekwana hunt less, but more successfully. But becoming dependent on traded guns + ammo, now need to grow cash crops, so more agric labor time, mostly by women. Loss of traditional specialized hunting tools, but bow survives because ammo supply for guns unsteady. Some overhunting, especially caiman and egrets, but with low population density, most game hunted sustainably.

**Hamilton, Henry W.** o

1952 The Spiro Mound. *The Missouri Archaeologist* 14: 1-276.

Illustrates some atlatl weights and bannerstones from the looting of the mound. One bannerstone has a bead in the hole and was reputedly found strung with others, documenting a secondary use. See Brown 1996.

**Hamilton, T. M.** o

1972 *Native American Bows*. York: George Shumway Publishers.

**Hamlin, Christine** o

2001 Sharing the Load: Gender and Task Division at the Windover Site. In *Gender and the Archaeology of Death*, B. Arnold and N. L. Wicker eds., pp. 119-135. Altamira Press, Walnut Creek, CA.

Florida mortuary pond, Archaic, dates 8120-6990 BP. Good organic preservation, 145 burials. Hunting related artifacts include atlatl cup/hooks, dart shaft, weights, points of antler and stone, all conclusively associated more with males than females and adults more than juveniles. However, of 15 individuals with hunting artifacts, two females had antler points.

**Hamm, Jim** o

1989 *Bows and Arrows of the Native Americans*. New York: Lyons and Burford.

**Handwerk, Brian** x

2006 Ancient Spear Weapon OK'd for Deer Hunt in Pennsylvania. *National Geographic News* January 26, 2006. URL [http://news.nationalgeographic.com/news/2006/01/0124\\_060124\\_atlatl\\_deer.html](http://news.nationalgeographic.com/news/2006/01/0124_060124_atlatl_deer.html) accessed 1/28/06.

Preliminary approval from PA Game Commission for legalizing atlatl deer hunt. Pretty much same quotes as others - Fogelman, Rowe, Perkins, Birkett, supportive commissioner Roxane Palone, negative comm. Jerry Feaser. Adequate description, drawing of throw. No mention of anti-hunter opposition.

**Haney, Patricia J.**

x

1974 Atlatl Elbow in Central California Prehistoric Cultures. In *Readings in Archaeological Method and Technique*, edited by Robert Kautz. Center for Archaeological Research at Davis Publication Number 4. University of California, Davis.

Assessing correlations between technology, subsistence, and ecology by elbow arthritis in 3 sites representing Early, M, and L Horizons. Joint and arthritis described. Technol efficiency and resulting subsistence improved thru time. Early Horizon 3/17 male burials have elbow arth, in both L and R, but “hypertrophic bone formation in the olecranon fossae of 2 of the R humeri, in contrast to only lateral osteophytes on the 2 L hum, indicates a difference in aetiological factors and it is suggested that these 2 arthritic R elbows are examples of atlatl elbow.” Late M Horiz Cook site has atlatl spurs, but more evid fish and plant food, bow and arrow. 5 M and 3 F burials with arth elbows, all but one both, suggest more general stress, espec acorn processing. Late H Stone Lake site of 9 adults, only 1 F arth both elbows = no atlatl.

**Hansen, Richard D.**

2012 Relativism, Revisionism, Aboriginalism, and Emic/Etic Truth: The Case Study of Apocalypto. In *The Ethics of Anthropology and Amerindian Research: Reporting on Environmental Degradation and Warfare*. R. J. Chacon and R. G. Mendoza, eds., pp. 147-190. Springer, New York.

[Good points but rather clumsily written.] Defends Apocalypto - fiction about the past provides both interpretations and insight into motives of authors. Critiques based on aboriginalism, relativism, and revisionism can be valid, but also can be attempts to distort the past. Solution is to return to philosophical foundations of science, search for objective truth as part of anthropological goals. In this case, the argument that Maya did not practice human sacrifice is an example of “aboriginalism” - belief that native peoples were exceptional, and have claims over depictions of their past, so depicting sacrifice is “racism, inequality, and slander.” This view is revisionism and a distortion of the facts.

Gibson was inspired by National Geographic film Dawn of the Maya and made extensive research visits to Tikal and others before writing a “chase” story line for “universal appeal.” Built set on 40 acres near Veracruz. Site was “an ancient village site” (150). [No word on the destructive effect of building a fake city on it.] Hansen was consultant. Enormous detail [photos] “authentic reproduction, seldom if ever provided on film sets.” Facilities showing corn,

cacao, basket, mat, cotton + weaving, fruit, bean, chile production areas, butchers, markets, potters, with masses of material including debitage, tools, dogs + turkeys, etc. Emphasis on pomp and decay led to ritual structures being shown in Classic rather than Post Classic style, but weathered and remodeling. Yucatec language used to provide aural authenticity. Costuming based on archaeological images.

Criticisms of Ardren and others about inaccuracies are wrong, most of film images supported by evidence. Diseased girl suffers small pox, brought by Spanish, time is 1511-1518, beginning coastal contact. Cocom Maya had extensive trade, engaged in slavery. Spanish ships at end did not represent in Gibson's mind the arrival of the "savior" but of the destruction of the Maya, also set up for possible sequel. Friedel (2007) in *Archaeology* magazine claims violence is a "big lie about the savagery of the civilization created by the pre-Columbian Maya," and the film "slandorously mis-represents an entire civilization." Not enough of the elaborate set was shown to see more complexity of Maya culture. PreClassic murals showing sacrifice were used because they moved the story line, showing the captives their fate without dialog. Predatory raids, heart sacrifice, and cannibalism are well documented in Maya art and archaeology. There were in fact large areas of forest where hunter villages could live. Gives extensive documentation of Maya and general Mesoamerican sacrifice. Wearing flayed skin and cannibalism were also present but not shown in film.

Revisionism and view that indigenous rights always trump scientific inquiry (Zimmerman et al.2003) "defy the establishment of truth and see an unqualified political correctness that is both unwarranted and dangerous to the realities of the human saga." Better critiques recognize that Gibson used Maya society to reflect on larger issues of contemporary society - violence and hypocrisy about it, nature, heroism, the struggles of family.

**Hare, P. Gregory, S. Greer, R. Gotthardt, R. Farnell, V. Bowyer, C. Sweger, and D. Strand**

x

2004 Ethnographic and Archaeological Investigations of Alpine Ice Patches in Southwest Yukon, Canada. *Arctic* 57 (3): 260-272.

Since 1999 146 artifacts from 18 ice patches, mostly hunt technol. 43 wood dart shafts or frags or foreshafts, 17 stone dart pts, 2 antler pts, 2 bone or antler foreshafts; 13 wood arrow shafts, 18 antler pts, 3 bow frags [photos of some specimens].

Dart shafts variable: Several fletched [but no details given!], 8 complete, max L 194 cm, most long and tapered w thick end distal, most "very flexible and must have evidenced considerable spring force when propelled." Some thicker and shorter, more rigid. Largest distal end 1.54 cm diam, smallest prox .46 cm diam. Both staves and saplings; most birch, also spruce, willow, and maple. One made w 3 spliced segments plus bevel for missing foreshaft. 8 prox ends w sockets, 12

distal ends slotted for stone pt, 1 w open socket for antler pt. One barbed antler f-shaft 39 cm L w slot ( $4360 \pm 40$  BP). Variety of stone pts, some w ocher [notable because not burial context]. Another antler pt slotted for micro side blades ( $7310 \pm 70$  BP). 28 dart artifacts date  $8360 \pm 60 - 1250 \pm 40$  BP, with most between 4700-3200. Little chronol pattern in darts, but latest is wood shaft w open socket for antler point, transitional to arrow system.

Arrows – 12 complete, 4 w antler pts; 2 nocked ends. 14 barbed antler or bone pts, 3 frags same self bow. Details of arrows. 19 dates: 1300-90 BP with one other shaft at 3600 BP.

Almost no overlap: oldest b+a = bow frag  $1300 \pm 60$  BP, youngest atlatl = 126 cm long shaft  $1260 \pm 60$  BP. Anomaly: 100 cm shaft frag missing distal, with arrow type nock on prox, prob assoc w stone dart pt, 2 dates 3500-3600 BP. Could be unusual nocked dart, or early arrow unrelated to later b+a development. [Diameter is not given, 100 cm is not too long for arrow and is short for dart, but that makes early date for arrow.]

Wooden artifact 22 cm long w knobbed end, square hole near other end,  $1210 \pm 40$  BP. Could be small atlatl missing inset hook. [Possible, but would be short and odd form, late date.]

[Great stuff! But note that there are still ambiguous artifacts at transition from atlatl to bow. Hope they find a real good atlatl soon!]

### **Harper, Cheryl, and William Andrefsky**

**pdf**

2008 Exploring the Dart and Arrow Dilemma: Retouch Indices as Functional Determinants. In *Lithic Technology: Measures of Production, Use, and Curation*. William Andrefsky, editor, pp. 175-191. Cambridge: Cambridge University Press.

“rather than signaling the use of dart technology during the Ancestral Pueblo period, some large hafted bifaces recycled from Archaic sites served as cutting or sawing tools, fulfilling need for Ancestral Pueblo people not filled by expedient flake tools.” Pajarito Plateau, NM sites, 83 bifaces, Archaic with large corner-notched points compared to Coalition Period (1150-1325) and Classic Period (1325-1600) with small arrow points made from flake blanks, 178 “with the final shape often related to the shape of the original flake blank rather than a purposeful choice by the maker of the projectile tip.” [even the poorly flaked points are shaped by choice!]. 3 theories explain presence of both in late sites: 1 multiple temporal components, 2 “replication” of large form for dart point or knife [really should just say “continued making that form”], 3 collection of old points for use as darts, knives, or ritually. Good context usually rules out 1, lack of biface debitage etc rules out 2. Ritual + functional use of old points in ethnography, a few refs. If reused for cutting, should have more wear + retouch [problem: larger points will anyway, they are more multifunction than little STPC arrow points]. If used only as cutting tools because arrows were the projectiles, lg pts in late sites should have more retouch, different shape than in Archaic contexts. If just used ritually, maybe not. Tests: haft area same both periods, but late site pts have much

narrower + shorter blades = more retouch. Lg pts occur more often at late nonhabitation sites where tool production is not taking place; small arrow pts more in habitation + ritual contexts. So Archaic pts recycled into a system of expedient tools. Also implies arrow + dart were not contemporaneous.

**Harper, Veronica, Azzura Di Marcello, and Jessica Jaynes**

2007 Beveled Projectile Points and Ballistics Technology. Poster presented at? Accessed on web, URL: <http://www.csulb.edu/~clipo/papers/551Posters-2007/BeveledProjectilePoints.pdf>

[C. Lipo students' paper.] Assymetrical beveling, common in mid Archaic, should promote projectile spin at speed of throwing spear, 18 mps (Hughes 1998). Tested 6 beveled arch specimens, 3 non beveled, in low speed wind tunnel. They began spinning at 18 mps, and ceased spin at ca 22 mps. Assymetrical "twisted" bevel spun at lower speeds than symetrical bevel [not clear what they mean], suggesting assymetry intentional. Non beveled pt did not spin. [Why does spin cease at higher speeds?]

**Harrington, Mark R.**

1924 The Ozark Bluff-Dwellers. *American Anthropologist* n.s. 26(1):1-21.

Dry shelter excavations in Arkansas. Preserved organics include atlatl and foreshafts. Two cultures recognized: "Bluff-Dweller" and "top-layer culture". For earlier, emphasizes hunting – lots of faunal bone, heavy flint points "too large for arrows" wooden foreshafts, cane spear shafts, and a wooden atlatl. Possible crude arrows also in Bluff-Dweller levels. Atlatl: 1 complete, several broken examples. Made of wood, 19" long, projection at one end for spear and transverse peg at handle for grasping. Comparable to an Aztec type. [Small photo shows rough looking stick with transverse peg high where forefinger and thumb might grasp it. Shaft also appears to have finger notches at that point. Hook might be integral, but can't see it.] Foreshafts about 8" long, some ornamented with incised lines, both binding and mastic used, tapered to fit shaft. Points usually "diamond shape" or side-notched or stemmed.

Associated culture described at length, including: Oval biface found hafted as axe. Numerous corn cobs, also beans in bags, and squash, and sunflower, and gourds, as well as unidentified seeds. Hafted mussel shell hoe. Storage pits for corn. Lots of nets and baskets. "Bushels" of acorns, walnuts, hickory, hazelnuts. Deer skin robes, feather blankets [like SW], breechcloth, moccasins. Sees similarity to Southwestern prehistoric cultures, and atlatl suggests equal antiquity.

**Harrington, M. R.**

x

1930 Ashes Found with Sloth Remains. *The Science News-Letter* 17(478):365.

In Gypsum Cave, NV, artifacts and hearth under sloth dung, which is under Basketmaker material, shows humans associated with Pleistocene mammals. Small photo shows “Bertha Pallan, expedition secretary, showing difference in size of early type (small) and late type atlatl darts from GC.” [no other info]

**Harrington, Mark R.**

1959 A Two-Purpose Atlatl. *The Masterkey* 33(2):60

[Photo shows basketmaker SW type atlatl with finger loops] found in shelter, Winnemucca Lake, NV. Handle is long and narrow and has an antler attached for chipping, also photographed. [Too short, no further info, and I can’t find a better source]

**Harris, Rolf**

**o**

1975 *Rolf Goes Bush*. A.H. and A.W. Reed Ltd, Sydney.

Travel narrative. RH [Australian/British TV personality, musician, artist] visits back country with aboriginal friends to see life in the bush. [Amusing account, nice photos, but little real information.] Plays with spears, throwing using cordage as “woomera.” Spear shafts hardened and straightened in fire. Metal [“shovel-nose”] blade attached with cordage and gum, using moistened woomera to smooth gum. Describes making woomera hook by carving a wooden point using heel of foot as backstop for knife, attached hook to woomera with gum. [photo of spear, drawing of carving on heel, no picture or description of woomera at all. N Aust, but no indication of what kind woomeras.] Claims “could hit Bert’s hat at fifty yards” with woomera + spear [but since he calls string his woomera, was it string or a real one, and should we believe this?]. They were going to hunt on this trip but did not.

**Harrison, Chris**

**o**

2006 The Sling in Medieval Europe. *Bulletin of Primitive Technology* 31:74-79.

History, accounts of accuracy, good refs.

**Harrison, Peter D’Arcy**

**x**

2003 The Atlatl from Operation 96D, Structure 5D-51, Group 5D-11, Tikal. Appendix J in H. Moholy-Nagy, *The Artifacts of Tikal: Utilitarian Artifacts and Unworked Material*. Tikal Report No. 27, Part B. pp. 105-106, figures 123, 159, 160. University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia

Poorly preserved proximal portion ca 20 cm long of wooden atlatl with carved bone finger loops. Context in fill in palace room, but late, “survivor of Collapse” of Tikal. No photo, poor drawing, good drawing of one loop shows elaborately carved and drilled for attachment.

**Hassig, Ross** **B**

1988 *Aztec Warfare: Imperial Expansion and Political Control*. University of Oklahoma Press, Norman.

Compiled from various sources. Atlatl predates Aztecs, although some myth claims they invented it, or credits god Opochtli. Surviving examples often ornate, perhaps for ceremonial occasions, ca. 2 feet long with hook and groove. Grips with loops, holes, or pegs. [Poor photo shows elaborate atlatl with apparently simple grip; codex drawing shows peg grips on atlatls used against Spanish] Darts made of oak [unlikely] and fletched, a variety of points used. Shown in art carried in hand, not quiver. Spanish sources say could penetrate armour. Suggests range over 55 meters, 60% more thrust than unaided spear [but all this is from old experiments of Browne, Howard, Peets]. Bows and slings also used in warfare.

Macuahuitl (obsidian edged wooden sword) also described, none survive, but 19<sup>th</sup> C illustration of one in Madrid armory does, and lots of contemporary illustrations.

Atlatl probably used as armies closed for hand to hand combat, after bow and sling barrage.

**Hassig, Ross** **B**

1992 *War and Society in Ancient Mesoamerica*. University of California Press, Berkeley.

15: Olmec had atlatls, but rarely depicted so not important. Two specimens (stone) in Dumbarton Oaks collections [models, not for use]. One depicted on Stela D at Tres Zapotes.

102: Cacaxtla murals show battle scene with atlatls

120: Chicimec [northern barbarian] bow with greater range and rate of fire gave advantage over Toltecs with atlatl + sling

125: Chichen Itza murals with Toltec vs Maya, both using atlatls. 127: Toltec use of atlatl with short sword gave advantage against Maya who wore no armor

137: Aztec atlatls along with new weapons: bow and broadsword [macahuitl].

...60% more thrust than hand thrown spear, range no more than 60 m, wooden, .6 m long, groove with hook, fingerholes, loops or pegs for grip. Darts of oak, feathered, variety of points, carried loose in hand. Slings with shaped stones, probable range several hundred meters [no refs for any of this].

172: Teotihuacan times, atlatl specialized weapon, required other troops with spears in integrated use, so only large armies used it, smaller armies favored thrusting spears. Toltec times, atlatl with short sword in combination, carried together, no need for specialized troops. Spread to lesser armies like Maya where elite troops used in combination with shock weapons. Aztec times, superior bow replaced, except for elite troops using before a charge with shock weapons. "Thus the atlatl remained important in armies with large elite components but was displaced by the bow in small armies."

Plates: designs on Oaxaca atlatl in Smithsonian 10/8724, sculpture at El Tijin, E Classic pot design, stela design from Tikal, mural from Teotihuacan, all showing warriors with dart/atlatl. Drawings 1846 of macuahuitl and thrusting spear edged with obsidian.

[many other minor mentions. He is very interested in social + tactical meanings of different weapons, which sometimes leads him to overgeneralize about weapons whose actual use and effectiveness he really doesn't know.]

### **Hayden, Brian**

1979 *Palaeolithic Reflections: Lithic Technology and Ethnographic Excavation Among Australian Aborigines*. Australian Institute of Aboriginal Studies, Canberra and Humanities Press Inc, New Jersey.

Very detailed description of stone tools and use experiments conducted with aboriginal men and women in Australia. Includes some information on manufacture of woomera type "meru" spear throwers (scoop shape with adze stone hafted in handle) and "crude" spears. [Focus is on hyper-detailed descriptions of use of simple stone tools and their manufacture and wear, useful for lithic studies, not very useful for atlatl interests. Most informants had not actually used stone tools since the 1940s, and were not all competent. No illustrations of finished spear throwers, so hard to judge how well they did.]

### **Hayes, Virgil**

1994 Tuning Weights. *The Atlatl* 7(3):1-4.

Weights "tune" atlatl for proper flex of atlatl and dart by adjusting speed/force of throw and flex, which he explains in terms of "archer's paradox". [Interesting ideas, but I still don't think atlatl flex is very important or needs tuning to dart].

### **Haynes, C. Vance**

**O**

2011 Distribution of Clovis Points in Arizona and the Clovis Exploration of the State, 11,000 BC. *Kiva* 76(3):343-367.

Table of 109 point finds, including those from Naco, Lehner, Murray Springs. Most points in E half of state, clusters around Tucson + Flagstaff, sparse around Phoenix. Speculative scenario of a band of hunters moving into state from Utah to explain point distribution [but there is really no reason to assume all from one group - too much variability and a span of multiple lifetimes at least.] Assumes C points used with atlatls.

### **Headrick, Annabeth**

**B**

2003 Butterfly War at Teotihuacan. In *Ancient Mesoamerican Warfare*. M. Kathryn Brown and Travis W. Stanton eds., pp. 149-170. Altamira Press, Walnut Creek, CA.

Butterfly images connected to Tlaloc, a god of rain and war by same goggle eyes, proboscis, and antennae that are the same as the fletching ends on atlatl dart depictions. Good illustration of atlatl armed warrior from Teotihuacan. Butterfly as propagandistic image of duty of holy war, warriors often depicted with butterfly costuming, often conflated with owl.

**Heath, E. G. and Vilma Chiara**

x

1977 *Brazilian Indian Archery: A Preliminary Ethno-toxological Study of the Archery of the Brazilian Indians*. The Simon Archery Foundation, Manchester Museum, Manchester.

Typology and distributional study of bows and arrows, with some details on manufacture, curare, fletchings, grip types, arrow points, and social aspects. [But the result is almost worthless, a few photos of bows in use, but no details of individual specimens from particular areas or of exemplary types. In no place is all the info on bows of any one tribe or region put together; data is all distributed in uneven smatters under topical headings. They boast about the cooperation of an archer and an ethnologist, but details useful to an archer are completely lacking. Not enough detail to replicate any bow, no info on draw weights or even brace height. Some of this is because sources are poor, and they worked mostly from museum specimens, but it is inexcusable that they didn't go out and collect case study details from at least one or two accessible tribes. Any single example would have been more useful than this pointless general study.]

Spear thrower use: one paragraph in section on other weapons, with a few vague literature citations and the undocumented statement: "use of the spear-thrower as a weapon has disappeared in Brazil, but its use persists in competitive sport."

**Hein, Wulf**

x

2005 Spear Thrower. Archaeo-Technik Webpage, Electronic document, URL: [http://www.archaeo-technik.de/material/spear\\_thrower\\_05.pdf](http://www.archaeo-technik.de/material/spear_thrower_05.pdf) Accessed 10/2010.

General discussion of European Upper Paleolithic throwers, illustrated.

**Heizer, Robert F.**

1938 A Complete Atlatl Dart from Pershing County, Nevada. *New Mexico Anthropologist* 2(4/5): 68-71.

From guano mining in a cave near Lovelock Cave [Leonard Rockshelter]. Length 129.5 cm, three sections. Butt: cane, 38 cm, sinew wrapped at both ends, tangential eagle feather fletching with tufts of bluebird feathers, proximal end left open to engage atlatl. Central section: cane, 45 cm long, no decoration. Foreshaft: greasewood, 57 cm long (of which 10.5 cm inside cane of central section), inserted end long cylindrical taper, point damaged but no stone point was used. [By modern standards this dart is both very short (129.5 cm = 4' 6") and very

light (38 grams, Heizer 1951). Wish he gave balance point info.]

**Heizer, Robert F.**

1938 An Inquiry into the Status of the Santa Barbara Spear-Thrower. *American Antiquity* 4(2): 137-141.

Collected 1793, Santa Barbara, Chumash area, by G.G. Hewett of ship "Discovery."

Short (5 1/8") [how would it work? Or is is symbolic only?] board type with groove, raised bone hook, symmetrical 2 finger holes.

No precedents in area, probably results from 250 yrs of Spanish contact and colonization by Mexican Indians.

**Heizer, Robert F.**

1942 Ancient Grooved Clubs and Modern Rabbit Sticks. *American Antiquity* 8(1):41-56.

SW prehistoric grooved clubs – are they the same as historic SW rabbit sticks? Basketmaker - long, flat, S-curved, 3-4 grooves. Guernsey and Kidder 1921 suggest association with atlatl as warding sticks, and note similar in hands of Maya/Toltec carvings. Now clubs seem wider distributed in the west, not all with associated atlatl, some with bow. Roberts 1929 thinks TX specimens fighting or throwing clubs. Heizer thinks "specialized adjunct to hunting, first with atlatl, later bow" to dispatch wounded game. Archaeological and ethnographic information summarized (many finds, ethnographic from all over west including Hopi and CA). Should be a historical connection, perhaps from war to later hunting. [I find it hard to picture fighting with atlatl in one hand, while warding off darts with the other hand that has to hold the club and extra darts – a fighting or throwing club seems more likely].

**Heizer, Robert F.**

1945 Introduced Spearthrowers (Atlatls) in California. *The Masterkey* 19:109-112.

Three separate historic introductions of atlatl: 1. Santa Barbara [short little thing], collected 1792, is "poor copy of Tarascan type", introduced through Spanish colonial settlement. 2. Two Alaskan spear throwers, collected late 1800s, Chumash area, introduced by Aleut and Koniag hunters employed by Russian sea-otter hunting expeditions. 3. Susanville basketmaker type [see Fenenga and Heizer 1941] turns out to have belonged to a local Indian whose son-in-law learned how to make and use atlatls from M.R. Harrington. So California had prehistoric atlatls, but there is no evidence of survival into historic times.

**Heizer, Robert F.**

1951 Preliminary Report on the Leonard Rockshelter Site, Pershing County,

Nevada. *American Antiquity* 17(2):89-98.

Work in 1949 at site where atlatl dart found 1936, in deep bat guano layer. C14 dates on guano average  $8660 \pm 300$ , greasewood atlatl shaft fragment  $7038 \pm 350$  B.P., relatively humid Anathermal period of the Postglacial. Dart shaft complete, 3 sections, 130 cm long, cane shaft, long greasewood foreshaft with simple tip, 38.5 grams, two tangential feathers, red painted spiral decoration. Long chronological discussion.

**Helmick, Troy C.** ○

1996 Atlatl Weights Found in Montana: An Atlatlist's Perspective. *Archaeology in Montana* 37(2):67-78. Reprinted *Indian Artifact Magazine* 17(3):16-19 (Aug 1998). Reprinted *The Atlatl* 14(3):1-6 (July 2001).

Nine specimens described + mapped, well illustrated, variety of materials and sizes, mostly elongate with central groove for lashing. Lists functional theories [but reaches no conclusion].

**Helwig, Kate, Valery Monahan, and Jennifer Poulin** ○

2008 The Identification of Hafting Adhesive on a Slotted Antler Point from a Southwest Yukon Ice Patch. *American Antiquity* 73(2):279-288.

Ice finds show atlatl darts from before 8000 BP to appearance of bow and arrow at ca 1200 BP. This pt dates  $7310 \pm 40$  BP uncal.; assoc w similar dated shaft frag. 24.6 cm long, now warped, slotted both edges for microblade insertion, one frag remains, slots 1-1.5 mm W, 3-4 mm deep along whole length. Short tang scored for attachment. Incised linear decoration, red pigment traces. Microscopy and spectroscopy show mastic is pure spruce resin with no inorganic additives, and not heated to produce tar or pitch.

**Hemmings, Christopher Andrew** ○

2004 *The Organic Clovis: A Single Continent-Wide Cultural Adaptation*. Unpublished PhD dissertation, University of Florida.

[Important study, earliest direct evidence of paleoindian atlatl use]. Clovis is a continent-wide pattern irrespective of local environmental constraints. "State of the art" specialized technology for a generalist subsistence strategy without good recent analogs, in response to unique enviro of Pleistocene. Data from 246 early Paleoindian sites with organic remains, focus on artifacts made of extinct fauna bone. 352 species plants + animals represented, with 116 having direct evidence of use, although clear preference for mammoth and mastodon. Nearly 250 formal bone + ivory tools in 45 different forms. Tight definition of Paleoindian = Clovis only, all others lack Rancholabrean fauna and are a different adaptation. [Makes extensive and convincing case documenting Clovis use of wide variety of plant and animal resources (although burning is not always a secure indicator of an

animal being eaten)]. Florida ivory tools overwhelmingly mastodon, not mammoth. Direct evidence of many species argues against human “overkill” but effect of hunting on proboscidiens could have been important factor in their extinction, since they were doing very well just before Clovis.

Skeptical of expedient flaked bone “tools” - at odds with formal + curated Clovis assemblages. Formal tools ground, not flaked.

Most Clovis bone + ivory from Florida river sites, where context often poor. Three atlatl hooks: 1. Hendrix collection, Santa Fe R. *Paleolama* proximal phalanx with distal end ground to isolate spur .68 cm long with high contact polish. 2. Mastodon vestigial tusk hook, split, scored for hafting, beveled to elevate spur tip, 5 cm long. Ichetucknee R. 3. Proboscidian ivory shaft fragment reworked into atlatl hook, Santa Fe R. 7.5 cm L, sim in form to others. [also mentions but does not describe similar antler hooks. The photos in my copy are completely illegible, but he provided electronic versions see Whittaker 2007]

Bannerstone [?] of proboscidian vertebra centrum 13.5x1.5x5.4 cm, tapered bun in form, hafting hole mentioned but not measured, broken in middle with two drill holes for mend. [He’s not sure it’s Clovis, resembles later stuff eg Windover].

Ivory points: short ones are “launched;” long ones often considered foreshafts are really lance points [doesn’t describe many individ specimens or argue about function much. P 192 confused section appears to dislike foreshaft idea because curved foreshafts not fly straight.].

Only 6 species documented for tool use: mammoth, mastodon, paleolama, dire wolf, horse, deer. Tools and manuf technique same all over continent. Split tusk analogous to splitting large bifaces to make point blanks, a characteristic Clovis technique. Overshot flakes for thinning and as tools. Two co-traditions of point form, parallel sided and excurvate. Blades from cylindrical + wedge-shaped polyhedral cores.

Clovis fluting failure rate 50+% [No!] so bone tools used because more reliable. Ivory pts puncture better if greased, explaining presence of ochre outside of caches [Huh? No connection explained]. Clovis used three alternative point types: short (launched) bone, stone (launched) and long curved bone/ivory pts used as lances and intended not to remain in prey.

Limited art (geometric incisions, one possible mastodon, beads) connect to Euro Up Paleolithic, but lack cave art. Counts points from sites and surveys [not considering thousands in private undocumented hands], argues that kill sites without bone would look very small. Distance of pts from stone sources indicates mobility. Oldest Clovis sites already have exotic stone, indicating prior exploration and travel. Highly mobile population of low density produced thin spread of homogenous cultural remains. “Technology-centered” foragers, relying on technol, mobility, and use of predictable large game, but also very broad spectrum of resources, an adaptation with no recent analog.

### **Hemmings, E. Thomas**

o

2007 Buried Animal Kills and Processing Localities, Areas 1-5. In *Murray Springs: A Clovis Site with Multiple Activity Areas in the San Pedro Valley*,



reason a flexed atlatl adds nothing - unless you slow dart or atlatl down, it has no time to spring back until after atlatl stops pushing dart.]

**Herbert, Wally** o

1981 *Hunters of the Polar North: The Eskimos*. Time-Life Books, Amsterdam.

Nice photos and essays on W. Greenland Eskimo. Two photos of throwing harpoon with "throwing stick" from a kayak while hunting narwhal (142, 148). [In both, the atlatl is above the hunter and has clearly made a flipping motion in throwing harpoon attached by pegs along shaft, not from proximal end.]

**Hermann, Ferdinand** o

1967 *Volkerkunde Australiens*. Bibliographisches Institut, Mannheim.

In German. Ethnology focused on tribal distributions. Short section on spears and spear thrower, 2 good photos, one showing throw with flexing darts.

**Hester, Thomas R.** x

1974a Archaeological Materials from Site NV-WA-197, Western Nevada: Atlatl and Animal Skin Ponches. *Contributions of the University of California Archaeological Research Facility* 21:1-43. Berkeley: University of California

Analysis of looted material from dry cave, near Winnemucca Lake, NV. Unusual atlatl >6000BC. Wooden shaft with attached bone hook and long bar weight (19 cm L, weighs 80-100 gm). Atlatl L = 58.1 cm. [This is the model for Bob Perkins atlatls, aka Nicolarsen Cave atlatl, see Allely 1992]. 2 skin pouches w/stone tools - hafted bifaces used as fish knives plus ? [A. Romano points out more likely atlatl dart foreshafts, possibly used in fishing, with a feathered line found with them attached as float.]

>100 pts and preforms of Eastgate type (shows type's reality), probably by one individual, with compound short antler pressure-flaker.

**Hester, Thomas R.** o

1974b Supplementary Notes on A Great Basin Atlatl. In *Great Basin Atlatl Studies*, RF Heizer, ed., pp 29-32. Ramona: Ballena Press

Winnemucca Lake specimen [number 2 - not same as above, see Harrington 1959. Note presence of two different forms in same lake basin, see Hester 1974a].

Basketmaker style handle with pair of leather finger loops, but with antler flaker on proximal end, odd keeled hook which may be incomplete, 56 cm long, max W 2.5 cm, max T 1.25 cm, couldn't weigh.

**Hester, Thomas R, and M.P. Mildner** o

1974 An Atlatl from Council Hall Cave, Nevada. In *Great Basin Atlatl Studies*, R.F. Heizer, M.P. Mildner, and L. Spencer eds., pp 33-36. Ramona: Ballena

Press.

From Harrington's excavations, 1920s.

Specimen described – basic SW form: a straight flat stick with groove and integral hook, finger notches but no surviving loops, 52.7 cm long, 1.9 cm wide, no thickness measured.

**Hibben, Frank C.**

**o**

1975 *Kiva Art of the Anasazi at Pottery Mound*. KC Publications, Las Vegas.

Identifies atlatls in 2 murals, P IV 1350-1475. [This would be extraordinarily late. One(p 70) is a rectangle with 2 central loops and 2 slots? at one end, more likely a stylized bird, feather, or prayer stick depiction; the others (p131) are very vague hooks peeking over the edge of shields. Neither is at all convincing, never mind the questions about the accuracy of Hibben's mural recording.]

**Hill, Kim, and Kristen Hawkes**

**s**

1983 Neotropical Hunting among the Ache of Eastern Paraguay. In *Adaptive Responses of Native Amazonians*, edited by Raymond Hames and William Vickers, pp. 139-188. Academic Press, New York.

Bow hunters, self-bow of palm wood ca 2 m long. Arrows are reed shaft with hardwood head, often barbed, ca 1.8 m long. No poison, no dogs until recently. Attempt to approach sleeping deer to 15 m for accurate heart shot. [Details but not ranges for lots other game]. Ca 1/8 of men have shotgun, a few brass shells, use large shot. Range with bow or gun ca 15 m, accuracy similar, but gun more knock-down power. Archery contests for fun, observed accuracy ca 21% at 15 cm target 25 m distant and 45 degrees above horizontal. Accuracy improves as approach 90 degrees, rarely shoot horizontally more than 15 m. Bow hunt returns .53 kg meat/hr hunting over 3500 hrs observed, much better with shotgun, espec for larger game. Game populations rapidly diminished. Quantitative optimizing models applied.

**Hill, Malcolm**

**x**

1948 The Atlatl, or Throwing Stick, A Recent Study of Atlatls in Use with Darts of Various Sizes. *Tennessee Archaeologist* 4:37-44.

Importance of different grips. Could use one hand to hold back dart and add flexing force to throw if atlatl flexible, "grasping the handle of the atlatl with the left hand and the spur end, including the rear end of the dart, with the right hand." Probably influenced invention of bow. He then says "sweeping movement is necessary to propel the dart." But he claims the 2-hand method works in cramped quarters to "propel the dart with the wrist alone 40-50 feet." [Absurd – I can't believe that after experimentation he still suggested this.] Darts less than 30" didn't work well. Small darts better - up to 60 yards. Rigid atlatl gives longer

throws than flexible. Recognizes limitations of his reproductions and skill [also small samples of throws]. Two atlatls tested with and without small weights near handle, “their value was definitely negative.” [Actually, it seems to improve distance for the light darts, but not for the medium or heavier, but as he only measured 6 shots for each of 12 trials, not statistically significant.]  
Max throw 242 feet. [Illustrations show he tried a variety of atlatl forms.]

**Hill, Malcolm**

**x**

1949 A Time Study in Making an Atlatl with Primitive Flint Tools. *Tennessee Archaeologist* 5(1):12.

Took him two hours and 58 minutes.

**Hirst, Kris**

**x**

2005 The Raging Cow: An Atlatl Contest Among the Corn. Your Guide to Archaeology About.Com webpage, URL:

<http://archaeology.about.com/od/atlatls/a/ragingcow.htm> accessed 4/06

Good basic info on atlatls, description of event, photos.

**History Channel**

**o**

1999 *Arms in Action I: Slings and Spears*. VHS, A + E Television Networks.

[This whole series is shallow, with overgeneralizations, inaccuracies, and no info on practical use.] Brief scene of knapping British flint [T. Lord?] hafting biface to spear, throwing with atlatl. [But spear and atlatl are crude, doesn't look like skilled throw, but you never see flight or outcome.] Slings, stones + cast shot [but again, slinger doesn't look skilled, uses odd underarm throw, you can't see whether he hits a target or not - how do they expect to convince anyone that these are deadly and effective weapons?] Rest devoted to Greek + Macedonian phalanx, Roman pilum, later lances.

**History Channel**

2009 *Warriors with Terry Schappert: Maya Armegaddon*

Educational TV program, A + E Television Networks. 45 min.

Tom Mills provides atlatl expertise, Jim Winn knapping and obsidian tools. Larry Kinsella, Bob Perkins, and Greg Nunn also mentioned in weapons credits. Hyperactive host dramatizes Maya battles, accidentally cuts himself with obsidian edged sword, enthuses over atlatls, argues that they were new weapons from Teotihuacan that changed the nature of Maya warfare from capture for sacrifice into war for conquest. “Transverse waves” are mentioned as allowing dart to fly, but Terry more correctly recognizes that flexibility lets dart stabilize after throw, Tom describes atlatl as lever. Also features blow guns, a version of Maya ball game, stone celt/axe [made by LK, producers added ridiculous unnecessary

lashings], spears with improbable huge obsidian biface blades [but looks like they used mock-ups for sparring].

**Hobbs, Horace P.**

1963 The Mystery of the Bannerstones and a Possible Solution. *Archaeological Society of Virginia Quarterly Bulletin* 18:2-7.

Bannerstones, especially butterfly and related forms, could have been mounted to slide on a central rod between two side rods on a “super atlatl.” This explains fragility, small holes, and symmetry. Tested with concrete bannerstone and 5.5’ spear [details lacking] against hand throwing and “simple” atlatl. Either atlatl doubled distance thrown by hand; super atlatl did better, up to about 55 yards. Bannerstone adds thrust, and also “counteracts forward weight of spear, keeping it in balance until thrown.” Super atlatl allows stone position to be adjusted according to weight of spear.

[Creative idea, but excessively complicated and implausible.]

**Hoffecker, John F.**

o

2005 Innovation and Technological Knowledge in the Upper Paleolithic of Northern Eurasia. *Evolutionary Anthropology* 14 (5): 186-198.

Early (45-30 kya) Mid (30-20), Late (20-12) Upper Paleolithic innovations discussed world wide with first evidence dates for many. Early (dispersal period, before end Neanderthals at 30). Pre-35, only bone awls, eyed needles Kostenki 15 E Euro Plain 35-30. Drills by earliest EUP, so prob fire drills. EUP split base antler point, prob simple traps + snares. Beginnings of notational systems, painted images, and pipes or flutes.

MUP, Gravettian technol, periglacial envir, improved shelters, bone fuel, storage pits. At Buret, Siberia, 25 kya, figurine shows hood = sewn skin clothing. Beveled bone spear pts, ivory “boomerang” at Oblazowa, Poland. Isotopic + bone evidence of broader range of diet. Weaving + netting tools at several N. Euro sites. Intentionally fired clay ritual objects. Larger sites, denser occupations. By Solutrean times in W Euro, eyed needles, self-barbed antler pts (= fishing?), first spear thrower (Combe-Sauniere I) [drawing from Cattelain 1989].

LUP W Euro (Magdalenian) sites include multiple structures, lamps, poss stone boiling pits, large pops. Siberian contrast - short term sites = less productive habitat. Wider food ranges in all, barbed harpoons (Magd and E Euro + Siberia) but hooks only late eg Courbet France. Eliseevichi Russia 1000s fox bones = trapping. Spear thrower common in Magd but unknown in E Euro + Siberian sites. Bow and arrow not sure until 14 kya Stellmoor Germany, but backed microliths in Magd + Epi-Gravettian may = bow. Dogs also LUP. Cave art, lamps, mixed paints.

**Holmer, Richard N.**

s

1986 Common Projectile Points of the Intermountain West. In *Anthropology of the Desert West: Essays in Memory of Jesse D. Jennings*, edited by Carol J. Condie and Don D. Fowler, pp. 89-115. University of Utah Press, Salt Lake City.

Bow arrives around 300 AD or a bit before.

### **Holly, Lance E.**

2010 n.d. Beyond the Point: Arrow Shaft Technology of the Prehistoric Southwest. Unpublished MA thesis, U Colorado at Boulder, 2010.

Surveys surviving arrow shafts in SW from many sites, some literature only, for comparison of Pueblo Bonito and Aztec Ruins. Surprisingly consistent in construction: compound with cane shaft, only 2 of 491 arrow fragment specimens were from self arrows. Foreshaft always wood (many species), mainshaft always reed (*Phragmites communis*). 68 specimens with feather remnants, all with 3 feathers equidistant. (2 feathers attested in lit also). All with lead feather oriented perpendicular to nock. [No tangential lashing? Apparently all split vein?]

Variation is in use of stone points, and painting:

152 foreshaft tips: 55% tapered [= sharpened]; 33% notched [for stone point]; 13% blunt.

But Pueblo Bonito has 51 specimens of which 30 (59%) are notched. [There are some sampling problems - first, the sample from PB may not be normal, second, it is included in the overall 152; third, unusual preservation of arrows everywhere may often be in unusual contexts like burials, ceremonial caves, sealed rooms at PB, etc] Aztec has 20 specimens, only 1 (5%) notched, Mesa Verde area sites 31 specimens, 2 (6.5%) notched; and Other Sites (all over pueblo world) 51 specimens, 18 (35%) notched. [Note that MV has 39% blunts, way high - maybe indicates more bird and rabbit hunting, less big game?] Sharpened tips most common everywhere: PB 39%; AR 90%; MV area 55%; Other Sites 55%.

Painting: 55 specimens, most common colors red and green, designs usually solid color between fletchings, narrow bands, or longitudinal stripes, usually all near nock. Foreshafts rarely painted [but while none at AR or MV, at PB 13% of painted is foreshaft, and at Other Sites 39%]. Red dominates in all sites but PB, where green is more common, and AR has some green too.

So concludes connection between PB and AR, where Chacoan warriors or ritualists influenced or brought green, stone-tipped arrows.

[very interesting that in surviving arrows, sharpened tips outnumber stone tips, but he goes overboard - there are millions of points from sites, so stone tipped arrows cannot be negligible, and although in his sample, green may correlate with stone tips (or this may just be at PB), stone tips can't be mostly ceremonial arrows - too many with impact damage.]

### **Holt, C. Brian**

1992 A Brief Study on Atlatl Spur Angles. *The Atlatl* 5(2): 3-4.

Lower angle spur (less elevated) required flatter throw, less follow through, flatter trajectory, more force.

**Holm, Bill**

1988 Art and Culture Change at the Tlingit-Eskimo Border. In *Crossroads of Continents: Cultures of Siberia and Alaska*, edited by William W. Fitzhugh and Aron Crowell, pp. 281-294. Smithsonian Institution Press, Washington, DC.

Tlingit, northernmost NW Coast culture, in contact with Eskimo Chugach and Koniag, show many Eskimo features, including throwing boards. Exchange increased after Russians brought Aleut and Eskimo fur hunters. Sea-otter harpoon/arrow is most obvious borrowing – form and decoration, but used exclusively with bow instead of atlatl. But a dozen Tlingit throwing boards are known, with NW Coast decoration. Many appear old and worn, functional but not efficient – poor handle, short length between forefinger hole and hook (about 1/2 total length). Shamanic decoration suggests purely ritual use. [Figure contrasts Eskimo and Tlingit grips, shows 19<sup>th</sup> C Tlingit throwing board, nicely carved but clumsy looking. Can't see upper face with hook.]

**Holmes, William Henry**

1897 Stone Implements of the Potomac-Chesapeake Tidewater Province. *Bureau of American Ethnology, Annual Report, 1893-94*: 13-152.

Bannerstones illustrated, referred to as “winged ceremonial stones.”

**Holmes, William Henry**

1919 *Handbook of Aboriginal American Antiquities. Part I: Introductory and the Lithic Industries*. Bureau of American Ethnology Bulletin 60. Government Printing Office, Washington D.C.

(23, 24) He refers to “banner stones” which “certainly had no other than sacred and ceremonial functions.” Ignores chronological evidence (see Moorehead 1910) to suggest that they may imitate Viking axes, but seems to favor Gordon (1916) idea that they originate in northern American whale tail symbolism. No mention of atlatls.

**Hothem, Lar**

o

1998 Chlorite Pick Bannerstones. *Prehistoric Antiquities Quarterly* 18(3):70-72.

Pick or wing shaped with hole for wood shaft. Considers Indian Knoll type atlatls too weak for practical use. [They aren't – I've made and used one, as have others.]

**Hothem, Lar**

o

2006 The Point is... Semi-Finished Bannerstones. *Indian Artifact Magazine*

25(3):73-75.

Finds of pieces unfinished at different stages, info on manufacture, eg. 3 different types drill. Some unfinished but partly polished.

**Hothem, Lar, and James R. Bennet**

o

2009 *Indian Bannerstones and Related Artifacts: Identification and Value Guide*. Collector Books, Paducah, KY.

Many bannerstones were atlatl parts, demonstrated by excavation context. Invented middle to late Paleoindian period. Photo of reconstruction, Fogelman using. Photos of antler hooks with associated bannerstones [but from looted sites, so who knows]. Oodles of nice photos of bannerstones, a few out of focus, arranged by type, both drilled and “tie-on” usually no useful provenience information. Measurements, but no weight or hole diameter info. Some likely ceremonial - not strong enough for use, too elaborate, too large, or incompletely drilled. Variability suggests different uses, from practical to ritual. Miniatures, salvaged pieces or repaired examples. Manufacture techniques shown by unfinished pieces. Antler hooks and handles [plus a few things that are either outside usual range or had other uses]. Valuation and collecting. [Nice pictures, but little archaeologically useful information.]

**Hough, Walter**

1891 Arrow Feathering and Pointing. *American Anthropologist* 4(1):60-63.

“rifling” the feathers by spiraling invented by ancients, but rarely found in Smithsonian specimens. Beveling point may have same effect.

**Hough, Walter**

sB

1914 *Culture of the Ancient Pueblos of the Upper Gila River Region, New Mexico and Arizona*. Smithsonian Institution United States National Museum Bulletin 87. Washington, Government Printing Office.

[Primitive museum collecting/archaeology expedition - lots of info on artifacts, little on the hastily dug sites.] Tularosa Cave, NM [Same as Martin’s?] - lots of turkey + plant remains. Bear Creek Cave - pahos and other offerings. Small sites on Blue River. Misc other stuff found by locals.

P. 19: “Points for throwstick darts appear to be extremely scarce...No throwsticks were found by the Museum-Gates Exped, nor is it known that any have been found in this region. The only evidence that such an implement was used is a few foreshafts of darts of the kind hurled by means of the throwstick.” [Fig of long ovoid dart pt in foreshaft, found near Lava NM] Fig 136 p. 61 “Bunt head for throwdart from Tularosa cave” [short wooden, with fat head]. Among carved pahos from Bear Creek Cave, one “suggests the throwstick but it is not possible to reach a definite conclusion on the subject.” [Plate 20 shows, does look

like prox end of atlatl, but since there is lots of variety, and many mini bows, this is probably coincidence.] P. 94: Many crook pahos, Cushing suggests throwstick use, “but the shafts of none of them show any particular adaptation to facilitate grasping.”

Blue River Caves - shows lots of arrow fore + mainshafts, fletching, hafted pts. Fire-making by hand-drill.

**Howard, Calvin D.**

o

1974 The Atlatl: Function and Performance. *American Antiquity* 39(1):102-104.

Not catapult, flipping device, or lever arm etc. Spur and handle remain level throughout throw - greater thrust because spur remains in contact w/spear longer than hand would. “...during a proper throw, the spur...reaches no greater elevation than that reached by the handle... The spur does not swing upward in an arc, but merely ‘follows through’ in the original portion of the spear’s flight path...throw the spear with the atlatl exactly the way it is thrown without it...The atlatl provides greater thrust than the unaided hand simply because it remains in contact with the spear during a greater proportion of the total thrust than does the hand.” (102). At the point where the hand releases the spear and starts to swing down, the atlatl handle goes down a bit, but the hook continues to propel the spear. “Hooking results when the thrower fails to keep the atlatl level during the thrust. Any attempt to use the atlatl in a catapult or whipping fashion will hook the end of the spear, forcing it down, and resulting in a completely uncontrolled flight.” (103) [It is possible that Arctic rigid harpoons and throwing boards work by his principle, but for other atlatls this is an unusual theory, and simply wrong – in a good throw atlatls do not remain level in use, the lever action is what does the work - was his hook wrong? Did he use a rigid spear?] Atlatl 50.8 cm long, spears 193 cm, ca 166 grams, longer works better because less affected by hooking. “Because the atlatl is not a catapulting device, increasing its length will not provide a corresponding increase in thrust energy.” (103) [But of course a longer atlatl does increase distance thrown, another demonstration that atlatls are levers - see Whittaker 2011.]

Adds 58% spear thrust [distance is what he really measured] over same spear hand thrown [a considerable underestimate]. Adding 64 gram weight reduced distance. Good accuracy possible, better than reported by Browne.

**Howard, Calvin D.**

o

1976 Atlatl function: A Reply to Butler. *Plains Anthropologist* 21 (74):313-314.

Counters Butler 1975. Atlatl is not catapult or flipping device [wrong]. Arm and atlatl are not extended to height above the head equal to length of arm and atlatl [he’s right there]. Preposterous because spur would break off under stresses of a throw where the dart pivoted 90 degrees on it. [Demonstrably wrong.]

**Howard, Edgar B.**

x (61-70)

1935 Evidence of Early Man in North America. *The Museum Journal* 24 (2-3):61-159 plus plates.

Burnet Cave, Guadalupe Mts, New Mexico, investigations for early material. Upper levels Basketmaker burials etc, but “grooved point” [fluted] found with hearths deeper than 3’.

p. 68: B5 cremated burial in basket [were these really cremated?] with “spur end and several other pieces of an atlatl (#32-25-26) adhering to the side of the basket...and..a pinkish quartz pebble with a distinct band about the middle as though it may have been used in connection with the atlatl.”

**Hranicky, Wm Jack**

o

2002 *Lithic Technology in the Middle Potomac River Valley of Maryland and Virginia*. Kluwer Academic/Plenum Publishers, New York.

[Full of useful information on lithics and related topics much beyond the focus on Middle Potomac, but rather incoherently organized and written, and he’s too fond of creating bad new jargon.] Lots of illustrations of varying quality. Major sections on chronology, lithic technology, point typology, flake tools, caches, miscellaneous implements, and experimental archaeology.

[Small section on atlatls, not well defined, not very useful information. Illustrates atlatl hook of basalt from VA, no provenience given. Mentions “Hardaway site produced an atlatl made from antler” but no citation. How the heck does a “Functional Angle of 45-180 degrees” apply to atlatls?] Bannerstone section summarizes Hranicky 2003.

**Hranicky, Wm Jack**

x

2003 Bannerstones: A Study on Their Holes. *Quarterly Bulletin of the Archaeological Society of Virginia*. 58(1): 35-46.

Accepts bannerstones, barstones and boatstones as atlatl weights. Weights add balance and stability, and inertia in a pendulum system [apparently Webb’s idea], silences launch [claims as his idea, but see Perkins 1993]. Virginia lacks high quality forms, only datable contexts are Woodland and probably Late Archaic. Could be used as pendant, or multiple stones on one atlatl. Stone or reed drilling, one or both directions. Some too large for atlatl use (should be <50 mm in any dimension) [no weight information given]. Large bannerstones are higher quality, some holes show polish suggesting strap wear. Hole diameter 11-15 mm usual. [Problematic statements include:] “Clovis point was a knife and based on its size, not flyable as a spear point.” “Bannerstone ...a life-time personal object...for males...made during adolescence and carried until the user could no longer hunt.” Replaced only if had bad magic, in which case killed by breaking, or killed at death of owner, but rare in graves. [So what evidence associates them with age or gender?] Some fragments continued in use, drilled for pendants.



**Hrdlicka, Daryl**

2003 How Hard Does It Hit? A Revised Study of Atlatl and Dart Ballistics. *The Atlatl* 16(2):15-18. Also posted (2004) at <http://www.thudscave.com/npaa/articles/howhard.htm>

Three variables for comparison: how hard it hits (kinetic energy), how hard it is to stop (momentum) and how effectively it penetrates (sectional density). Calculations for spears, atlatl darts, arrows, bullets. Darts much less kinetic energy ( $KE = 1/2 \text{ Mass} \times \text{Velocity squared}$ ) than bullets, but more than arrows, and plenty to take big game by archery standards. Momentum = Mass X Velocity so darts less than heavy spears or fast bullets, but more than .357 magnum or arrows. High momentum promotes penetration, especially of harder tissues. Sectional density (Weight/Diameter<sup>2</sup>) also affects penetration – denser, smaller projectiles penetrate better, so darts very effective, relatively heavy and small. [Improved version of 2002. Good explanations of physics, but I still think a “slug-ft/sec” is a measurement used in slow garden races.]

**Hrdlicka, Daryl****x**

2003 NPAA Northern Plains Atlatl Association Web Page. URL <http://www.thudscave.com/npaa/index.htm> (accessed 2/2004)

Many links and articles, including the following by Hrdlicka. One of the most useful atlatl sites.

2003 Intro to the Atlatl.

2003 Using the Atlatl: The Basics. Also printed 2009 in The Dart August 2009:5-8.

Distinguishes 4 grip types based on how dart, not atlatl, is held: Knuckle (split finger, Basketmaker, with dart between knuckles); Thumb (thumb and index thru loops hold dart); Modified Thumb (1-hole Eskimo with index thru hole, thumb helps hold dart); Hammer (dart on rest, not held by fingers, modern) [so no holes, no rest like Peruvian would be what? Thumb or M Thumb? A good idea for classifying grips but not exhaustive.] Good description of throwing motion.

2003 Shaft Wrenches.

2003 Terms for the Atlatl.

Ethnographic (Australia has most) and modern, “Klingon,” and ancient [Sumerian, Egypt, Sanskrit – I know no other evidence for atlatls in these areas and suspect the words relate to spears or rabbit stick type “throwing sticks”]

2003 Peg Styles.

2003 Atlatl Weight Attachments.

2003 Handles



MS mammoths and others suggests Clovis caused extinction, but mat also reflects climate change. San Pedro sites are microcosm of extinction event: decline in environment carrying capacity (dry), with addition of new predator.

**Hughes, Susan S.**

1998 Getting to the Point: Evolutionary Change in Prehistoric Weaponry. *Journal of Archaeological Method and Theory* 5(4):345-408.

[Mixed paper.] Begins with long discussion of engineering characteristics of thrusting spears, fletched and unfletched darts, and arrows. Evaluates particularly mass, width, and tip cross-sectional area (TCAS) as important attributes of points. Applies expectations to interpret sequence of points from Mummy Cave, Wyoming. Concludes small late points indicate rapid and complete replacement of atlatl by bow and arrow 1500-1300 BP, spearthrower dominated assemblage from beginning as early as 9200 BP to 1500 BP, and thrusting spears (very large points) were in use as supplement throughout. Before 7970 BP, points large but variable, probably because used to balance unfletched darts; after fletching, less variable, somewhat lighter. [Her conclusions are plausible and probably right, but the engineering section, although has some good ideas and info, is very theoretical, not based on practical experience, and has a lot of weak reasoning and inadequate data. Her ideas about the advantages of different weapons in particular are weakly supported and overgeneralized.]

**Humane Society**

x

2006 Commission's Decision to Chuck Atlatl Hunting Hits the Mark, says The Humane Society of the United States. URL:

[http://www.hsus.org/press\\_and\\_publications/press\\_releases/pa\\_commission\\_bans\\_atlatl\\_hunting](http://www.hsus.org/press_and_publications/press_releases/pa_commission_bans_atlatl_hunting)

“atlatl is a primitive, small wooden sling... Because it is hurled rather than aimed, an atlatl spear is very inaccurate, even in the hands of a skilled user...the commissioners have come to their senses and returned atlatl hunting to the history books where it belongs... To launch a spear an atlatl must jump up and stride quickly forward, swinging his arm in an overhand throwing motion. This movement often frightens the intended target, who then tries to flee, making a clean kill unlikely.” [Ignorant and biased.]

**Hunter, Wryley**

1992 Reconstructing a Generic Basketmaker Atlatl. *Bulletin of Primitive Technology* 1(4):57-61.

Good information and illustrations of several Basketmaker (SW) atlatls, including good drawings of Broken Roof Cave, Lukachukai, White Dog Cave, Sand Dune Cave specimens, with table of dimensions and specifics. Diagram of loop system on SDC from Lindsay et al. 1969.

**Hunzicker, David A.**

o

2008 Folsom Projectile Technology: An Experiment in Design, Effectiveness, and Efficiency. *Plains Anthropologist* 53(207):291-311.

Used 25 F points replicated by Patten (80 counting reuse after damage and reshaping), hafted 5 ways, fired with crossbow at 30-35 m/s perpendicularly into beef carcass ribs. Foreshafts on 220 cm, 240 gm shafts to simulate atlatl. Fluting helps hafting - easier to fit convex foreshaft notch interior to flute surface than usual concave notch interior to lenticular point, but labor intensive. Hafted to full length of flutes.

Foreshaft types all performed similarly regarding break types. Break types: snap 30%, crush 21%, edge damage 15%, burination 12%, impact flute 8%, longitudinal split 3%, complex + snap 11%. Foreshafts rated on manufacture cost, penetration, durability, and point preservation. Of 108 shots, 32% between ribs to lethal depth, 42% hit rib but still lethal depth, 26% failed to penetrate 40 cm (judged as lethal). The 73 rib impacts damaged 73 pts (18 destroyed), 18 foreshafts, and 3 mainshafts - foreshafting protects main shaft. Hafting protected point - most damage to tip, point could be rejuvenated as in Ahler + Geib model = highly maintainable. 39% of shots minor damage, 32% no damage, 12% major damage, 17% total destruction of point. Average survival of 4.6 shots. Fragment frequency compared with archaeological finds. Rejuvenation index based on length reduction allows assessment of relative numbers of uses of archaeological assemblage points, then 75% lethality rate allows estimate of number of kills represented [as he notes, this is getting rather far from evidence; too many intervening variables of technology and human skill, eg accurate hits, exper was not with atlatl etc].

**Hurst, Winston B. and Christy G. Turner**

o

1993 Rediscovering the "Great Discovery:" Wetherill's First Cave 7 and its Record of Basketmaker Violence. In *Anasazi Basketmaker: Papers from the 1990 Wetherill-Grand Gulch Symposium*, V.M. Atkins ed, pp. 143-192. Salt Lake City: Bureau of Land Management Cultural Resource Series No. 24.

Site in Utah where Wetherill first recognized people earlier than pueblos. About 90 burials, evidence of violence including atlatl dart points in bodies, clubbing, scalping, stabbing with stone knives and bone daggers. Distinguishes knives (>9 cm, diagonal notches) from atlatl dart points (smaller, diagonal or horizontal notches). The point assemblage is comparable to other Basketmaker points, less so to Archaic (Elko) point series.

**Hutchings, Wallace Karl**

x

1997 *The Paleoindian Fluted Point: Dart or Spear Armature? The Identification of Paleoindian Delivery Technology Through the Analysis of Lithic Fracture Velocity*. PhD dissertation, Simon Fraser University.

“Velocity-dependent fractures on fluted points reveal fracture rates associated with high-velocity impacts, indicating the use of the spearthrower” No clear evidence of Clovis atlatl, but early dates on hooks from Marmes Rockshelter and Warm Mineral Springs, both 9-10,000 BP, others. Summarizes Clovis and Folsom tool kits and hunting strategies. Problems of classifying points as dart or arrow tips, criticizes Odell’s flake point hypothesis – accidental fractures look similar. Fracture surface features on flakes reflect manufacture. Relation between Wallner lines and fracture origin reflects velocity of fracture. [Fracture mechanics details and derivation of fracture velocities difficult to understand, illustrations in my copy reproduced poorly.] Test on manufacturing techniques, with velocity distinguishing pressure, soft percussion and indirect perc, and hard hammer perc, but variable and overlapping, especially pressure. Impact fracture should be in the “dynamic loading” or high speed range of fracture propagation.

Problems of reconstructing hafting system for experiments [good example of reasoning from variety of evidence]. Uses flute width to estimate shaft diameters of 12-17 mm. Compares Huckell 1982 and Frison 1989 experiments. Prehistoric darts (mostly SW and Gt Basin) 3-19 mm diameter, foreshafts 6-19 mm diameters, most 8-11 mm. Coleman, boar hunter, prefers 221 cm long, 11mm diam, Clovis point 20-30 gm, total weight 240 gm, similar to Australian average weight of 246 gm.

Ethnog hunting range data poor, suggest accurate range 10-30 m.

Coleman's Georgia boar hunts - 51 hits, 58 misses, kills from 3-46 m, average 15 m. Measured spearthrower velocities, see Hutchings and Bruchert 1997.

Point fracture velocity tests using large cross bow at short range, shots against stone and beef ribs. All points obsidian, more or less Clovis form. Darts 167-296 gms, velocities averaged 35.6 m/sec, kinetic energy 117-165 Joules. Fracture velocity data from 53 points, spanned rapid (38%) and dynamic (62%) loading rate regimes. In other words, lots of variability, with fracture velocities “spanning full range of fracture velocities associated with stone tool manufacture. This suggests that the impact fracturing of lithic projectiles is a complex process which involves more than just those fractures caused by the extreme force of sudden impact.” Fracture velocity less affected by impacted material (stone or rib) than in manufacture experiments. Compared also javelin, spear, and arrow, and dropped darts. Spear continuous pressure produces quasi-static (slow) fracture, javelin much slower than dart and arrow, which are similar. Only arrow and dart produce fractures in the upper dynamic loading range.

[I have trouble believing that projectile velocity makes much difference to fracture velocities which are 10-50 times greater, ie projectile velocities around 35 m/s, fracture velocities from 454-2231 m/sec. Also, note fairly consistent dart velocity, highly variable fracture velocity. His explanation that fractures are complex, and one impact may produce evidence of several speeds may be right. He would say lower ranges aren't definitive, but high range only achieved by arrow or dart.]

Examined archaeological specimens, total of 668, mostly fluted points and

fragments, from many sites. Clovis – 19 pts with “velocity dependent” fracture features, 63% in “dynamic” range. Eight Folsom points, all within dynamic range. [Problems here include small sample, and calculations of fracture velocity apparently based on Modoc obsidian rather than actual material of points.]

Low fracture velocities in flute scars suggest pressure fluting of Clovis.

[Very interesting, high potential. I want to see other similar studies before I’m fully convinced.]

### **Hutchings, Karl** **s**

2011 When is a Point a Projectile? Impact Fractures, Scientific Rigor, and the Limits of Inference. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

“Employing modern experimental results to explain past behaviours demands, however, that archaeologists not only practice rigor in their experimental research, but give careful consideration to the limits of inference.”

Points identified in archaeology by morphology – neck/stem width, overall size and shape. Fenenga, Thomas, Shott give standards. Dart shaft data shows .8-1.1 cm diam, but some <.6 cm. NC Cave dart foreshafts and other NV info from Tuohy. One problem is overgeneralizing from small sample.

Tip Cross Sectional Area, TCSA

Diagnostic impact fractures: problems with ambiguity of production – are they really diagnostic? Odell applies to flakes, argues for early flake points, but Hutchings examined experimental debitage (246 pc), 74% suitable for points, 6.1% of them had damage suggestive of point use = erroneous “use-wear”.

Middle Paleolithic points ID by such methods – not adequate evidence for projectile use, need better scientific reasoning. [Curiously, he did not mention his microfracture methods, though in conversation he remains convinced that is the way to go.]

### **Hutchings, W. Karl and Lorenz W. Bruchert** **xo**

1997 Spearthrower Performance: Ethnographic and Experimental Research. *Antiquity* 71(274): 890-897.

[Key article, good references]

Experimental focus has been on how spear thrower works - but performance capability is more interesting. Browne, Butler, Patterson threw incorrectly, thus failed to evaluate right.

More than 1/2 spear velocity comes from "rotational acceleration of wrist and forearm" [so does atlatl work by magnifying that?]. Velocity data should not be derived from distance throws - measure directly at launch and target by photo. Dart variation affects performance more than atlatl.

Ethnographic range of dart lengths is 1.2 m (Eskimo) to 3.4 m (Australia).

American West darts from caves consistently light (45-90 gm), short (116-160 cm).

Ethnog hunting range data poor (Arctic + Aust refs), suggest accurate range 10-30 m. Coleman's Georgia boar hunts - 51 hits, 58 misses, kills from 3-46 m, average 15 m.

Velocity measurements by others 20 to 40 m/sec.

Tested darts 82-545 gm at 15 m target distance. Velocity 28-64 m/sec, averages 33-47 m/sec, even heavy dart worked fine, 220 gm best matched to atlatl - need match so dart flex and oscillation "allows it to spring away from the hook after maximum acceleration of the spear thrower." [Velocity maximums are probably too high - see Whittaker and Kamp 2007].

Would produce >350 Joules kinetic energy, = 4x arrow from modern bow.

Conclusions: 1) Need adequate skill to test. 2) Spearthrower not inaccurate or inefficient. 3) More powerful than generally realized - capable of more force than arrow, and when used at similar ranges, equivalent accuracy. 4) Replacement probably because bow easier to use.

### **Iovita, Radu pdf**

2011 Shape Variation in Aterian Tanged Tools and the Origins of Projectile

Technology: A Morphometric Perspective on Stone Tool Function. *PLoS ONE*

6(12):1-14. electronic document, accessed 12/29/11 URL:

E:<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0029029>.

N. African Middle Stone Age technocomplex - the Aterian is older than previously assumed (back to earliest Middle Stone Age), and associated with anatomically modern human morphology and behavior. Aterian is defined by the presence of 'tanged' or 'stemmed' tools, assumed to be among earliest projectile weapon tips. Actually, very variable, with some pointy ones, other dull or even rounded, more like scrapers – assemblages are similar to scraper-rich Mousterian, except with tangs. Microwear studies are problematical. Classical morphometrics and Elliptical Fourier Analysis of tool outlines are used to show that the shape variation in the sample exhibits size-dependent patterns consistent with a reduction of the tools from tip down, with the tang remaining intact. They were sharpened like scrapers and knives, usually asymmetrically, with tangs remaining large while blades got smaller = sharpened in hafts. Comparison of shape-change trajectories between Aterian tools and Late Paleolithic arrowheads from the N German site of Stellmoor reveal significant differences in amount and location of the variation.

The patterns of size-dependent shape variation strongly support the functional hypothesis of Aterian tools as hafted knives or scrapers with alternating active edges, rather than as weapon tips, but represents one of the earliest evidences for hafting modification, and for combination of different raw materials (haft and stone tip) into one implement.

**Iovita, Radu, Holger Schönekeß, Sabine Gaudzinski-Windheuser and Frank Jäger**

2011 Controlled ballistic experiments with glass replicas of Levallois points. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

“Evidence of Neandertal hunting: faunal data, Schöningen spears (Thieme 1997, *Nature* 385:807-810), Umm-el-Tlel stone tip embedded in a vertebra (Boëda et al. 1999 *Antiquity* 280:394-402), and increasing evidence for hafting in the Middle Paleolithic. Despite much work on identifying fracture and wear patterns associated with stone projectile use, no unambiguous criteria exist, because previous studies have not sufficiently controlled for confounding factors.

Results of a rigorous experimental program should enable us to create a reference collection of impact fractures. We test the effect of kinetic energy, momentum, and angle of impact on fracture patterns in identical glass copies of an archaeological Levallois point from Jabrud (controlling for shape and raw material fracture properties). The copies were cold-pressed, resulting in a material similar to obsidian. A series of recent controlled experiments in flake propagation (Dibble and Rezek 2009 *JAS*:1945-1954; Rezek et al. 2011, *JAS*:1346-1359) have further demonstrated the similarity of glass to siliceous materials used by past hominins and, consequently, its suitability for experimentation. In our experiment, the projectiles are slot-hafted with beeswax in wooden shafts and shot at homogeneous targets of synthetic materials (ballistic gelatine, ballistic soap, and synthetic polyurethane plates which simulate the properties of cortical bone). They are launched from a high-precision ballistic air-gun which measures the exact exit velocity with the aid of a photoelectric barrier. Each point is only launched once. The test velocities are matched to those of experimentally and ethnographically observed speeds found in the literature. Preliminary results indicate that the variability of damage traces is much higher than expected for such tightly controlled conditions. However, of the factors investigated, the angle of impact seems to provide the most reliable indicator of damage extent on the tips of the projectile points.”

Fractures considered were flute-like, ventral and dorsal, transverse snap + spin-off, crushing from point skipping on surface of “bone” plate. After about 18 mps everything shatters, so only used velocity up to 22 m per sec. Upward trend in damage with increase of velocity, then peak where bone plate shatters. Some pts did not break. Angle of incidence important – 30 degrees got most flutes and longer fractures, some fracture types more common at different angles, acute angle produced more damage. [Useful but very artificial experiment – the L pts are identical, but edges are beveled by process; the hafting is very crude, and the projectile does not behave like an arrow or spear.]

### **Irwin, Arthur**

**o**

2000 The Hooked Stick in the Lascaux Shaft Scene. *Antiquity* 74 (284): 293-298.

Famous scene with bison, apparently pierced by spear and losing its intestines, falling or fallen man who is possibly bird-headed, bird on stick, and small line

with hook and cross-piece at feet of man + bison. Barbed spear is broken on ribs of bison [a silly over-interpretation of slight jog in shaft obscured by line of bison stomach] and other object is a “short-harpoon” which would be used to open belly. [Cites N. Am. bison hunting ethnog, but fails to make any real connection, especially to any such weapon, which he compares to Pume “throwing instrument” which is actually an arrow! A much better interp is that the hooked object is a spear thrower, an interp he mentions but denies because Marshak (1972) says the “cross-handle” would not work. But it probably is an atlatl, and for that matter the bird on staff also has a hooked end and could also be an atlatl. But they are pretty undetailed images, and this is a pretty ignorant article.]

**Jackson, Margaret A.**

o

2008 *Moche Art and Visual Culture in Ancient Peru*. University of New Mexico Press, Albuquerque.

Some ceramic fine-line and other art is narrative and structured in a language-like way. A couple images of warriors with atlatls. “Revolt of the Objects” narrative shows weapons, clothing, tools as animated warriors [but oddly atlatls don’t appear.]

**Janetski, Joel C.**

o

1993 The Archaic to Formative Transition North of the Anasazi: A Basketmaker Perspective. In *Anasazi Basketmaker: Papers from the 1990 Wetherill-Grand Gulch Symposium*, edited by Victoria Atkins, pp. 223-241. Cultural Resource Series No. 24, Bureau of Land Management, Salt Lake City.

Bow and arrow arrived ca 200 AD, although C14 dates on wood charcoal may be a bit too early, but certainly early millenium, and after corn.

**Janetski, Joel C.**

s

1980 Wood and Reed Artifacts. In *Cowboy Cave*, Jesse D. Jennings ed., pp. 75-95. University of Utah Anthropological Papers 104.

Atlatl p 75: in Unit IV (See Jennings 1980 for dates), mountain mahogany, broken and charred at both ends. Roughly and abruptly notched 2 cm from prox end, probably not for fingers but to hold loops. Overall L = 42.2 cm, W = 2.1, T = .9 cm. Central groove begins 2.8 cm from distal end, so female type [No, surely mixed BM type though a bit robust, but hook is missing, photo too poor for more info]. Three dart mainshaft frags, prox with cup, central with sinew lashing, distal with socket. No surviving fletching. Three foreshafts, one complete sharp, 2 frags. Split twig figurines from same level IVc as atlatl and some of shaft frags. Ungulate hyoid bone pendants.

**Janetski, Joel C.**

sic

1984 Addendum to Brigham Young University Department of Anthropology Technical Series No. 83-73: An Archaeological and Geological Assessment of Antelope Cave (NA5507), Mohave County, Northwestern Arizona. Ms. on file, Department of Anthropology, Brigham Young University, Provo.

[Not seen] cited by Madsen 1992 to say atlatl dates  $1850 \pm 60$  B.P. [presumably uncalibrated, if typical of the 1980s, probably a date on loosely associated charcoal]

**Janetski, Joel C., and Michael J. Hall** xfig

1983 *An Archaeological and Geological Assessment of Antelope Cave (NA 5507), Mohave County, Northwestern Arizona*. Department of Anthropology Technical Series No. 83-73. Brigham Young University, Provo.

Among finds, in looter's trench, most of a Basketmaker atlatl, with distal end burned off. Oak, 41 cm L, 2.2 W, .5 thick. Loops of yucca fiber wrapped in hide.

**Jarman, Josh** o

2010 In Step with Ohio's Past. *The Columbus Dispatch* [other info missing] reprinted in *The Dart* September 2010:11-12.

Flint Ridge knap-in, Strischek organizing atlatls.

**Jeffries, Richard W.** s

1987 *The Archaeology of Carrier Mills: 10,000 Years in the Saline Valley of Illinois*. Southern Illinois University Press.

Illustrated by Thomas W. Gatlin; drawing of Archaic Hunter throwing with Indian Knoll type atlatl. [Used by Fagan and other].

**Jenkins, Jason** x

2008 The Ancient Atlatl. *Rural Missouri* January 2008. Electronic document URL: <http://www.ruralmissouri.org/08pages/08JanAtlatl.html> accessed 1/2/08.

Good description of basics, features R Madden and R Mertz. Hunting issues. [One of the better press pieces.]

**Jennings, Jesse D.** s

1980 *Cowboy Cave*. University of Utah Anthropological Papers 104.

SE Utah, pinon-juniper, big alcoves on S side of open canyon [I'd expect Basketmaker stuff in them], 1975 excav, presence of extinct fauna dung - sloth, bison, elephant, horse, camel-like ruminant, but under the cultural layers, not associated with artifacts. Looting disturbance, nearby Walters cave destroyed by looters. Point sequence of Archaic dart points ending with small dart/arrow Rose

Springs types. Unit IVc has Elko and Gypsum types.

Date from level IVc on charcoal p24-25 [no more specific context given]  $3635 \pm 55$  BP [uncalibrated]. Jennings considers the material from IVc, level with atlatl, to be “terminal Archaic rather than Basketmaker II” the equivalent of “BM I” which is probably equivalent to Sand Dune and Dust Devil Cave material.

**Jimenez, Carla**

x

2010 Today’s Question: Do You Plan to Use the Atlatl This Season? *Columbia Missourian*, September 29, 2010, electronic version, accessed February 7, 2011, URL: <http://www.columbiamissourian.com/stories/2010/09/29/todays-question-do-you-plan-use-atlatl-season/>

Legal for deer firearms season, legal for small game since 2007. Madden, Mertz. No responses.

**Johnson, Ann S.**

x

1971 Finger-Loops and Cruciform Objects. *American Antiquity* 36 (2): 188-194.

Eckholm 1962 IDs loops from two specimens with them [Brit Mus and Florence?]. Two frags from La Playa site, Sonora, Mexico, Trincheras Culture, AD 800-1100, Hohokam relations. Loops relate to SW [but her distrib map is mixed up]. Chipped and polished cruciform objects may have been attached to atlatls. Found in line in a couple burials, curved staff atlatl of Quetzalcoatl described as “starry.” [This is real weak evidence since none are assoc w known atlatl parts].

**Johnson, Elden**

x

1956 Review of The Atlatl in North America. *American Antiquity* 22 (1): 86.

Notes Kellar wants to use only direct evidence, not point size or problematical artifacts. Thus can’t claim Paleoindian origin.

**Johnson, Frederick**

o

1951 Introduction. In Radiocarbon Dating: A Report on the Program to Aid in the Development of the Method of Dating. F. Johnson, ed. *Memoirs of the Society for American Archaeology* 8:1-19.

Early compilation of C14 dates. Including:

Indian Knoll, antler,  $5709 \pm 350$ ,  $4894 \pm 560$ , average  $5302 \pm 300$

Leonard Rockshelter, NV, greasewood atl foreshaft  $7038 \pm 350$

Nazca Valley, Peru, sections of 4 darts from graves,  $1314 \pm 250$

Nazca Valley, Peru, 2 atl frags from graves,  $1681 \pm 250$ ,  $2477 \pm 200$

[same grave, Bird suggests shaft wood shorter lived than atl wood, thus more recent date]

**Jones, David E.**

o

2007 *Poison Arrows: North American Indian Hunting and Warfare*. University of Texas Press, Austin.

Surveys world uses of poisons. In N. Am., where armor was worn, enemies used poison arrows. In N. Am, most poison based on plants like Aconite, and snake venom, often used with decayed animal matter. Jones argues that poisons were common and effective. [It's hard to tell - little modern toxicological evaluation, and many "poisons" relied on magical thinking, or were so processed by fire or decay that some venoms, like snake, would probably not survive. Lots of accounts are old, and infections seem likely to be as deadly as poisons in many cases and result in "poison" symptoms.]

Chapter on Paleoindians: Clovis points used on mammoth probably "equivalent to a pinprick on a human.... Too short and too fragile to be the sole killing force against a mammoth." Relatively few points found at kill sites. Contemporary Africans used poison against elephants. Ainu fluted bamboo points to hold poison. [He thinks Clovis flutes could be used this way, but ignores hafting realities of stone points]. If Paleoinds came to Americas through Asia, they would have "traveled through arrow-poisoning cultures." [Ignoring chronology of culture changes]. *Aconitum sp* as used in Aleut whale hunting is likely Clovis poison. Bison hunted by Folsom are faster and still large, suggesting reason for longer flutes to hold poison on Folsom points, to prevent bison from running too far before dying. Also more efficient on atlatl darts, which needed to be thrown farther than for mammoth, so Folsom perhaps developed atlatl. As poisons got better, need for fluting diminished. [Suggestion of poison use is quite plausible, but much of his "evidence" is not.]

**Jones, Jason**

s

2006 *Spear Pressure*. The Daily Show/Comedy Central, January 5, 2006.

Jason Jones interviews Gary Fogelman and an SPCA rep on legalization of atlatl. Plays for laughs: primitiveness, JJ inability to hit target or pronounce word. But Fogelman demonstrates effective accuracy on moving target.

<http://www.thedailyshow.com/video/index.jhtml?videoId=115027&title=spear-pressure&to=4>

**Jones, Tim**

x

2009 *Vero Beach Ice Age Engraving - Mammoth Hoax or the Real Deal?*  
Remote Central Blogspot, electronic document, accessed 9/25/09, URL:  
<http://remotecentral.blogspot.com/2009/06/vero-beach-ice-age-engraving-mammoth.html>

Most detailed article, quotes original news sources, remains skeptical for same reasons I am, see Picat 2009.



throwing. John Shea quoted on theories of importance of throwing, demos rock, spear, atlatl “a long flexible dart that attaches to the end of a rod strapped to the hand.” Flexibility stores energy in the dart. [Surely the horrible definition is the fault of the journalist!] [Photo of JS with what looks like Berg darts and SW inspired atlatl.]

**Junkmanns, Jurgen**

2001 *Arc et Fleche: Fabrication et Utilisation au Néolithique*. (Bow and Arrow: Manufacture and Use in the Neolithic). Editions Musee Schwab, Bienne.

In French. Booklet, well illustrated in color, large number of prehistoric European bows and points, information on experimental manufacture. Short section on atlatl with photos of use [but showing bad form].

**Jurmain, Robert**

1978 Paleoepidemiology of degenerative joint disease. *Medical College of Virginia Quarterly* 14:45-56.

1999 *Stories from the Skeleton: Behavioral Reconstruction in Human Osteology*. Amsterdam: Gordon and Breach Science Publishers.

References and discussion of atlatl elbow. Discusses problems with interpreting osteoarthritis in terms of activities, doesn't feel there is good evidence for atlatl use in archaeological skeletal arthritis.

**Justice, Noel D.**

o

2002 *Stone Age Spear and Arrow Points of the Southwestern United States*. Indiana University Press, Bloomington.

[Pages 30-37 good summary of SW atlatls and references, although mechanics poorly explained. Good small drawings of Broken Roof Cave and White Dog atlatls, foreshafts, poor drawing of action. Lots of discussion of atlatl dart point types.]

**Justice, Noel D.**

o

2002 *Stone Age Spear and Arrow Points of California and the Great Basin*. Indiana University Press, Bloomington.

[Justice's books are tremendously impressive syntheses of all sorts of relevant info, even if you don't agree with all his typological groupings.]

p 16 atlatl vs dart pts by size, Thomas, Fenenga etc refs.

p 32-39 foreshaft manufacture, dart evidence from caves - Leonard Rockshelter, Hogup, Danger, Gypsum caves summarized, good pics Hidden Cave, Humboldt Cave foreshafts w stone pts. Hafting mastics include pine pitch, asphaltum, others [some like jojoba seem unlikely].

p 41-45 almost identical descrip of atlatls to SW book, [adequate but his explanation of mechanics is poor: he seems to accept Webbs theory that weights on flexible shafts are “most efficient” but correctly notes in his own experiments that “adding enough weight to the atlatl to actually be felt when throwing a spear impedes the delivery of thrust.” His diagram of throwing is poor.] Good small drawings and descriptions of Lovelock Cave, Hogup Cave, and Winnemucca NVWa197 atlatls.

p 55-59 transition from atlatl to bow: most evidence says ca 500 AD in west US, although there are some arguments from small points for earlier, and some suggestions of late atlatl survival.

Lots of discussion of points identified as atlatl dart points.

**Kaeppler, Adrienne L. s (Vetter)**

1978 “*Artificial Curiosities*” being an *Exposition of Native Manufactures Collected on the three Pacific Voyages of Captain James Cook, R.N. at the Bernice Pauahi Bishop Museum January 18, 1978 -August 31, 1978 on the Occasion of the Bicentennial of the European Discovery of the Hawaiian Islands by Captain Cook - January 18, 1778*. Bernice P. Bishop Museum Special Publication 65. Bishop Museum Press, Honolulu.

[Exhibit catalog with commentary of varying usefulness on artifacts. Kaeppler seems to feel it includes all available Cook material and pieces not in it are likely to be mis-attributed, but the focus is on Pacific islands and interest fades as gets to N. Am., as exemplified by his listing of spear throwers, which is plainly incomplete, and shows only one very small picture, Aleut, in Edinburgh. Lists 5 others in Cambridge, Vienna, Gottingen, Berne, and Florence. Lacks the example I recorded in British Museum. No useful info on spear throwers.]

**Kamei, Nobutaka s**

2005 Play Among Baka Children in Cameroon. In *Hunter-Gatherer Childhoods: Evolutionary, Developmental and Cultural Perspectives*, edited by Barry S. Hewlett and Michael E. Lamb, pp. 343-359. New Brunswick, Transaction Publishers.

Children as subculture. Children in Mbuti imitate adult foraging and hunting activities, learn. Baka (another Pygmy group) in tropical Congo Basin. From 4-5 yo, in peer groups, little adult interference. Play = children activity undirected by adults, involving specific rules, tools, and purposes, not primarily intended to make a productive contribution. Of 269 play sessions observed, 50 related to hunting, including making traps and papaya stem guns, attacking animals with stones, hunting mice + lizards w bow or spear (girl participated once), target shooting with bow, spear, slingshot. Another 14 involved collecting insects or termites, and fishing, so total 24% play was subsistence-related. [Not stated whether any results were eaten.]

**Karger, Bernd, Hubert Sudhues, B.P. Knewubuehl, and B. Brinkmann** x  
1998 Experimental Arrow Wounds: Ballistics and Traumatology. *Journal of Trauma: Injury, Infection, and Critical Care* 45(3):495-501.

Medical experiments, longbow, compound bow, crossbow. Pig carcasses, soap, gelatin targets at 8 m. Velocity 45 m/s longbow to 67 m/s compound bow. Penetration in non-bone tissue 17-60 cm, depending on velocity and type of arrowhead. Ribs always perforated, thick bone not, extraction from bone difficult. Although arrows are light and low velocity, much less kinetic energy than bullet, but they penetrate by cutting and stabbing, and have high sectional density, i.e. they are long so have lots of mass per cross-section area. Less tissue damage and bleeding than gunshot wounds.

**Karpowitz, Adam** o  
2007 Ottoman Bows: An Assessment of Draw Weight, Performance, and Tactical Use. *Antiquity* 81 (313):675-685.

Compares favorably to longbow: similar draw weight 90-130 lbs, higher velocity with lighter arrow, good penetration of armor etc.

**Keddie, Grant** x  
2003 The Atlatl Weapon. Royal British Columbia Museum, Victoria, BC. Accessed 1/12/05 URL: <http://rbcm1.rbcm.gov.bc.ca/history/atlatl/atlatl.html>

Public ed pamphlet. Illustrates antler atlatl 2000 yr old from bottom of drained Quilntanton Lake. Narrow shuttle shape ca 53 cm long, flat upper surface with groove but apparently no hook, and sharply narrowed prox end that should have had some kind of handle on it. Also drilled and carved weights mostly Frazer R.

**Keddie, Grant** x  
2007 Quilntanton Lake Atlatl (EcRg-Y:1). A Technical Report. Electronic document, accessed 1/10, URL [http://www.bcarchives.bc.ca/Content\\_Files/Files/QuilntantonAtlatlDraftWeb.pdf](http://www.bcarchives.bc.ca/Content_Files/Files/QuilntantonAtlatlDraftWeb.pdf)

C14 1950+100 BP. From bottom of drained Quilntanton Lake. Narrow shuttle shape ca 53 cm long, flat upper surface with groove, raised distal end has small hole [either female] or for attachment of hook, and sharply narrowed prox end that should have had some kind of handle on it. Caribou antler, 124 gms. Small geometric decoration on edge. He reconstructs like McClure atlatl with missing grip. Gives detailed measurements, good photos.

**Keeley, Lawrence H.** o  
1997 *War before Civilization: The Myth of the Peaceful Savage*. Oxford U Press, New York.

Anthropologists and archaeologists have “artificially pacified the past” for a variety of reasons, ignoring evidence of pervasive violence in tribal, non-western, and prehistoric societies, considering primitive war ineffective, childish, non-rational, driven by personal motivations such as revenge and theft, and not very destructive. He presents numerous examples to the contrary, a picture of pervasive warfare in primitive societies, even more destructive and mortal given issues of scale, and evaluates reasons for warfare. Archaeology is important because it produces physical evidence for instance that warfare in primitive societies goes deep into the past in all parts of the world, long before Western colonialism which is often blamed by some anthropologists for bringing war to other cultures. [Often credited as the starting point for a revival of consideration of warfare in archaeology in the last couple decades. It’s an argument, so it’s often a bit one-sided, and many of the examples are not discussed in enough detail to evaluate them. E.g. discussing Weapons, p 51 atlatls get a paragraph: defined, effective range 40m to max 80 m, rate of fire unknown, quilted cotton armor protected against darts. But the only source referred to is an Australian ethnography. Shortly thereafter, he exaggerates the inefficiency of muskets - his goal being to show that primitive weapons are just as deadly.]

**Kellar, James H.**

**OX**

1955 *The Atlatl in North America*. Indiana Historical Society, Prehistory Research Series, Volume 3, Number 3: 280-352.

[Good summary of available reports, still useful. Focus on distribution. Experiment notably lacking.] “No objective analysis of the efficacy of a projectile thrown with the aid of the atlatl is extant.” Cites a few ethnographic observations, including Nelson 1899 to support accuracy. Distributional discussion, begins with Old World. Earliest from Magdalenian, bow appears to be Neolithic. Archaeology is lacking where there is known ethnographic atlatl use. Distinguishes eastern (tapered, more specialized handles, undecorated) and western (more rectangular, finger grooves, decorated in Greenland) Eskimo areas. Archaeological evidence back to Old Bering Sea culture, surveys other finds. [Illustrations throughout are too few, mostly line drawings, clear but lacking detail.] One Tlingit specimen, puzzling Santa Barbara (short) example. SW, including Oklahoma, atlatls are relatively homogeneous – grooved, loop handles, thin, weights. Weights may be functional if not too close to the handle. Possible association with curved throwing stick. Great Basin atlatls differ. Gypsum Cave foreshafts associated with extinct fauna; Leonard Rock Shelter foreshaft C14 date 7038±350. History of interpretations of SE atlatl parts discussed, atlatl interpretation now considered conclusive. Six varieties of antler or bone hooks widely distributed: TX, OK, KY, TN, AL, GO, MS, IN, OH. Weights also, but antler handle confined to KY and IN. Suggestions of Hopewell atlatls by Moorehead. Cushing’s Key Marco atlatls and SE ethnohistory. For Mesoamerica, follows Nuttall, considers SW connection, diffused from N to S.

Probably once all over continent; evidence lacking. Early introduction, possibly associated with one or more of the older physical types, but could be single introduction followed by regional specialization. Atlatl persisted after bow, sometimes together, especially in marginal areas. Dating transition is difficult – maybe beginning of Christian Era in SW. Association recently between canoe hunting and atlatl (Eskimo and Mexico), and Eskimo bird darts and atlatl. Atlatl good for one hand use, and not damaged by moisture. Mesoamerican and S. Am. warfare used atlatls, perhaps for penetration against protective clothing, perhaps also ceremonial significance.

**Kelley, J. Charles**

**x**

1950 *Atlatls, Bows and Arrows, Pictographs, and the Pecos River Focus. American Antiquity* 16 (1): 71-74.

Assoc of b+a w atlatl in some PRF [W Archaic period] sites is prob due to bad stratigraphy. PRF pictos show only atlatl, b + a only appears in succeeding phase rock art, red designs overlaying earlier polychromes, assoc with horse + other late motifs in some. Bow perhaps as early as 900 AD from other evidence elsewhere. Pictographs of hunter w atlatl, darts, rabbit sticks, staff, “bag-like” objects, express existence of “a well-organized ceremonial hunting cult.”

**Kelker, Nancy L., and Karen O. Bruhns**

**o**

2010 *Faking Ancient Mesoamerica*. Left Coast Press, Walnut Creek, CA.

Well written, covers lots of different fakes. No one should ever trust an unprovenanced ancient art work again!

Makes point of showing long history, well back into 19C for some things. Discusses complicity of museums and collectors, reluctance to recognize faking problem, political and economic motives. A few specific fakers named, often a bit too vague about naming museums and other supporters of faking and looting, sometimes needs more citations. Quotes museum experts as “40+ %” fakes. Good fakes appeal to modern ideas of “the primitive” and often use titillating elements like human sacrifice and sexuality. Faking “pollutes” the archaeological record - examples include p 146 fake incensarios supposedly from Teotihuacan interpreted to suggest influence on Guatemala. Ceramics most common, but also hard stone from ornament to monument size, Teotihuacan stone masks, crystal skulls, metal work, Maya codices and wooden lintels. Many fakes by adding to plain original, or dishonest reconstruction, or incorporate old material to foil dating tests.

Often humorous, sometimes too flip or superficial as in p164 discussion of flaked stone from Teotihuacan area, with unsupported suggestion that knapper learned from US university class. Photo of the “tumi” shaped obsidian axe heads and 3 lanceolate bifaces. My work on modern knappers not cited, and they don’t discuss the current tourist use of knapped artifacts. pp. 205-207 Aztec atlatl - the photo + description of the fake in Rome [they say in Argentina ethnographic

museum] that copies British Museum loops and Florentine specimen carvings (Bushnell 1905; Callegari 1934; Beyer 1934).

See companion volume *Faking the Ancient Andes* (Bruhns + Kelker 2010).

**Kelly, Alexandra** x

1970 *The Australian Spearthrower*. Unpublished B.A. Honors Thesis, Anthropology Department, University of Sydney.

Compiled ethnographic accounts, typology using collection of Australian Museum. Appendix of scale drawings [not great] of examples. Wommera or woomera is term used in Sydney area, but other groups had many different terms.

“The spearthrower works on the same principle as the sling. It adds an extra length to the arm and thus increases the velocity of the spear thrown and makes the throw more powerful and accurate by concentrating the entire force of delivery behind the butt of the spear (5).” Comparisons between accounts of different forms of spearthrower and spears, and secondary functions.

Davidson (1936) types and distribution maps used. His theories on age based on distribution are not reliable, but his distribution info is. [Lengthy descriptions of each type, adequate illustrations, some ethnographic descriptions of use, accuracy, range].

**Kelly, Everett** s

2004 *Everett Kelly's The Atlatl*. Virtualbookworm.com Publishing Inc, College Station, TX.

Novel. The Calusa encounter Ponce de Leon, brave warrior Asaha and tribe fights off Spanish and preserves their freedom. [Basic story is ok, but writing is amateur – Calusa often lapse into stilted Hollywood Indian English. Atlatl is mentioned briefly, as powerful weapon, but no details and is not important enough to inspire the title – Kelly probably just thought it sounded exotic.]

**Kennedy, Kenneth A. R.** o

2004 Slings and Arrows of Predaceous Fortune: Asian Evidence of Prehistoric Spear Use. *Evolutionary Anthropology* 13 (4): 127-131.

S. Asian Mesolithic (India) used microlithic tools, hunt big game, spear use evidenced by hypertrophy of supinator crest on right ulnae (but could be “due to other cares of daily life”), supported by cave art showing spear throwing, thrusting over and underhanded, atlatl, bow and arrow, bolas, slings. [Conclusion not clear – lots of different weapons in use – why assert spear as producing physical trait?]

**Khlopachev, Gennady, Dmytro Nuzhnyi & E.Y. Girya** s

2011 Results of experimental use of mammoth ivory projectile points of Upper

Palaeolithic forms. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

“Results of experimental use of mammoth ivory projectile points of Upper Paleolithic forms. Mechanical properties of mammoth ivory (Siberia) – it can be knapped like stone, even making blades at very low temperatures. In the second experiment, arrows and darts were shot with a bow into a body of a young cow. The good penetrative abilities of such “bipointe” arrow-heads and “sagaies a base recouci” were confirmed, the “bipointes” were more efficient than “sagaies a base recouci”. [They also used atlatl, but looks poor.] Bone was only used after Mesolithic, because not as good as ivory.

**Kidd, Kenneth E.**

**o**

1960 Review of Townsend, Birdstones of the North American Indian. *Ethnohistory* 7 (4): 419-421.

Favorable review, notes utility of such artifact studies. Includes “90% of known specimens, which probably represent more than half of all that were ever produced.” [Doubt it!]. Warns of fakes.

**Kidder, A. V.**

**x**

1938 Arrow-Heads or Dart Points. *American Antiquity* 4 (2): 156-157.

Responds to Browne 1937 with reasons why small points are arrows: late in SW, vs large points early w Basketmaker and atlatls, common in Gt Plains bison kills, if Folsom etc were arrowheads, then why replaced by smaller points later?

**Kidder, Alfred Vincent and Samuel J. Guernsey**

**o + x part**

1919 *Archeological Explorations in Northeastern Arizona*. Smithsonian Institution Bureau of American Ethnology Bulletin 65.

[Classic report on Anasazi Pueblo and Basketmaker cave sites.]

Atlatls: several fragments, 1 complete from BM cist with burial.

Described pages 178-183: flat board, distorted by earth pressure, missing loops, limestone weight (elbow shaped, close to grip, 1 oz), groove with flush hook "mixed" type, L 28", W 1 3/8" at distal end.

Describes grip and use.

Weights might balance, add power, or be ceremonial.

Darts: all broken, butts sinew-wrapped, fletched, foreshafts into socket.

**Kidder, A. V., and S. J. Guernsey**

**x**

1922 Notes on the Artifacts. In Nusbaum, Jesse L. A Basket-Maker Cave in Kane County, Utah, pp. 107-113. *Indian Notes and Monographs*. Museum of the American Indian, Heye Foundation. New York.

Cave du Pont. No atlatls recovered, but darts. “A little more than 50 inches long,” 3 fletches, cupped butt end, socketed for wooden foreshafts, seized with sinew. Box elder. Bundle of 5 probable dart shaft blanks. Wooden foreshafts slotted for points, 3.75-5 inches long. [illustrated]

**Kidder, Norm** o

2006 An Atlatl Spur from the San Francisco Bay Area. *Bulletin of Primitive Technology* 32: 57.

Ohlone Indian site Fremont CA, 400 BC-1800 AD. Elk? bone. Notched lump shape to tie on. Tried replica. Photo.

**King, J. C. H.** x IL

1981 *Artificial Curiosities from the Northwest Coast of America: Native American Artefacts in the British Museum Collected on the Third Voyage of Captain James Cook and Acquired through Sir Joseph Banks*. British Museum Publications, London.

Pacific Eskimo spear thrower photo'd , also several harpoons, including fletched sea-otter “harpoon-darts” with blunt [male] proximal ends. Thrower has stylized sea-otter carved on underside, ivory hook, finger notches. [I photo'd this one at Brit Mus]. Info about voyage (1770s) and collections.

**King, Ron** x

1989 An Archer's Notes. *Society for California Archaeology Newsletter* 24(4):8-9.

Influence of Pope + Ishi on archery.

Point weights - archeols use 2g as dart/arrow distinction point, but Ishi and other ethnog bows around 45 lb draw, capable of “shooting through” deer, and modern hunting bows at 45lb also adequate, using points 110-150 grains = 7.1-9.7 grams, so need different explanations of bimodal point weight distrib.

Bow more versatile, less movement, more positions possible, more shots, less exposure than atlatl. Points don't kill by impact shock but by bleeding, also leaves trail for hunter. So greater cutting surface of atlatl pt an advantage - greater damage. Atlatlist must be more selective about shots than archer, maybe earliest hunters with spears needed groups and drives, atlatlists smaller groups on trails, blinds and stands, and archers better as individual hunters.

**Kinsella, Larry and David Klostermeier** o

1993 *Indian Knoll Atlatls*. VHS, privately distributed, L. Kinsella, 645 Pleasant Ridge, Fairview Heights, Illinois, 62208

Detailed video documentation of all atlatl parts from Indian knoll – antler tine hooks, antler beam grips, stone and composite shell tubular weights.

**Kirkland, Forrest, and W.W. Newcomb**

o

1967 *The Rock Art of Texas Indians*. University of Texas Press, Austin.

Amateur Kirkland made watercolors between 1934 and 1941; archaeologist Newcomb produced text. Western Archaic, Pecos River (W TX). Atlatls common, sometimes recognizable with loops like SW, one seems to have cross bar also. Darts common, fletched, some indistinguishable from atlatls. Figures identified as 'shamans' (broad shoulders, outline colored in + elaborated, arms raised) usually assoc with atlatl and darts, [but often atlatl just a line from hand to dart end] also often with prickly pear pad or fringed bag, fending or rabbit sticks, animals with darts in them. A couple of the atlatls have 2 darts loaded on them. [Some atlatls appear to have a weight or rest on them (like a New Guinea model). Original artists were not sticklers for careful detail, but Kirkland apparently called atlatl + dart "broken plants" so detail might be better if he had understood them.] Later "Red Monochrome" style has bow and arrow, no atlatls. Hueco Tanks (W TX panhandle) also late, lacking atlatl.

**Kjelgaard, Jim**

o

1951 *Fire Hunter*. Scholastic Book Services, New York.

Novel. In Pleistocene America, Hawk, the tribe's spear maker and Willow, an injured young woman, are cast out of their tribe and survive encounters with wolves, sabretooths, and hostile tribes by wit and courage. In the course of their adventures they invent in rapid succession the spear thrower, fletching, bows and arrows, arrow poison, and domestic dogs. The David Drake (1990) re-issue adds chapters on the disasters that befall the tribe that kicked them out. [This is a classic boy's story that inspired me when I was a kid. The conception of prehistoric society is pretty 1950s tooth and claw stuff, and Kjelgaard didn't know a lot about prehistoric technology either. He thinks the flexing power of wood is what makes the atlatl work, which in turn leads to the invention of the bow. Fun, but not to take seriously.]

**Kjelgaard, Jim**

o

1960 *Boomerang Hunter*. Avon Books, New York.

Novel. Australian Balulu and his dingo survive hardships to find a new territory for their tribe in time of drought. "Made of wood and laboriously fashioned to his personal taste, the spear thrower was about two feet over all. The grip was shaped to conform perfectly to the shape of Balulu's clenched fist. At the tip end was a spear rest, a cavity made with a burning brand and sand-polished to a glassy smoothness. When in use, the butt end of the spear rested in the cavity and the womera's effect was to double the length of the spearman's arm and permit a corresponding increase in the force and effective range of the thrown spear." [Actually, almost all Australian womera have hooks. The rest of his

ethnographic info is about on a par, despite a curious “American” way of looking at things: his heroes always solve their problems by inventing new technology, in this case water carrying gear.]

**Kleiner, Kurt**

**x**

1999 Stone Age Kalashnikov. *New Scientist* 162 (2186):40-43.

[Nice but basic description weak, focus on Bob Perkins, lots of small errors: “thousands” of atlatlists today (we wish!); most hunters abandoned atlatl 10,000 years ago; first atlatls N. Africa; Perkin’s spring and wave theories and rather weird illustration of them. Does mention Baugh’s work as counter to Perkins.]

**Kleiner, Kurt**

2002 Neanderthals Used Both Hands to Kill. *New Scientist* 11/23/02 online  
www.newscientist.com

Reports Churchill’s work, Neanderthal right arms stronger, bone denser, experiments confirm that thrusting puts much more force on dominant arm, so don’t need throwing to explain. [But will occasional forceful use really create such differences, aside from the fact that N’s used their arms for other things too? All he has really shown is that most N’s were right handed.]

**Klopsteg, Paul E.**

1943 Physics of Bows and Arrows. *American Journal of Physics* 11(4):175-192.

Explains lots of stuff, much not relevant to atlatls. Measured arrow velocity, which decreases proportional to cube root of its mass on a given bow, from 175 fps with 250 grain arrow to 137 fps with 625 grain arrow. Bow geometry, changes due to mechanical understanding: up to 1932 tournament bows were English longbow style and inefficient, but articles at that time led to change to rectangular cross section bow limbs. Silk and sinew backing possible [fiberglass not yet considered]. Archer’s paradox: arrow must flex as passes bow to maintain flight to target - it actually oscillates without touching the bow and continues to oscillate in flight. Oscillation begins because tip is flexed to left and also nock to left by string, bending arrow to R in middle. Properly timed oscillation means that as middle of arrow passes bow grip, it is now flexing convex side to L and passes around grip. Depth of penetration varies directly as kinetic energy of arrow, heavier arrow better, takes more energy from the bow although less velocity.

**Knapp, Wyatt**

**o**

2010 *The New Atlatl and Dart Workbook*. Onagocag Publishing Co.,  
Winterhaven, FL.

Updated version of Knapp + Becker 2000. Rather good drawings, and detailed



28-36. Société Royale Belge d'Anthropologie et Préhistoire, Bruxelles.

Several simple manufacture and hafting systems described, for points that would have been used with atlatl darts.

**Knoblock, Byron W.**

**o**

1939 *Bannerstones of the North American Indian*. Published by the author, LaGrange, Ill. Reprinted 1965? Quincy, Ill. Reprinted 2008 Gustavs Library Reprints, Davenport.

Huge 596 pp, mostly plates, a few color.

Primarily typology + illustrations, of perforated bannerstones only.

Discusses manufacture, good illustrations of unfinished specimens, some experiments in drilling.

Prefers ceremonial or ornamental use theory, tribal symbols, but includes some others, e.g. section on Indian Knoll and Moore's theory that antler hooks were netting needles, bannerstones were mesh spacers, which he likes. Also letter from Webb arguing for atlatl part theory, which he questions, and says even if some were on atlatls, ceremonial importance was foremost.

**Knoblock, Byron W.**

**x**

1955 Bannerstones are Ceremonials. *Central States Archaeological Journal* 1(3):84-90.

Collectors see bannerstones as ceremonial, archaeologists follow Webb, see them as atlatl parts. Dismisses Webb because: 1. if b were atlatl weights, all men would have them but axes are more common and they occur in female graves too. 2. no arrowheads assoc w Webbs hooks + b [not true] 3. even if atlatl, could still be ceremonial 4. intentional destruction = ceremonial 5. too large and fragile, too pretty for use 6. not always assoc w hooks 7. if before bow, then whole east was occupied before bow 8. [... missing page]. [Lots of bad reasoning, ignoring issues of archaeological context.]

**Knusel, Christopher**

**o**

2000 Activity-related Skeletal Change. In V. Fioratto, A. Boylston, and C. Knusel, eds. *Blood Red Roses: The Archaeology of a Mass Grave from the Battle of Towton AD 1461*. Oxford, Oxbow Books., pp 103-118.

Asymmetry in arms of 14 men show right humerus larger proximal, left humerus larger distal. This may represent habitual archery – left elbow, right shoulder get most strain. Also one had healed avulsion fracture where epiphysis of left distal humerus (elbow) had separated at growth plate in adolescence.

**Koerper, Henry C., Adella Schroth, and Roger Mason**

**x**

1994 Morphological and Temporal Point Types: Evidence from Orange County,

California. *Journal of California and Great Basin Anthropology* 16(1):81-105.

Testing applicability of Great Basin and Mojave types to coastal CA. [Stimulated by silly arguments of Flenniken + Wilke]. 8 Middle Holocene (3500-6650 RCYBP) sites with 79 C14 dates, variety of dart points (>3.5 gm). Many types co-occur, so not good temporal indicators. Minimal OC spans: Pinto + Elko 3580-6535 BP, Northern Side-Notched 5227-5647, Gypsum 4400-6324, Humboldt 3580-6324, Silver Lake 3580-6535. [Dates mostly on aggregated marine shell, so not the best, although isotope-adjusted and calibrated. Also the stratigraphy in these sites is not good, all points are oddly in the top levels of the sites, and the sample of points is too small.] Rejuvenation accounts for much of the variability [Maybe, but that's partly Flenniken bs, and I don't think these guys can really tell.] 72% are < 7 gm, too small for efficient dart point [according to Perkins 1992 - nonsense]. Gt B temporal associations don't apply to OC [fair enough].

**Koerper, Henry, Adella Schroth, Roger Mason, and Mark Peterson** x  
1996 Arrow Projectile Point Types as Temporal Types: Evidence from Orange County, California. *Journal of California and Great Basin Anthropology* 18(2):258-283.

Bow and arrow intro ca 500 AD but some argue as early as 1250 BC. Rose Spring, Eastgate, Rosegate types seen as downsized Elko pts as bow replaced atlatl (Heizer + Baumhoff 1961) in Gt Basin. Also found in OC, weights around 3.5 gm boundary between arrow/dart. Earliest Cottonwood series pts in OC also similar to earlier atlatl pts. OC site dates support intro of Cottonwood Triangular and Leaf-Shaped forms ca 600 ± 200 AD, earlier than in Gt B. The leaf form seems earlier, but basal configuration of triangular forms shows no temporal significance. Long narrow flared base forms related to Hohokam, suggest a "Sonoran Series", terminal Late Prehistoric dates. Bow advantages: less movement, more ammo, in both war and hunt. Bow as temporal boundary between Intermediate Period and Late Prehistoric Period around 600 AD.

**Koerper, Henry C., Jeffrey Couch, Joanne Couch, and Nancy Desautels** x  
2006 A Unique Atlatl Dart Bunt from CA-ORA-365, The Borchard Site. *Proceedings of the Society for California Archaeology* 19:132-137.

"Bunt" defined: a blunt point with rounded head and tapering stem. They protect shaft and balance for flight. Other forms more properly "blunts."

This specimen chlorite schist, flaked and ground, 66 mm L, 27 mm W, 24 mm T, weight 53 g. Flake scars from impact reground. Battering wear and striations on head. Surface find, undatable. Atlatl replaced by bow 400-600 AD. Atlatl and bow both springs, with dart being most important spring in atlatl system [Incorrect, and cites Farmer instead of Perkins].

**Kolianos, Phyllis E. and Brent R. Weisman** o

2005 *The Florida Journals of Frank Hamilton Cushing*. University Press of Florida, Gainesville.

Edited incomplete journal, missing section where might have commented on atlatl finds. Appendix of comparative illustrations include birdstones reconstructed with gorgets as duck effigies or hair ornaments, shark tooth “swords” (possibly atlatls) among comparative war clubs. Cushing’s sketches do not show any indication that he thought they could be used as atlatls, and no evidence that they would be.

**Kolianos, Phyllis E. and Brent R. Weisman** o

2005 *The Lost Florida Manuscript of Frank Hamilton Cushing*. University Press of Florida, Gainesville.

Lengthy report in preparation when C died. Interest in survivals or “perpetuation of form.” Atlatl finds apparently not mentioned.

**Korfmann, Manfred** x

1973 *The Sling as a Weapon*. Scientific American 229(4):34-42.

Historical records from classical times, archaeology (stone, lead and clay shot) and iconography. Extreme accuracy possible, range 200-400 m, so equal or surpassing bows. Ammunition 13-450gm, mostly 20-50 gm [seems remarkably light and small]. Sling and bow were apparently mutually exclusive and used at same time by different “culture spheres” between 8000-4000 BC in Near East [I’m not convinced, not enough evidence given.] [Interesting, but not much practical experience or experiment.]

**Kornfield, Marcel, George C. Frison, and Mary Lou Larson** o

2010 *Prehistoric Hunter-Gatherers of the High Plains and Rockies, 3<sup>rd</sup> ed.* Left Coast Press, Walnut Creek, CA.

Massive rewrite of Frison’s Prehist Hunters book.

Typology and chronology of pts, p 50 value of experimental arch. P. 55 intentional burination reworking of pts vs impact fracture. Knives and resharpening.

Possible pre-Clovis sites with mammoth bone modified or oddly distributed. [Seems skeptical, as they should, for sites with no stone tools.] Cultural sequence Clovis to recent illustrated by point types and other info. P. 127 Spring Creek Cave atlatl, hafted pts, and shaft frag (photo), late Plains Archaic, [BM related form].

Modern animals as analogs, and arch experiments. Photos and info from his experiment with Clovis pts on culled elephants. P175-180 weaponry – pts delivered by atlatl to elephants survived well, but can’t penetrate if strike rib, shafts must be straight and atlatl hook must engage base of cup [he’s too sensitive

about these details], individual gear requires practice, primitive hunter needs patience and close range shots. Butchering – experiments with stone tools.

P 269 bow and arrow replace atlatl at Late Prehistoric Period boundary ca 500 AD, more versatile and faster than atlatl.

Quarries and lithic raw material – Spanish Diggings, Barger Gulch (Folsom, CO). Caches – Fenn cache (drawings), Crook Co cache, Larson cache (Cody, >40 Scottsbluff pts), McKean site caches.

**Kortlandt, Adriaan**

o

2002 Neanderthal Anatomy and the Use of Spears. *Evolutionary Anthropology* 11:183-184.

African ethnographic spears used in two ways: short spear for overhand shoulder-high stab, longer for javelin-like throw. Neanderthals' "sturdy build" perhaps an adaptation not just to cold but to "hunting large mammals with stabbing spears in dense bush and forest." [see Churchill 2002]

**Kostiw, Scott**

2000 Atlatl Use In the Siege of Tenochtitlan. *Indian Artifact Magazine* 19(3):31, 69.

[Brief info from Maudslay's version of Castillo].

**Koup, William S.**

2002 Bannerstones...What Are They? *Prehistoric American* 36(2):3-5.

Short review of main theories, somewhat critical of Webb, but concludes probably atlatl weights, with special significance, and some "ceremonial" forms.

**Krause, F.**

1902 Schleudervorrichtungen für Wurfaffen. *Archives Internationales d'Ethnographie* 15:121-155, plates 9-16.

[In German. "Sling Contrivances for Projectile Weapons." Presumably similar info to 1905. Plates have nice clear engravings of many types, favoring Arctic. Distribution maps.]

**Krause, F.**

1905 Sling Contrivances for Projectile Weapons. *Annual Report of the Smithsonian Institution, 1904*: 619-638.

"Spear slings" [he dislikes "throwing stick" and does not use "atlatl"]. Works by "lengthens the arm and serves as a lever to thrust spear forward after it has flown beyond the reach of the hand." "same motion as in ordinary spear throwing" [so he expects a level motion as Howard 1974, which is not correct].

Defines nock types: male = hook on atlatl for hollow spear butt.  
 Female = groove on atlatl, tapered end or hook on spear.  
 Mixed = hook at end of groove, hollow spear butt. [This is a misnomer – the hook is the effective part, so it really should be “male” with added groove.]  
 Efficiency (from ethnographic reports) "3-4 times as far as with bare hands" = 200-300 feet, Australians said to reach 150 yards, accurate to 40 paces.  
 Different types described by area: Australia, New Guinea, Micronesia and Melanesia; North circumpolar region, especially Eskimo and Aleut; Central and S. America, including American west briefly mentioned.  
 Small but clear line drawings of many types.  
 Projectile [spear] slings and loops briefly discussed.

**Krajic, Kevin**

**x**

2002 Melting Glaciers Release Ancient Relics. *Science* 296 (5567):

Yukon ice field dung deposits with artifacts. Mentions others. Atlatl used until 1300 yr ago, then bow. BC Iceman was 550 yr old, atlatl also found in that area. Photo of stone point on foreshaft, and iceman's knife.

**Kricun, Morrie E.**

**x**

1994 Paleoradiology of the Prehistoric Australian Aborigines. *American Journal of Roentgenology* 163:241-247.

Spear thrower use mentioned as possible cause of elbow arthritis. [But no discussion, details, or even info on number of specimens examined – useless.]

**Krieger, Alex D.**

**f**

1956 Historic Survival of the Atlatl in the Lower Mississippi Region. *Bulletin of the Texas Archeological Society* 27:195-207.

Texas domesticated hog skull with large point, Spanish accounts of atlatl in Mississippi Delta. Pt is Gary type, lg, stemmed. Loosely in skull, which is filled w river sand holding it in. [Photo shows large hole, Archaic contracting stem point type. I'll bet this one is a fake.]

**Kurten, Bjorn**

**o**

1976 *The Cave Bear Story: Life and Death of a Vanished Animal*. Columbia University Press, New York.

Good popular account of cave bear paleontology, biology, and archaeology. Dismisses the “Neanderthal bear cult” as result of poor standards of early excavation, lack of knowledge of the oddities caused by natural processes in caves occupied by bears for centuries. Little real evidence for hunting cave bears at all.

**Kurten, Bjorn**

o

1980 *Dance of the Tiger*. New York City: Random House, Inc.

Novel. Reconstructs Neanderthals as peaceful, intelligent, with gestural communication, brow ridges for facial expression, and pale skin, contrasting with the more organized and vocal modern humans who have dark skin [reflecting current theories of African origins of moderns]. Neanderthal extinction is explained as result of interbreeding that produced infertile offspring. Not a bad novel, some ok archaeological detail, but some that is wrong, eg. “granite” for Neanderthal spear points, “mammoth tongue with cranberry sauce,” and other too-sophisticated cookery. Neanderthals have elaborate social rituals connected to the eyes and expression, which is plausible, but the (modern human) villains attempt to conquer other tribes, and some other aspects are way too complex for Paleolithic societies, even those of modern humans. The moderns use atlatls, but need heavier spears for mammoth (p5).

**Kutscher, Gerdt**

x

1958 Ceremonial ‘Badminton’ in the Ancient Culture of Moche (North Peru). *Proceedings of the 32<sup>nd</sup> International Congress of Americanists*, pp. 422-432, Copenhagen.

Describes and interprets in detail several fine-line vase paintings [which are reproduced too small to examine well]. Spears and individuals with spear throwers depicted, but spears have not points, but cross bars and are “staffs” attached by strings to flowers or “shuttlecocks” which would break away and float down from the thrown staff in a ‘ceremonial game’ near and on the pyramids. Equipment seen in libation and runner scenes also present here.

**Kwas, Mary L.**

x

1981 Bannerstones as Chronological Markers in the Southeastern United States. *Tennessee Anthropologist* 6(2):144-171.

Uses modification of Knoblock’s typology, excavated examples to establish basic chronology from Middle Archaic (6000-5000 BC) appearance to shift to 2-hole gorgets in Late Archaic (around 1200 BC). Generalized trend: begins with crescent forms (crescent, shuttle, reel, double-edge, double bit axe, knobbed lunate) in early Middle Archaic, then from 4000-3000 BC (late Middle Archaic) replaced by tubular, geniculate, humped, and ovoid forms which last until ca 2000. Meanwhile, hourglass and saddle-face forms (as at Indian Knoll) appear about the same time, and apparently last a bit longer. Finally the bottle and butterfly forms begin ca 2000 in the Late Archaic, and are ending sometime after 1000, with a shift to the 2-hole gorget around 1200 and a later shift to boatstones around 600-500 BC. Tables list all specific finds from sites with association info.

**Kwas, Mary L.**

x

1982 Bannerstones: A Historical Overview. *Journal of Alabama Archaeology* 28(2): 155-178.

Name “bannerstone” assumed ritual or social function. Moorehead 1917 first systematic classification: lunate, bilunate, bipennate, geniculate. Knoblock 1939 major work, base for typology although his evolutionary scheme has no empirical support. Researchers tend to ignore bannerstones or inadequately describe.

Functional theories: 1) Ceremonial staff. NC find of 3 mounted on stone shafts a foot long (Baer 1921), and wear on only part of hole (Knoblock 1939), also fancy material, fragility. Carlson Annis find strung with beads around neck of burial.

2) Net spacers. Moore (1916) at Indian Knoll, association with net needles (hooks).

3) Atlatl weights. Webb, from finds at Indian Knoll and elsewhere, analogous to Basketmaker specimens (Kidder and Guersey 1919). Burial alignments consistent with SW examples – weight about 1/3 to 1/2 distance from hook. Problem with atlatl theory – hooks and bannerstones not always together, and found with female burials. Uses Indian Knoll data to demonstrate this. Also often not found with points.

Discusses experiments, which provide variable and sometimes conflicting results, partly because not systematic enough.

Precourt (1973) and Winters (1968) argue that could be both functional atlatl weights and social or status markers. Research should not assume the atlatl weight function is proven.

[Good literature review and critique up to its time. Many of the objections to atlatl weight interpretation are now less supportable, and most would now agree that symbolic as well as hunting uses are likely.]

### **Lahren, Larry**

**o**

2006 *Homeland: An Archaeologist's View of Yellowstone Country's Past*. Cayuse Press, Livingston, Montana.

Nice personalized illustrated narrative of Montana prehistory. Anzick Clovis site frequently referred to. Lithic archaeology includes projectile point chronology, knapping discussion featuring work of Ray Alt, Bonnicksen. Shoshone legend of how coyote stole knapping knowledge from wolf. Experiments with bow (Alt) and atlatl leave them skeptical of ability to distinguish points by size, and of penetrating ability of atlatl dart. [Stories about effectiveness of bow and arrow, and experiments with dart size points on arrows, but no info on any atlatl experiments.] Damage to points. Drawings and photos of Anzick artifacts, brief and not very clear discussion of events of find and study, including comments by “psychic” apparently accepted at face value. Mentions of “Clovis Hustle” and Woody Blackwell. Discusses relations between academic and contract and avocational archaeology; example of contract report on Dozer Rock Site. Bison hunting and kill sites. Spread of horse.

**Lahren, Larry, and Robson Bonnichsen** s

1974 Bone Foreshafts from a Clovis Burial in Southwestern Montana. *Science* 186 (4159): 147-150.

Anzick cache, Montana, 2 subadults, ochre covered, points + bifaces, bone rods. Large mammal bone, possibly mammoth, beveled ends with hatching, possible resin. Postulated hafting with added splint of bone, could serve as detachable foreshaft allowing repeated thrust with rearmament.

**Laird, Roderick D.** x

1984 *How to Make and Use the Atlatl: Ancient Weapon of the Ice Age Hunters*. Saratoga Museum Papers 1. Saratoga Historical and Cultural Association Atlatl Press, Saratoga.

Laird is school teacher, amateur arch, participant in World Open Atlat Contest since beginning. Prefers pronunciation at-latl but unable to find evidence. Aztec origins [from Nuttall – throughout he mentions “authorities” without citations]. Mechanics discussed, unclear. Some sketchy archaeology and designs. How to make section. Recommends wooden spears 6-7’ long. Optional weights serve as counterbalance to spear. Photos of manufacture, some design tips, including a forked antler proximal spear rest. How to throw section with photos, including clear sequence showing overhead flip motion and dart flex. World Open contest described. Winners 1981-1984 include Laird, B. Bradley, L. Kinsella. [notable that one of Laird’s 6<sup>th</sup> graders beat adults 1984 – skills not much developed then]. [Nice enthusiastic intro for kids and novices, 50 page booklet, now seems rather primitive and could use more scholarly info. Laird is one of the originators of modern atlatl study and sport.]

**Laird, Roderick D.**

1999 Experiments Confirm Likely Usage of Murray Springs Bone Tool. *The Mammoth Trumpet* 14(2):18-20.

Shaft wrench, not spinning tool as argued by Heite (MT 13(3)). Works well in pairs with heated wood shaft, has notches at ends of opening, necessary to keep from cracking shaft or letting it roll.

**Laming- Emperaire, Annette** s

1959 *Lascaux, Paintings and Engravings, trans by E. F. Armstrong*. Penguin Books, Baltimore.

Interps Lascaux image w bison as spear thrower, see Irving 2000, Marshak 1972.

**Langley, Michelle** s

2011 Less to the Point: Curation of Magdalenian Antler Projectile Points. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age

Weaponry, Mainz, 19-22 September 2011.

“Magdalenian osseous projectile points are carefully worked components of a technological system vital to the acquisition of subsistence resources, and as such, it is important to understand the entire chaînes opératoire of these artefacts. Recent studies focus on manufacture and use wear. Studies have established the durability and efficiency of osseous projectile points, but few consider the final phases of the chaînes opératoire – restoration, recycling and eventual discard with the embedded issue of curation. Archaeological material is largely trash in the view of the people responsible for its deposition. Issues surrounding the investigation of how Magdalenian osseous projectile points were restored, reduced and recycled - Can we determine if particular point types were curated or expedient? How much can we hope to learn about the curation of these distinctive projectile points?”

Barbed points were depicted on other antler pieces. Reduction of size + damage to decoration indicated reworking.

### **Lansac, Jean Pierre**

2001 Discussion d'un cadre chronologique pour l'utilisation du propulseur et de l'arc. Unpublished MA thesis, University of Bordeaux. Obtained on web <http://perso.wanadoo.fr/archeries/MEMOIRE.htm>, 8/20/01

[“On a chronological framework for the use of the spearthrower and the bow.” In French] Hunting weapons (spears) are known from at least Middle Paleolithic times, and common opinion is that spearthrowers begin at least by Solutrean, but bow not until Mesolithic. Two methods of evaluating this chronology: “direct” evidence of the weapons themselves, and “indirect” evidence of the projectile points compared to ethnographic and experimental information. Describes basic use, and male, female, and “androgenous” hook types.

First French Upper Paleolithic spearthrower finds by Lartet and Christy at Laugerie-Basse in 1862, recognized by analogy to Australian woomera by Mortillet 1891. Finds now dated from late Solutrean (17,500 BP) to late Magdalenian (12,500 BP). First European bow finds from Swiss lake dwellings [Neolithic and Bronze Age] in 19<sup>th</sup> century. Now earliest bows from Mesolithic sites like Stellmoor (Germany, ca 11,000 BP) and Holmegaard (Denmark). Earliest arrows about same date, from Lila Loshult (Sweden) and Stellmoor. Points are more difficult to deal with. Solutrean shouldered points have been shown to work well with spearthrowers, which are found in contemporary sites. Others, like Gravette points [small straight points made on retouched blades], were probably projectile tips, but we don't know whether for bow or atlatl. Experiments show they work with either. Some interpret as change to light point for arrow, but no direct evidence. Ethnographic Eskimo use both bow and atlatl for different purposes – why not an archaeological transition period in Upper Paleolithic? Evidence: Most known ancient bows already sophisticated, thus long ancestry likely. Magdalenian spearthrowers are close in date to Azilian

microlithic industry – small stone tools suggesting bows. Bone tools become scarce, but atlatls could be all wood and not preserved.

[Brief, few details, but useful compilation of dates, bibliography].

**Lansac, Pierre**

x

2004 Un cadre chronologique pour l'utilisation du propulseur et de l'arc durant le Paleolithique superieur europeen. *Bulletin des Chercheurs de la Wallonie* 43: 29-36. On web at URL: <http://perso.wanadoo.fr/archeries/articles/Lansac.pdf> accessed 10/25/05.

Similar to 2001.

Compiles velocity from other experts. His experts w Font-Robert points (Gravettian/Perigordian) – fractures show projectile use, but not distinguish bow from atlatl. F-R pts and Gravette pts prob used w atlatl before atlatl finds of Solutrean age, so prob perishable. Similarly, bow + atlatl should overlap even if not well documented, so for Paleolithic can say atlatl sure, bow possible; for Mesolithic bow sure, atlatl possible.

**Lantz, Dennis**

o

2005 Pennsylvania Game Commission Hears Proposal to Allow Hunting With the Atlatl. *Indian Artifact Magazine* 24 (3): 12-13.

**Lantz, Dennis**

o

2006 Farewell to a Friend. *The Atlatl* 19(3):3.

Obituary/tribute to Terry Keefer.

**Largent, Floyd B.**

o

2004 Diving Into Florida Prehistory: The Paleoindian Record at Sloth Hole. *Mammoth Trumpet* 19 (4): 18-20.

In Aucilla R., dive excavs by C. Andrew Hemmings, lots fauna, worked bone and ivory, w Clovis pts. Ivory shafts and “points”, bone pins. [But not clear evidence of Clovis atlatl].

**Larson, Susan G.**

o

2007 Evolutionary Transformation of the Hominin Shoulder. *Evolutionary Anthropology* 16(5):172-187.

Variability in the few shoulder fossils of early human ancestors and relatives.

Neanderthals have longer clavicles, dorsally positioned scapulae, and laterally facing glenoid fossae compared to some ancestors, and less humeral torsion than modern humans, which would be advantageous for overhead throwing. In modern humans “reduced humeral torsion [correlates with] overhand throwing, which entails a high degree of external rotation of the abducted and extended arm during

the cocking phase. Individuals with lower torsion values have...greater ranges of external rotation. Those who throw habitually have significantly lower torsion and a greater range of external rotation on their throwing side.”

**LaRue, Chuck**

o

2010 Looking Closer at Basketmaker Atlatls and Darts. *Bulletin of Primitive Technology* 39:12-21.

[Good overview] Description of basic form. Gambel oak common material. Detail photos and drawings of LaRue replicas and originals from Sand Dune Cave, White Dog Cave, Broken Roof Cave (especially loops), small stone weights, darts – mostly willow and dogwood, short mainshaft, socket drilling with passive drill, hardwood foreshafts with pitch filler to seat stone points, bunts also, fletching with both whole and split feathers. Some rock art.

**Lau, George F.**

o

2004 Object of Contention: An Examination of Recuay-Moche Combat Imagery. *Cambridge Archaeological Journal* 14 (2): 163-184.

Luhrsen stirrup bottle depicts pairs of warriors, one Moche (coastal Peru) one Recuay (highlands), ethnic diffs distinguished by costume and weapons (different maces). Moche are all winning, could be re-enactment or ritualized war, glorifies Moche. Recuay use slings and rocks as well as maces, Moche maces only, no atlatls shown.

**Laughlin, William S.**

o

1980 *Aleuts: Survivors of the Bering Land Bridge*. Holt, Rinehart, and Winston, New York.

Chapter on hunting: “Kayak hunting on the open sea is the most skilled and demanding form of hunting practiced by human beings.” High reward, high risk. Long section on child training, which includes unusually specific exercises for particular skills, including for throwing harpoon with throwing board from kayak (p. 28), for which need to “stretch the ligaments and tendons of the knee, back, and shoulder early in life.” Uncle, father, or grandfather pulls arm of boy “straight over the shoulder and back behind the head...to make the shoulder joint supple and permit greater excursion from behind with a straight arm, a valuable ability for casting harpoons with the throwing board.” Also press down knees to lengthen hamstring muscles and small of back to allow you to sit comfortably in kayak.

(p 30) Throwing boards were personal possessions, tailored to size of owner. Children practiced on land before kayak hunting. (p 32) Maximum effective range for light harpoon (4 foot length, 1.2 m) thrown with throwing board is 120 feet (36.3 m).

(p 39) Throwing board illustrated. Wooden, wide board with groove and ivory

hook, hole for index finger, shaped on underside for hand grip. Looks short. “Black paint on back represented fur of the sea otter, and red paint on belly represented blood. The various parts had anatomical names.” Used with four foot harpoons, often for sea otter, but also against whale. “The spear was cast with a throwing board, assuring deep penetration.” Tips “poisoned” but ingredients magical rather than effective.

Throwing board length was elbow to end of middle finger (p 148). Harpoon heads were barbed rather than toggling (p 84). Used bow drills for fire and drilling until Russians introduced pump drill (P 86).

**Laughlin, W.S., S.B. Laughlin, and S.B. Beman** **x**

1991 Aleut Kayak Hunter’s Hypertrophic Humerus. *Current Research in the Pleistocene* 8:55-57.

Comp to 18 C Russian: Aleut shorter but much stouter, larger muscle attachments. Difference attributed to kayak paddling [atlatl not mentioned.]

**LeBlanc, Steven** **o**

1997 Modeling Warfare in Southwestern Prehistory. *North American Archaeologist* 18(3):235-276.

pretty much same info as others below

**LeBlanc, Steven** **o**

1999 *Prehistoric Warfare in the American Southwest*. University of Utah Press, Salt Lake City.

[Excellent and readable book, arguing case for endemic warfare in SW, with changing patterns through time, but usually associated with climatic stress periods. Sometimes he pushes too hard with dubious arguments.]

Atlatl assoc with fending stick implies formalized combat p 96, p 106, 124. [But are S-shaped sticks in BM context really for fending? Talking to him in 2011, agrees this is not certain.] Arrow from self-bow 50% faster than atlatl dart (cites Bergman et al, Raymond velocity figures), can’t fend, with bow, fending sticks disappear. Self bow intro ca 200 AD from N, recurve sinew-backed bows 1100-1400s. Mogollon settlement pattern shift as hills lose advantage with bow.

**LeBlanc, Steven** **s**

2003 Warfare in the American Southwest and Mesoamerica. In *Ancient Mesoamerican Warfare*. M. Katherine Brown and Travis W. Stanton eds., pp. 265-286. Altamira Press, New York.

After period of neglect, archys again looking at warfare - data + reconstructions differ in SW and Mesoam but should be complementary.

Early period SW (to AD 900): standardized artifacts (fending stick + atlatl,

basketry scalp stretcher) as well as iconography, site location, and a few mass victims indicate systemic warfare. Bow and arrow intro AD 200 in N SW. Mogollon hilltop sites (unfortified) from 200-600 sufficed against atlatl “hard to throw uphill” but abandoned with arrival of bow. Middle period (900-1150) less war but some sacrifice and Chaco-related cannibalism etc. Late period lots of evidence of warfare again. Warfare correlates with periods of environmental stress.

Data less for Mesoam, but also should include non-peaceful spread of agriculture in Formative. Classic warfare widespread in iconography, can't be just elites. New technology (bow) must have changed war here too - AD 600 collapse of Teotihuacan, and AD800 end of Classic Maya maybe because now could arm commoners with an “area weapon” that required less skill to saturate an area with projectiles - dangerous to elite warfare. But arrival time of bow uncertain. Atlatl survived and bow lacking in iconography because of elite emphasis.

### **Lechler, George**

o

1951 The Interpretation of the ‘Accident Scene’ at Lascaux. *Man* 51: 165-167.

Usual interpretation: man speared bison, whose entrails are out and who is looking away, so no longer in action, then man was killed by rhino, who is walking away. [Unnecessarily complicated, and rhino is stylistically different from others, probably not part of same story.] Short hooked object is a dart, with typical Upper Paleolithic bone point; bird on stick is not totem, but the spearthrower. Parallels in Larthet cave dart-thrower with monkey head and hook fragment carved with birds, which would magically aid flight of dart. “Entrails” are actually abstract magical signs, paralleled by others [more rectilinear] on other animals. Editor’s note adds possible interp of bird as decoy, with short object as spearthrower, which would explain cross piece.

### **Leduc, Charlotte**

s

2011 New hunting evidences from projectile impacts on bones in Danish Maglemosian sites: identification problems and contributions to archaeozoological analyses. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Two kinds of evidence from Mesolithic: hunting weapons (bow and arrow fragments, lithic and bone projectile weapon elements) and their use-wear traces, and hunting lesions from impact on animal bone remains. Embedded lithic or bone projectile in a bone constitutes incontestable proof of hunting, making the direct connection between weapon and game. Archaeozoological re-analysis of the two Maglemosian faunal assemblages from Mullerup and Lundby Mose (Sjælland) (9600-6500 BC), led to the discovery of new hunting lesions in Danish Early Mesolithic Period, two from the Lundby Mose site, seven from the Mullerup site, among them embedded flint fragments, perforations. Need meticulous analysis of bone assemblages, leaning on recent experimental works

on projectile impacts, to increase such discoveries. Healed lesions reflect on settlement patterns since they represent repeated hunting of same animal populations.”

### **Lee, Arthur**

1991 Weapon Found at Marcos Island Combined Atlatl and Sabre. *The Atlatl* 4(1): 5-6

Excerpts from Cushing 1896 - apparent atlatl with bottom edge set with shark teeth. [Possible atlatl but probably not; see Kolianos and Weisman 2005; Whittaker 2012].

### **Lee, Craig**

**x**

2010 Global Warming Reveals Wooden Artefact Frozen Over 10,000 Years Ago in the Rocky Mountains. *Antiquity* 84(325) Online Project Gallery. URL: <http://antiquity.ac.uk/projgall/lee325/>

Alpine ice near Yellowstone. Foreshaft 1.07 m long of birch sapling. Conical proximal end, split out notch distal end, markings possible ownership marks. Comparison to Gypsum Cave material suggests use with 300mm dart [shorter than foreshaft ?] and atlatl.

Calibrated AMS dates 10281-10497 BP = Cody Complex [later Paleoindian].

### **Leeth, Doug**

**o**

2004 *Spearthrower*. DVD, 120 min, Ice Age Arts Inc. (privately distributed.).

Starts with info on WAA and ISAC. Richard Lyons outlines prehistory with his board of different models, emphasizing Webb's Indian Knoll forms, with bannerstone toward hook. Also Eskimo models and Basketmaker-inspired form. Promotes atlatl leading to bow because both flex. DL: Throwing Techniques and atlatl construction, shows several modern models, 2 grips – forward (split finger) or to side, likes former and Bracken's version, blames closed fist side grip for tendon strains. Bob Berg: Hafting and Fletching, demonstrates use of bannerstone as spindle whorl on rested spindle for making cordage lashings. His theory to explain Webb's finds: spindle + atlatl stored + buried together in alignment. [Ingenious but not convincing]. Scorches wooden darts with propane torch to straighten and harden. The Younger Generation shows Ethan, 6, throwing. Mark Bracken, Tips on Accuracy, bannerstone as counterweight, dart matched to atlatl, 7' cane, keep tip still, arm up, wrist flick gives most energy. [Adequate info and demo. If step frame by frame, dart takes 9-10 frames = 1/3 sec to reach target at 20 m, which would = ca 60m/sec - but that would imply about 134 mph, which is unlikely, see Whittaker + Kamp 2007]. DL: Point styles – field pt, copper blade, copper pt or nail embedded in tip like pencil, antler cone. Bamboo and River Cane – DL shows harvest [but interestingly, he uses Berg wooden darts throughout]. Bracken discusses straightening: start with worst spots, over propane flame, does

nodes first, then segments. Running Pig target on sloping cord with pulleys. Fletching and Coning Darts – DL, with modern jig. Dart Penetration Test on 5/8” plywood and truck door. Steel broadhead, Archaic Hillsborough, and Clovis points perform similarly, pierce but not transfix, stone tips damaged but not broken. Same broadhead on 1.2 oz arrow with 55 lb bow does similarly on plywood but less penetration on door. [Unsystematic but very effective demonstration – as he notes, since he has killed many deer with arrow and broadhead, the atlatl is just as powerful.] Spearthrowers in Action – random shots of different throwers from variety of angles at an event. [Overall a nice introduction to atlatls with good practical info for modern sport].

**Leon-Portilla, Miguel**

o

1962 *The Broken Spears: The Aztec Account of the Conquest of Mexico*. Beacon Press, Boston.

p 77 After the Spanish attacked the celebrants at Feast of Toxcatl at the Templo Mayor, the Aztec retaliate: “Then the battle began. The Aztecs attacked with javelins and arrows, even with the light spears that are used for hunting birds. They hurled their javelins with all their strength, and the cloud of missiles spread out over the Spaniards like a yellow cloak.” from Sahagun, originally written in Nahuatl. [the yellow cloak should be cane shafts of what must be atlatl darts. See Sahagun 1975]

**Leroi-Gourhan, André**

o

1967 *Treasures of Prehistoric Art*. Harry N. Abrams, Inc, New York.

Big coffee-table picture book on Paleolithic art, with good text. Includes good photos of a dozen of the nicest spear throwers.

**Letourneaux, Claire, and Jean-Marc Pétilion**

x

2008 Hunting Lesions Caused by Osseous Projectile Points: Experimental Results and Archaeological Implications. *Journal of Archaeological Science* 35:2849-2862.

Upper Magdalenian (Upper Paleolithic) antler points, fork-based or double beveled, from Isturitz, France. Could be on darts or arrows - earliest definite bow evidence is Ahrensburgian arrow shafts from Stellmoor, Germany, ca 2000 yrs younger than Up Magd.

Replicated pts on foreshafts with hide glue and sinew, used (96) on arrows with self bow, and atlatl darts 2.5 m L, 157-193 gm, atlatls of Up Pal type 50-70 cm long, Chauvaux, Cattelain, Demoulin, and Rivere throwers. Two calf, 2 adult fallow deer carcasses at 10-13 m.

Three types damage to faunal bone: notches, punctures, and perforations (through and through), some with associated cracks, beveling, and embedded pt frags. Scapula most likely to be perf'd. Ribs most likely notched. Lighter arrows

have less kinetic energy than darts, but similar bone impacts except maybe more deflection and thus fewer punct + perf, more notching. Notching and perf often with internal beveling [like concoidal fracture]. Weapon impact rarely recog in archaeofaunal assemblages - preservation and recognition problems.

[Also provides evidence that round-section antler points on atlatl darts are very effective, deep wounds into bone, sometimes even transfixing animal and perforating scapula from inside.]

**Lewis, Darrell**

s

1988 *The Rock Paintings of Arnhem Land, Australia: Social, Ecological, and Material Culture Change in the Postglacial Period*. BAR, Oxford.

rock art chronology of spear throwers in Akerman and McConvell

**Lindsay, Alexander J., J. Richard Ambler, Mary Anne Stein, and Philip M. Hobler**

x

1969 *Survey and Excavations North and East of Navajo Mountain, Utah, 1959-1962*. Museum of Northern Arizona Bulletin No. 45, Flagstaff.

Report on several Anasazi sites including Sand Dune Cave, with Desha Complex (Archaic) and Pueblo I-III material but mostly Basketmaker II. Cache of dogskin bag with gaming pieces, turkey and other bird feathers, bone tools, uranium ore, 18 unfinished dart pts, 6 dart foreshafts with stone pts, 8 cylindrical “gaming sticks” of horn [flaking punches – see Geib], and other things. Also in cave, antler nubbin flakers, further dart and arrow fore and main shaft fragments, snares, sandals, basketry, a burial with Archaic points, etc. Isolated in fill, probably cached, was complete atlatl of classic Basketmaker type [on display, Museum Northern Arizona]. Described, photos, nice drawings + description of complex grip loops. Flat upper surface, convex lower, 59 cm long, 15-17 mm wide with distal flare to 26 mm, very short groove under spur, flexible with marked bowing, notched for grip with loops of leather rolled around sinew, complexly bound, decorated with blue feathers. [see also Matson 1991, Hunter 1992; Whittaker et al. 2009; LaRue 2010]

**Linné, Sigvald**

x

1937 Hunting and Fishing in the Valley of Mexico in the Middle of the 16<sup>th</sup> Century. *Ethnos* 2(1):56-64.

ca. 1550 map of Valley of M in Uppsala U. Library decorated with scenes of life, made for Emperor Charles V by Alonso de Santa Cruz. Similarities to codices. Shows blow gun, bow and arrow, nets, and hunting birds with 3-pronged spear + atlatl [probably, but atlatl not clearly shown] on Lake Texcoco.

**Lipo, Carl P., Robert C. Dunnell, Veronica Harper, and John Dudgeon**

2008 Beveled Bifaces and Ballistics Technology. Unpublished electronic

document, “for submission to Journal of Archaeological Science.” URL: [www.csulb.edu/~clipo/misc/BeveledBifacesAndBallistics-V2.doc](http://www.csulb.edu/~clipo/misc/BeveledBifacesAndBallistics-V2.doc) accessed: 7/12/11.

Beveling of Archaic points as knife resharpening vs to spin projectile. Many citations, especially early American archaeology. Only Wilson (1898) experimented; he found that beveled points on unfletched shafts rotated when dropped, drawn through water, or in wind tunnel. But mostly ignored by recent interpretations. Evolutionary view: beveling only on post-Clovis; most common pre-bow, therefore should be a response to particular set of conditions or requirements.

Like Wilson’s experiments, aerodynamic theory supports bevel as producing spin. “Computational fluid dynamics” allows us to model effect of air moving across different biface shapes to see if bevel would have effect in real world situation. Model shows that spinning forces should be created at wind speeds consistent with prehistoric projectiles. Wind tunnel experiments on bifaces mounted on a freely rotating axis show that they do indeed rotate. Rotation should improve accuracy and reduce drag of attached shaft, so should be selected for once it has been invented. Since not on all points, there must be certain conditions where it is advantageous. Mostly on larger points, thus larger shafts, whose rate of rotation will increase more slowly. Light objects at same starting velocity don’t go as far, so rotation would have less effect [explaining why arrow points not beveled?] Smaller faster arrow need fletching to keep from tumbling, and it can also be used to rotate them more effectively than point bevel. So optimal payoff for rotation between 100-220 grams, dart + thrown spear weight. Knife beveling likely too, distinguishable by wear patterns. Bevel/spin also should increase damage at impact.

[Is the rotational inertia enough to keep dart spinning after point hits solid material? Doubt it. Does rotation by point stabilize an atlatl dart? Doubt it very much. This whole paper is a good example of an experiment that does not apply well to real life, because it simplifies the variables too much. Like Wilson’s experiments, Lipo et al. show that bevels can rotate a shaft under ideal conditions. BUT: A straight, non-flexing shaft in an air tunnel is not enough like a flexing atlatl dart in flight. Pascal Chauvaux’s videos of darts in flight shows that they do indeed rotate as well as flex - but they have neither a beveled point, nor spiral fletching. They rotate in uneven pulses because of the oscillation of the flexing shaft. Resharpening of knives and points remains the better explanation of beveling. Arrow points are not usually beveled because many are too small to make it worth while, or perhaps because unlike dart points on foreshafts, they don't get secondary use as knives.]

**Lipo, Carl P., Robert C. Dunnell, Veronica Harper, and John Dudgeon**  
2010 Beveled Bifaces and Ballistics Technology. Unpublished electronic document, submitted to American Antiquity. Accessed Jan 2, 2012, URL: [http://www.isu.edu/anthro/dudgeon/pubs/Lipo\\_et\\_al\\_2011.pdf](http://www.isu.edu/anthro/dudgeon/pubs/Lipo_et_al_2011.pdf)

Pretty much the same as 2008, some rewriting, added caution that not all beveling must serve same purpose, discussion of point types: Why is beveling mostly in earlier Archaic? Clovis pts not beveled because they were “stabbing” and cutting tools. Beveling appears with Dalton pts, which are also more consistently pointed, thus more specialized as projectiles. Abrupt decline of beveling unlikely to be reduced need for the accuracy promoted by spinning projectile. Unless some incompatible invention is more valuable, or unless spin achieved by adding flitching, in which case points don’t need to be so heavy. Can’t resolve this now.

**Lister, Adrian, and Paul Bahn** o  
1994 *Mammoths*. Macmillan, New York.

[Nicely illustrated popular book, but the artists needed more coaching when drawing prehistoric humans: Clovis hunt includes silly looking hunters using crude hand-thrown spears and boulders, and Upper Paleolithic camp scene has a woman roasting an unskinned deer and one of the worst depictions of flintknapping ever.] Photos include two Up Pal mammoth depictions on spear thrower parts, from Bruniquel and Canecaude.

**Livingstone, Carl B.** x  
1932 Trailing Down the American King Tuts. *New Mexico* 10(5):-7-9.

Guadalupe Mts Basket Maker cave explorations, [unscientific, poorly written.] Broken fending stick [photo], “fragments of the dart-hurler, forebear of the bow-and-arrow” [no details].

**Lockett, H. Claiborne, and Lyndon L.Hargrave** x  
1953 *Woodchuck Cave: A Basketmaker II Site in Tsegi Canyon, Arizona*. Northern Arizona Society of Science and Art, Flagstaff.

Brief report on excavations in 1933-34. Burials in cists/storage pits, mostly disturbed (all missing crania) in prehistory, but lots artifacts. Cist 7 included old man and young woman, flexed, with decorated wooden combs [showing kin connection?]. Above L shoulder of M, 4 pts, 6 stone drills and scrapers. Above head parts of 2 atlatls broken into 7 inch sections. Frags of another near head of woman but in fill so may not be associated with her. Stone beads, stone pipe with M, on F chest gopher, skunk, and prairie dog mandibles. M had lignite pendant, bag with seeds and pigments. [Rather well endowed burials.] Photo shows 2 pathetically rotted distal end atlatls, 2 possible grip ends, one hide finger loop.

**Lockhart, James** s B  
1993 *We People Here: Nahuatl Accounts of the Conquest of Mexico*. University of California Press, Los Angeles.

[Gives English translation by Lockhart parallel with Nahuatl original and sometimes Spanish - selections from several documents.]

From Book XII of Sahagun's General History of Things of New Spain (Florentine Codex): p136 after massacre at Toxcatl festival "The warriors quickly came outfitted, bunched together, carrying arrows and shields. Then the fighting began; they shot at them with barbed darts, spears, and tridents, and they hurled darts with broad obsidian points at them. A cloud of yellow reeds spread over the Spaniards."

p 225-226, chapter 37, as the Spaniards attempt to flee by the canals. Two versions, 1) from Spanish text: ... y los tlatlulcanos del barrio de atliceuhyán, y los del barrio de ayacac resistían por el agua no descansaban en la pelea eran tan espesas las saetas y los dardos que todo el ayre parecía amarillo. "The Tlatelolca of the districts of Atliceuhyán and Ayacac fought back on the water, never resting from the battle. The arrows and darts were so thick that the whole sky seemed yellow."

2) from Nahuatl, last line: ...in iquac atlatica quitlaca iuhquin cozpul ommoteca in impan iaueme... "And the boatmen and archers of Atliceuhyán and Ayacac made great efforts to encounter [the Spaniards], they lost no time, they were equal to them. It seemed that barbed darts showered down; the arrows came in large bunches, <as when a serpent strikes>. When they threw darts with the atlatl, a yellow mass seemed to spread over the enemy."

**Lockwood, Douglas W.**

o

1980 *I, The Aboriginal* (first illustrated edition). Rigby Publishers Ltd, Adelaide.

Autobiography of Waipuldanya aka Phillip Roberts as told to Lockwood. First pub 1962. Born ca 1902 in N Australia, Roper River on Gulf of Carpentaria. As boy, "we fought with toy spears, the ends bound with rags so that anyone who was hit wouldn't be badly hurt." Hunting with woomera + 10 foot shovelnose spear frequently mentioned but not detailed. Mission school for a few years, then hunt with older man (his future wife's bro) for training, so at ca age 10-12. P. 80 'My spears were balanced in relation to my height, my weight, and the length of my arm.' Spear manufacture described, blood and ochre décor. Spear "fitted to woomera and test-thrown, spinning like a rifle bullet. If rear end oscillates too wide an arc it will whistle in flight, advertising its approach... must be trimmed and straightened until it is silent and perfect. ...Woomera is also made from Djindi-djindi with a wooden point bound to the shaft by wax made from roots of an ironwood tree.' Boomerangs of secondary importance, mostly for moving targets like birds.

Ultimately he went to school, met a doctor and became his orderly, had medical training.

**Loendorf, Lawrence L.**

o

2008 *Thunder and Herds: Rock Art of the High Plains*. Left Coast Press, Walnut Creek, CA.

Archaic mostly abstract motifs, pecked, a few quadrupeds. Possible Paleoindian under Archaic at Ancient Hogback site, CO. Incised abstract and linear elements underlying pecked Archaic abstracts. Includes a few possible dart depictions [likely]. Similarities to Gault Site abstract Clovis engravings.

Purgatoire Pecked-I Petroglyphs of Developmental Period (AD 100-1050, intro of bow with Scallorn pts, continued larger pts = atlatl, villages, pithouses, scattered evid of agric + pottery in some sites). Quadrupeds most frequent (deer, mt sheep, antelope, bison, elk) also anthropomorphs, abstracts, grid “nets”. Some quadrupeds have protruding spear or arrow. [apparently no depictions of bow or atlatl]. Purgatoire Pecked-II Petroglyphs of Diversification Period (AD 1050-1450), much cultural continuity. More anthro petros, more active, quadrupeds with strike marks, or spears/arrows, rare depiction of figure with bow. Red-tail Site – anthro picto with spear/arrow/atlatl (Fig 4.3) [line with loop]. Others – some anthros hold looped end of line piercing animal, not how atlatl is used, prob not atlatl [also would be very late atlatl – more likely symbolic strike with arrow]. Ethnog examples of hunt magic by shooting petros with arrows.

P 148 “propensity of rock art researchers to identify any linear hand-held rock art implements as atlatls.” Espec lines bisecting circles, but comp to Pecos, MN petros of atlatls [why not SW?] they are not convincing. More likely thrusting spears.

### **Lombard, Marlize, and Justin Pargeter**

**x**

2008 Hunting with Howiesons Poort Segments: Pilot Experimental Study and the Functional Interpretation of Archaeological Tools. *Journal of Archaeological Science* 35:2523-2531.

HP = Middle Stone Age, S Africa, ca 70-55,000 BP. Distinctive backed blade segments and blade tools. Use as barbs or tips on projectile weapons? Tested 4 configurations, look at fractures. Glued into slotted wood shafts [look real crude to me - dowels with saw cut ends, apparently taped to larger shaft]. Machine [not specified] launch, 10 per weapon, 27 weapons, 167 shots into impala carcass. 85% penetrated, 37% survived all 10 shots. Transverse hafted segments least effective. Bending fracture with step termination, or with spin-off flakes one or both faces, + burination considered diagnostic of impact. Also found notching [they seem unclear but photos show bending fract notches out of edges - probably are impact]. Burination + bending fractures common in experiment + arch specimens. Location of residue traces suggests variability in hafting as in experiment. Tip cross-sectional area values (Shea 2006) in range of ethnog arrow points, some in range of darts or spears. So HP segments make effective weapon armatures and some were used that way.

### **Lombard, Marlize, and Laurel Phillipson**

**o**

2010 Indications of Bow and Stone-tipped Arrow Use 64,000 Years Ago in KwaZulu-Natal, South Africa. *Antiquity* 84(325):635-648.

Stone tipped hunting technology back 100k in S Africa, mostly small stone points, but hard to distinguish spear, dart, or arrow. Here uses geometric stone artifacts other than points, identifying direction of impact based on patterns of macro-fracture, micro-wear, and micro-residue. Suggest spring-snares as precursor - both use bent wood and strong cordage. Maybe bow drill, evidenced by drilled holes in hard material [not as good an argument, bow not necessary. Thankfully they do not suggest atlatl as spring. In fact, while they mention spearthrowers, they hardly discuss them, contrasting spear vs arrow. This makes the whole project problematic since atlatls are far more likely at this early date than bow and arrow unless they can demonstrate some ability to distinguish them. I guess their small microliths hafted as transverse points seem more likely on arrows than darts.] Another precursor technology is hafting, and fletching is possible evidence of arrow but not necessary as Ju/'hoansi show.

So suggested checklist for detecting bow use: long strong cords, formal knots, use of latent energy in flexed wood, fishing + fowling, snares, bow drills, formal hafting technology, broad + varied hunting, change in faunal assemblages, change in climate and vegetation -- none alone, but when assoc with morphological, use-trace, and contextual evidence.

Howiesons Poort (59-65,000 years ago), Sibudu Cave, 79 stone segments [microliths], dimensions fit arrowheads, but some larger could be on spears or darts. Of 318 from SC, Klasies River etc, 21-24% have impact fractures. [Problems: these are microliths, presumably hafted as transverse arrowheads or side blades on organic points. They are little tiny pieces of quartz, crummy stone to see anything on, and I want to see more experiment before I accept all the little damage along fragile edges as "impact".] On 53 segments there are 971 occurrences of animal residue, mostly along edges. Little evidence in use-wear for cutting/scraping, and backed edges were hafted with compound adhesives. Some striations begin at impact scars on edges.

Further context: small fast game, fish, probable use of snares for small antelope, cordage for beads at least.

### **Lombard, Marlize and Isabelle Parsons**

o

2011 What happened to the human mind after the Howiesons Poort? *Antiquity* 85(330):1433-1443.

If bow and arrow started 64,000, why lost later? Should not assume that technological evolution is "accretive and progressive." Populations adapt up and down the slopes of "rugged fitness landscapes" with more or less success, and to changing conditions, i.e. there are peaks and valleys of adaptation. Unstable demographic systems interrupt build-up of knowledge; new behaviors may not be "fixed" (remembered and transmitted), or archaeologically visible unless successfully adopted by large population over long time. Technological simplification does not necessarily mean behavioral regression; post-HP populations retained other early modern traits, even though invented bow 64k and

lost after 59k. Climate change concentrating people in refugias may have spurred development of technology and transmission, and amelioration may have spread and isolated the populations while allowing easier subsistence, or greater specialization on resources not needing bow and arrow. [Interesting theoretical discussion, but starts from poor premise: their evidence in earlier articles is NOT adequate to demonstrate bow and arrow presence.]

**Lopez Lujan, Leonardo**

**o**

2005 *The Offerings of the Templo Major of Tenochtitlan*, revised edition. University of New Mexico Press, Albuquerque.

Central ceremonial district destroyed by Cortes, razed for construction of Metropolitan Cathedral. By 1700s, finding major statuary, and offerings reported through 19<sup>th</sup> C, also many unreported. Excavations to expose Templo 1979-82, 1980s. Dual shrines on top of TM to Huitzilopochtli and Tlaloc. Built in 1400s.

Analysis of 118 offerings, some from earlier finds, but most properly excavated undisturbed primary contexts reflecting “area of activity” i.e. repetitive rule-ordered religious ceremony, therefore we can interpret some of the rules. Numerical taxonomy analysis using artifact types as attributes to produce dendrogram interpreted as 13 “complexes” of associated artifacts, and 20 “complexes” or types of offering. [Unfortunately, this actually obscures patterns - it would have been better to work with object associations in the different levels of the offerings, and proximity of artifact types to one another.] For instance “representations of atlatls [none illustrated or described!] are clustered in Artifact Complex M with skull mask, beheaded skulls, personified sacrificial knife, tortoise, saw fish, sea urchin, sand, serpent, alligator, shark, rattlesnake, eagle, serpent form scepter, chicahuatzli scepter, bone bloodletter, brazier, hatchet and mace, epcololli, obsidian serpent head, turquoise mosaic, obsidian earplug, projectile point. [In other words, too many things to be usefully interpreted as a group - some refer to sacrifice, some to war, some to water/sea, some to fire, etc with many overlapping meanings.]

Identifies statues with 2 knobs on head as Xiutecuhtli/Huehuetotl, the Old God of Fire, central to universe, associated with braziers and cardinal direction fires, shown in one codex at center of world armed with atlatl + darts. Of 118 offerings, 26 include these statues, may relate to annual New Fire ceremony, in 22/26 also a Tlaloc sculpture - so reflecting duality: X/H = male, hot, celestial paired with T = wet, dark, terrestrial, and female [? but Tlaloc isn't shown as female].

P 177, 178 drawings of atlatl wielding dieties [unidentified] on ceramic cinerary urns from offerings 10 and 14. [But he doesn't ID the gods, nor give proper descriptions of the Complex E offerings (those with cremated remains in a container)]. They may “indicate death of an officer in battle” p. 83.

[Although there are supposedly atlatl representations [not described, but I think a miniature atlatl form scepter or the miniatures published in Saville 1928], and many things symbolically related, like serpents, there are NO recognizable

atlatls in the offerings at the Templo Mayor, despite the frequent depiction of Aztec gods with atlatls as important part of their power + gear, especially Huitzilopochtli, to whom the temple is dedicated along with Tlaloc.]

[I wish this had been a photographic catalog of the offering contents - they are not even enumerated or described in detail, and the drawings of the offering contexts are poor quality without enough detail. See McEwan + LLL 2009 for some pics, including the urn above, and Brumfiel + Feinman 2008]

**Lorentzen, Leon H.**

1993 *From Atlatl to Bow: The Impact of Improved Weapons on Wildlife in the Grasshopper Region*. MA Thesis, University of Arizona.

Small pueblos in central AZ, built 1260-1270s, abandoned and burned 1290s. Grasshopper Springs site dominated by larger corner notched points, neighboring Chodistaas site has more smaller triangular notched + unnotched points. Size differences, especially stem thickness and width, compared to surviving + ethnographic hafted points, suggest corner notched = dart, triangular = arrow. Shaft straighteners (work for reed arrows) 4 on floor at Chodistaas, 2 in fill (later reuse) at Grasshopper Springs. So transition to bow and arrow was late 1200s in this region.

After 1300 bow and arrow was improved by matching arrow sets - find perforated antler = arrow gauges [but why then is there so much diversity in size and form of points at Grasshopper 1300-1400?]. Population increase and better hunting technology resulted in destruction of game - some evidence in faunal remains and human skeleton isotope studies.

[Good try but late retention of atlatls is just not convincing: he shows definite differences in point assemblages, but points are still not direct atlatl evidence, larger points may be arrows too, why would some sites in central AZ still use atlatl long after all others there and in rest of SW had changed, why are there no late cave finds of atlatls or artistic depictions anywhere in SW?]

**Lotz, Mickey**

o

2008 Arrows of the World. In *The Traditional Bowyer's Bible, Volume Four*. Pp. 213-254. The Lyons Press, Guilford, CN.

Lots of arrow photos, including hafted stone pts from N. Am. With atlatl, longer distance possible, need fletching for stabilization. "Even earliest primitive arrows show evidence of spiral fletching." [but actually, of the many he shows from N. Am. and rest of world, very few have spiral. ]

**Loud, Llewellyn, and Mark R. Harrington**

1929 *Lovelock Cave*. University of California, Berkeley. (republished 1991, Falcon Hill Press, Sparks, NV).

Pp. 99-100 spear thrower, notches for grip, no loops, groove but hook missing, 45 cm long, illustration of model of original which is lost. [See also Mildner 1974 - a very odd form with grip like Arctic but notched like BM, flat shaft like Oregon type, distal missing]. Also found were cane shaft fragments, and foreshafts, some bunts, some with stone points.

**Lowe, Pat** **s**

2002 *Hunters and Trackers of the Australian Desert*. Rosenberg Publishing, Singapore.

Personal accounts of tracking-related natural history, nice photos. Lowe married Jimmy Pike and learned from him and relatives in Walmajarri people. Female perspective, lots mention women hunting, including with spears and other weapons. Central desert depopulated since 1960s, nobody living old life now, but many hunt and visit and know old ways. Hunter's tools: digging stick, coolamon wood dish, kana probe or spear (kularta), spear thrower (ngalpiliny), hunting sticks. Male carried 1 or more spear, woomera, pair hunting sticks (throwing clubs, not boomerangs). Different spears - some of wood, some of bamboo. Hunting spear just sharp point, if weapon, add quartz point, barbed spears used in public punishment, spearing legs. Spear-thrower used with running start, "artificially lengthens arm and gives greater thrust." Only men used in Walmajarri, but women said to have used in past elsewhere. [Jimmy shown in two pics with atlatl. On cover using flat northern type with bamboo spear with "shovel" metal point. P 19 with long bamboo spear, very long northern type thrower. Not the desert "woomera" types.]

Casual and intentional use of fire, creates burnt off mosaic of niches, removes spiny spinifex grass, promotes plant growth and game.

**Lowell, Julia C.** **o**

2010 Survival Strategies of Gender-Imbalanced Migrant Households in the Grasshopper Region of Arizona. In *Engendering Households in the Prehistoric Southwest*. Barbara Roth ed., pp. 185-207. University of Arizona Press, Tucson.

Argues that large late pueblo of GH (central AZ, Mogollon/W Pueblo roots) incorporated migrants displaced by warfare in Anasazi areas to N: war kills more men than women + children, thus refugee populations imbalanced, evidence of conflict in late 1200s in Anasazi region leading to abandonment around 1300 as Grasshopper founded, more violent death there among men, GH burial pop high numbers of females and subadults, low males, regional changes in pottery suggest immigration of women, not men.

At Chodistaas and Grasshopper Spring predecessors to GH, built 1270-1280s, Mogollon architecture in both, but at C, Anasazi pottery types, some imported, most made on local clay = influx of women. New triangular points may indicate some men, but more indicative of shift from atlatl to bow for warfare. Men would have introduced Anasazi kiva tradition. [she misuses Lorentzen, saying triangles

are late at C – they dominate there, I see no good evidence of a change, and shaft straighteners he considers also = arrow use are on floor, not evidence of late intro. Bow was well established long before the period she discusses.]

**Lubbock, Sir John**

o

1890 *Pre-Historic Times: As Illustrated by Ancient Remains and the Manners and Customs of Modern Savages, Fifth Edition*. Reprinted 1971, Books For Libraries Press, Freeport.

p 444: Modern Savages: Australians: spear is “national weapon” 10’ long, wood or cane, barbed. “They are light, and one would scarcely be inclined to believe that they could be darted with any force; this however is effected by aid of the wummera, a straight flat stick, 3 feet in length, terminating in a socket of bone or hide into which the end of the spear is fixed. The w is grasped in the R hand by 3 fingers, the spear lying between forefinger and thumb. Previous to throwing it, a tremulous or vibratory motion is given to it, which is supposed to add to the accuracy of the aim... Capt Grey tells us that he has often seen them kill a pigeon with a spear at a distance of 30 yards, and Capt Cook says that “at a distance of 50 yards these Indians were more sure of their mark than we could be with a single bullet.”

**Luebbers, R. A.**

x

1975 Ancient Boomerangs Discovered in South Australia. *Nature* 253: 39.

Wyrie Swamp peats date 10,200 ±150 – 8,990 ± 120 B.P. “Core-tool and scraper tradition” like Lake Mungo, wooden gear includes 3 complete boomerangs [but the dolt illustrated the fourth fragment instead], digging sticks, short simple spear, barbed javelin fragment.

**Lutz, David L.**

o

2000 *The Archaic Bannerstone: Its Chronological History and Purpose from 6000 B.C. to 1000 B.C.* David L. Lutz, Newburg, Indiana, privately published.

A massive and finely illustrated attempt to analyze chronological change in bannerstone styles. Examines associations of different bannerstone forms with projectile point types, C14 dates from excavations, and other chronological evidence, using museum collections, published excavation data, and non-archaeological collections. Reviews theories of function and history of study. Bannerstones are originally atlatl weights, but the ritual or social use is emphasized. [Usual weak arguments against atlatl function. I don’t understand why people want to think that stones actually used as atlatl weights could not also have ritual or social importance.] Recognizes a “3-Bannerstone Cache” trait in Middle and Late Archaic. Such finds often have stones of different form together, and different contemporary forms represent clan or tribal symbols. [Not a bad idea, although a bit simplistic. See Sassaman 1988.] Suggests antler atlatl hook

chronology: short Eva type 4500 BC, longer Black Earth type with shaped hook end 3800 B.C., long simpler tine hook Indian Knoll type 3000 B.C., Terminal Archaic type with slotted attachment to atlatl 2200-1200 B.C. The bannerstone chronology is too complex to summarize here. [Useful study, and just what needed to be done, but some problems. Introductory sections are badly organized. Hard to extract the important chronology or check the reasoning. He should have given the gist in a chart or table. Non-professional collections are dangerous – fake artifacts and failures of documentation and finders’ memories. Some of the associations claimed are probably not good, as when he argues that bannerstones found together on a site surface are contemporary, but points from same site are older “found” points. Although the photos are excellent, only outline size is measured, not hole diameter or weight.]

**Lyman, R. Lee, Todd L. VanPool, and Michael J. O’Brien** x

2008 Variation in North American Dart Points and Arrow Points when One or Both are Present. *Journal of Archaeological Science* 35:2805-2812.

There should be an increase in variability with introduction of new technology as makers experiment to find best combination of attributes, followed by decrease as less functional variations are discarded. Test when arrows are replacing darts, in stratig sequences in Verkamp Shelter, MO, Mummy Cave, WY, and Gatecliff Shelter, NV. Appears to work: “Diversity in dart-point classes should increase as artisans experiment with modifying dart points into effective arrow pts. Thus diversity in projectile points in general (arrow + dart) should be high ... when bow and arrow first appear but then decrease as some classes of dart points and less-efficient arrow points cease to be manufactured.” [Plausible, but there are many problems in testing this interesting idea: 1) depends on assumption that can tell dart from arrow point, which is by Thomas weight + neck width in some cases, by typology in other -- neither of these is good enough. 2) assumes that variation is functional, ignoring style. If all variation is functional, one should not expect standardization anyway, since artifacts are seen as responding to changing adaptive needs. 3) The trends visible in the variability measures are very slight. 4) Both positive and negative trends are explained by “experimentation” plus “archaeological misclassification” allowing any trend to fit the model.]

**Lyons, Richard B.**

1999 The Spine Tester. *The Atlatl* 12(1):7-8.

Method of measuring spine, data from a number of atlatlists.

**Lyons, Richard B.**

2002 Atlatl Weights. *The Atlatl* 15(4):1-3.

Lutz book reorders bannerstone sequence. Webb had hook type going from long to short, so weight could be closer to end of atlatl. His final form bannerstones

with hook are mistakes based on damaged specimens, but an atlatl with the weight out past the hook actually works well.

**Lyons, Richard B.**

2003 Atlatl Weights. *The Dart* December 2003: 17-20.

**Lyons, Richard B.**

2004 Atlatl to Bow. *The Atlatl* 17 (2): 12.

Similar principle of flexing energy storage, bow has two limbs, atlatl one. No known archaeological intermediates, but Katharine Dopp, 1912, U Chicago fictionalized primitive Denmark in *The Early Sea People* with illustration of combined atlatl/bow. [Bow and atlatl are *not* similar principles, and Dopp's figure derives from Cushing and is quite implausible, although Lyons has made one. I tried it - it did work, but not great, no advantage to springing action.]

**Lyons, Richard B.**

o

2010 A Reproduction Moche Atlatl. *The Atlatl* 23(3):1-2.

Nice simulacrum of specimen from royal tombs at Sipan. Color picture.

**Lyons, Richard B.**

o

2011 Dart Flex: Conversion of Stored Energy to Enhancement of Forward Propulsion. *The Atlatl* 24(2): 12-13.

Flex and oscillation makes feathers act like fishes tail to aid propulsion. Flex springs dart off hook before complete arc of throw. Thus flex adds to energy mostly from lever action. [I'm dubious about both, but the first is worth testing. See Henry 2011.]

**Madden, James W.**

1991 *The Art of Throwing Weapons*. Paladin Press, Boulder.

Simplistic basics for knives, tomahawks, spears, etc, and atlatl. None with enough detail to be useful. [Has he ever really mastered atlatl? - uses bad motion, poor atlatl, and apparently rigid heavy spear. Not useful.]

**Madden, Ray**

o

2007 Hunting Small Game in Missouri. *The Atlatl* 20(3):9-10.

Ray's squirrel is first small game kill under new MO law legalizing atlatl.

**Madsen, David B.**

1992 An Atlatl From Snow Canyon State Park. *Utah Archaeology* 5(1):133-136.

In lava tube cave, probably associated with adult male skeleton, estimated date 1500-2500 BP.

Simple flat stick atlatl, 59 cm long, narrowed grip but no loops or weights, integral hook at end of groove - like Basketmaker but no evidence of loops or weights.

**Malotki, Ekkehart** ○

2007 *The Rock Art of Arizona: Art for Life's Sake*. Kiva Publishing, Walnut CA.

Another book of fine photos, more analytical than Malotki and Weaver. Good intros to basic rock art theory, useful discussions of chronology and style regions in AZ. Only a few atlatl-related images: p 31 “long vertical line bisected by a small ellipse or circle generally portrays an atlatl or spear-thrower, a diagnostic motif for Archaic imagery.” [actually more common in later Basketmaker II “San Juan Anthropomorphic Style” rock art]. SJAS often large broad-shouldered anthropomorphs, often decorated, drooping hands + feet. Chinle Representational Style (BMIII) continuities but less spectacular anthros, diagnostic motifs = bighorn sheep, small anthros, fluteplayers, hunting scenes + “narrative content”. Further W in N AZ “Snake Gulch Style” is also BM with painted + pecked anthros with broad shoulders + decoration, ungulates, turkeys, and atlatls. Dates on paint 400 BC - 400 AD.

**Malotki, Ekkehart, and Donald E. Weaver** ○

2002 *Stone Chisel and Yucca Brush: Colorado Plateau Rock Art*. Kiva Publishing Inc, Walnut, CA.

Coffee-table book. [Splendid photos by EM, commentary by DW, no particular organization other than broad chronology, no depth of analysis of motifs or location, no maps or details of location. There are also unidentified sketches on the side of some pages, often as interesting as the photos. And petroglyphs were made by direct pecking, NOT done with chisels.] Many famous sites, including some atlatl depictions. Owl Spring: animal and human with dart in them. Butler Wash: dart or atlatl combined with yucca flower. “Atlatl Falls” + “Pinyon Perch”: impaled animals including carnivores, anthros striking. “Lefthand”: dart striking human. “Procession Panel”: darts and impaled animals. “Duel Ground”, Apache Co, AZ: 2 humans using atlatls against each other, holding spare darts in other hand. “Spear Rite”, Coconino Co, AZ: ogre with giant dart, impaled by others.

**Manney, Tim** ○

2006 The Effects of Cooking Time on the Strength of Pitch Glue made from Norway Spruce (*Picea abies*) Oleoresin. *Bulletin of Primitive Technology* 32:51-55.

Fresh “oleoresin” is composed of volatile terpenes which plasticize nonvolatile diterpenes, cooking drives off former. Tested resin “loaded” with ground

charcoal. Glue cooked only 15 min stronger than glue cooked much longer. Simple test relates roughly to hafting usefulness.

**Mark, Robert and Evelyn Billo**

**o**

2009 Pictographs at Hunters Shelter: Possible Extension of the Red Linear Style into the Guadalupe Mountains of Southern New Mexico. *Plains Anthropologist* 54(211):201-210.

Red Linear Style is Lower Pecos region 400km to SE, shows similarities. Probably Late Archaic, no bows. Hunting scenes with rabbits, nets, dogs, and butchering scene with hunters holding legs of prey, atlatls with darts and other tools laid around. Atlatls sketchy but look to have hook and crossbar grip on one, possible loop or weight on other.

**Markley, Max C.**

**x**

1942 Bow, Spear, and Atlatl: A Discussion of Progressive Relationships in these Weapons. *The Minnesota Archaeologist* 8 (1): 23-26.

Bow came with Athapascans, spread S, SW BM3 500-900 AD. Athapascans defeated Nahua in SW, who moved to Mexico, conquered Toltecs, who traded it to Maya, who took it to Inca. Folsom etc used spears, atlatl came later. [Almost all these ideas are now outmoded]. Atlatl has a hook or loop of thong to hold spear, acts as double length arm. Stone weights probably just ornamental.

**Marriner, Harry A.**

2000 Estolicas of the Columbian Muiscas. *The Atlatl* 13(2):1-2.

Brief historical account, legends, encountered by Spanish. Hook at each end [not explained], stone hooks, and miniature gold offerings (illustrated) known.

**Marriner, Harry A.**

**o, x**

2001 Dart-thrower Use in Colombia and its Representation in Colombian Rock Art. *The Atlatl* 14(2):1-5. Also on Rupestre/web URL

<http://rupestreweb.tripod.com/marriner.html> accessed 1/28/06

Muisca culture (700-1600 AD) both atlatl (Sp. "estolica," Muisca "Queskes") and bow and arrow represented on gold tunjo figures, as gold miniature offerings, and buried with mummies. Straight rod "Andean type" atlatl with hook and hook-like handle carved of stone or shell, 42-60 cm long, used with spear with barbed wooden points. Other estolica styles discussed, info on other parts S. Am. In rock art in Chiribiquete National Park.

[Most photos are badly computer reproduced and useless in Atlatl, but ok on web].

**Marshak, Alexander**

**o**

1972 *The Roots of Civilization: The Cognitive Beginnings of Man's First Art, Symbol, and Notation*. McGraw-Hill Book Company, New York.

[Attempts to interpret Upper Paleolithic cave art in terms of calendars and counting. The basic idea that early humans were interested in symbols and in “time-factored” thinking is good, but the specific interpretations of artifacts are often unconvincing.] P. 279 Lascaux image of wounded bison, falling man, bird on stick and short hooked object: Dismisses Laming-Emperaire's (1959) interp as spear thrower: “The hooked stick does not look like the spear throwers of the Up Pal that have actually been excavated. These have a small notch to catch hold of the spear at one end, but contain no encumbrances along the face that would hold the spear, even at the other end, for this would make its use difficult or impossible.” [Hard to know what he means, and in fact the specimens we have are only hooks, lacking the grip end, which could very well have had pegs or a cross bar.] Leroi-Gourhan's sexual symbolism also unconvincing [but in the end M has no idea, dismisses image as “perhaps the stick was a plant image” ie notation for time, Spring. See Irwin 2000, Lechler 1951]

Feathered or barbed images could = male symbols (Leroi-Gourhan) or sympathetic magic killing animals. More likely some are plants, some weapons, but reflect “time-factored” and “storied” nature of the art, not simple magic. [I find it curious that with many images of probable darts, there are few of spear throwers, and none of them in use.]

### **Martin, George C.**

1933 Archaeological Exploration of the Shumla Caves. *Southwest Texas Archaeological Society Bulletin* 3 (Big Bend Basket Maker Papers No. 3). Witte Memorial Museum, San Antonio, Texas.

Dry caves [apparently primitive excavation methods], with atlatl and related specimens pp. 24-25. Arrow shaft fragments “made for use with atlatl designed for throwing a light arrow” with deep flared nocks. Wooden arrow foreshafts 6-10” long, diameters 3/16” – 3/8”, some with notches for stone points. Wooden “atlatl javelin” foreshafts also found, one 7.5” long, 1/2” diam. with stone head cemented in with gum.

Distal end of atlatl, wood, flat, integral hook and groove. Bone or antler hook, shaped like end of flat atlatl with integral hook but no groove, hole for attaching, “a detachable device which would convert any stick of appropriate size into an atlatl.” Proximal end of atlatl, with two finger notches each side, heavy form for casting javelins. Proximal end of atlatl with single notch each side, light form for casting arrows. No apparent loops on either. [I don't find his interpretation of flared arrow nocks as intended for use with atlatl very convincing, but the idea of light and heavy atlatls and projectiles is worth considering. No information on weights that would help evaluation is provided. Kellar (1955) points out that this is apparently the only place where SW forms overlap with SE antler hook forms.] Five complete, fifteen fragments of grooved “rabbit stick” type clubs.

**Martin, Paul** x

1973 The Discovery of America. *Science* 179:969-974.

“Overkill” hypothesis of faunal extinction: models animal populations, human populations, and movement to support possibility that first humans in Americas (Clovis) wiped out Pleistocene megafauna - so fast that we should not expect many kill sites. [Classic article, but important to remember that this is a model, not evidence, and more recent information makes it much less plausible.]

**Martinez, Jorge G., and Carlos A. Aschero** x

2003 *Proyectiles Experimentales: Inca Cueva 7 Como Caso de Estudio. Cuadernos FHyCS-UNJu* 20:351-364.

[Spanish with English abstract. “Experimental Projectiles: Inca Cave 7 as a Case Study.”]

Site in Argentina, 4000 BP. Lanceolate point replicas (N=10), hafted, thrown at defleshed scapula, close range, simple Peruvian type atlatl, 15 throws, 10 breaks. But 8 throws missed the bone, some hitting rocks. [Poor accuracy, too small sample sizes].

**Martin-Jones, John, and Robert Tonkinson** dept

1966 *Desert People*. Australian Institute of Aboriginal Studies.

Film, classic ethnography, b/w with no sound except narration. Western Desert Australia, 2 families for one day [but probably composited]. Men and youths carry 2 to 5 spears and sometimes spearthrower and firestick as walk, women carry wooden trays and digging stick. Spears just sharpened wood, ca 2-2.5 m long. Spearthrower of tray-shaped woomera type, although one boy seems to have a narrow version. [You never get a good look and never see them in use.]

Man looks for waste stone around old campsite, finds and knaps old core, using simple hard hammer percussion with no platform preparation, takes a couple flakes, leaves core, hammer, and waste on site. Narrator says flake will be mounted in spear thrower.

Women harvest grass seeds in wooden tray, winnow them with hands and shake in tray, grind on stone slab, mix with water and bake in coals.

Men, boys (15 + 5-8), and women and teen girl all run down or dig out lizards, and the man digs out a bandicoot, kill animals by striking against spear, minimal cook on fire and then by covering in coals. Woman’s catch for day is about 8 lizards, from 10 cm to 30 cm in tray. Acacia root grub - dig out whole small tree for one finger size grub eaten raw on spot, with big smile.

Women dig for water with wooden tray in wells 1-2 m deep. Man collects bush tobacco, mix with ash for chew. Flies everywhere, on face, on food, mostly ignored but occasional hand waving.

Casually light grass fires to signal, for warmth and light, for fun, to keep fire stick smouldering - leaves burning bush as group walks on.

Meet at camp, broken branches for windbreak, loosen soil for sleeping area with digging stick or metal hatchet, only Western artifact visible.

### **Mason, J. Alden**

1928 Some Unusual Spear Throwers of Ancient America. *The Museum Journal* 19:290-324. University of Pennsylvania University Museum.

Older than bows, back to Paleolithic. Lengthens arm for greater speed and force. Requires only one hand so useful in boats or with shield.

Describes specimens at U. Penn Museum:

Thule Culture, Point Barrow, Alaska - coniferous drift wood, odd angular shape, with hand grip and hole for index finger, male hook of ivory inset into groove, rigid, no weights, 14.5 inches long, 2.75 wide.

Basket Makers of Utah - specimen from Chicago Exposition, probably collected by Wetherills in Grand Gulch - split sapling, .75-1 inch wide, 25 inches long, groove with integral "spur", handle with twin finger loops of rawhide, wrappings include carnivore tooth, cotton yarn, fur, feathers, and 4 beads revealed by x-ray, limonite nodule, flaked point bound to it (See Culin 1898).

- specimen from Hazzard Collection - handle only, simpler loops of hard material wrapped in leather.

- specimen from Lukachukai, Arizona - complete but lacking loops, largest and heaviest of all, 23.75 inches long, .25 thick, .875-1.25 wide, notched at grip, shallow groove but elevated male "spur."

Key Marco, Florida, Cushings excavations of 1896 - 2 complete, "slender and graceful" - two finger holes, 16-18 inches long, dark flexible wood, groove, short raised hook, flared handle end.

- single finger hole, hook carved in form of rabbit, handle end with volute knob, 19 inches long, springy hard wood.

Ethnographic Tarascan, Mexico, "of slight interest" one piece wood, plain undecorated, two finger holes.

Prehistoric coastal Peruvian graves, Nazca - 10 specimens: straight round stick with grip and hook bound on, 46-56 cm long, handles carved bone (owl, flute player etc).

### **Mason, Otis T.**

1885 Throwing Sticks in the National Museum. *Smithsonian Institution Annual Report for 1884*, part 2. pp. 279-290, plates 1-16. Washington: Government Printing Office.

Eskimo spear throwers, substitute for bow because can launch harpoon from kayak.

Works by longer force application to spear, some leverage.

Discusses several Eskimo subtypes and geographic distribution, illustrates 22

specimens.

[Basic "Eskimo" type is flat board with carved handgrip often with pegs and/or finger hole, mixed hook and groove, no weights].

**Mason, Otis T.** x

1891 Arrows and Arrow-Makers: Introduction. *The American Anthropologist* 4 (1):45-49.

Vocabulary of arrows. With articles by Holmes (Manufacture of Stone Arrow-points), Wilson (Forms of Ancient Arrow-Heads), Hough (Arrow Feathering and Pointing), Flint (Arrow in Modern Archery), Hoffman (Poisoned Arrows), and Bourke (Remarks).

**Mason, O. T.** x

1892 The Throwing-Stick in California. *The American Anthropologist* 5(1):66.

British Museum Hewitt collection from Vancouver's NW coast voyage 1790-1795 published by Read has 3 T'linkit type throwers, plus one from Santa Barbara Islands, very short 5 1/8 inches, but otherwise like those from Patzcuaro, so throwing stick found arctic to Calif. to Mexico.

**Mason, Otis T.** x

1893 Throwing Sticks [letter Sept 15] *Science* 22(554):152-153. Reprint also in *The Cast*, Spring 2001: 1.

[First notice of Basket Maker SW atlatls].

World Columbian Exposition, Colorado exhibit of Cliff Dwellers [Wetherill].

2 examples, describes, BM type, groove + hook, finger loops, attached bundle of stone point, mountain lion tooth, and hematite.

"First finding of atlatl figured in codices...connects Cliff Dwellers with the Mexican people."

**Mason, Otis T.** x

1893 Throwing-Sticks from Mexico and California. *Proceedings of the National Museum* 16(932):219-221.

Pretty good engravings and brief descriptions of Patzcuaro atlatl and dart collected by Bourke, Santa Barbara short atlatl in British Museum collected by Vancouver, decorated Tlingit atlatl, bird + fish harpoon from Makah Indians of WA with duck-foot like proximal end that fits two fingers to propel.

**Mason, Otis T.** s

1895 *The Origins of Invention: A Study of Industry Among Primitive Peoples*. Walter Scott Ltd, London. Reprint 1966 M.I.T. Press, Cambridge.

Nice illustrations of hafted N. Am. stone knives. Chapter on stone working. Mention of “dart-slings” in chapter on “War on the Animal Kingdom” but more on bow and arrow, blowgun, etc. Atlatl common Aust, Eskimo, Middle + S Am. Adds joint to arm. “Inseparable from this weapon in N. Am. is the bird trident...” “Greenland Eskimo attach [the throwing stick] to the side of the great harpoon, which new device indicates that the throwing stick traveled from West to East. In chapter on “Art of War” “The Mexican atlatl or throwing-stick or spear-thrower found in Aust, Melanesia, and Am from Point Barrow to the Argentine combines muscular force with prolonged effort. It is also a convenience for a man who has only one free hand.” p 377. [He makes no connection between bow and atlatl, and subscribes to the extended impulse model of atlatl function, comparing it to amentum, which allows impulse after the dart has left the hand]

**Massey, Lee Gooding**

1972 *Tabla and Atlatl: Two Unusual Wooden Artifacts from Baja California. Pacific Coast Archaeological Society Quarterly* 8(1):25-34.

Tabla is a ceremonial board.

Atlatls - two ethnographic accounts, but confusion about weapons and their dimensions. Several Baja specimens known. One collected by locals from shelter near Buena Vista: 81.5 cm long, regular 4 cm circumference, distal end wrapped in palm fiber, integral large blocky "male" hook, bark loop at grip [apparently only one], carved geometrical decoration. From a burial cave [apparently Massey 1957] with other fragments.

**Massey, William C.**

1957 *The Dart-Thrower in Baja California. Davidson Journal of Anthropology* 3(1):55-62.

Isolated populations retained old traits.

Four specimens found bundled in cave, Las Palmas culture.

Round wooden shafts, integral male hook, single bark finger loop [poor drawing, no further details].

Mentioned in 17th C Spanish accounts, but after 1720 no mention - disappeared?

**Massey, William C.**

**f**

1961 *The Survival of the Dart-Thrower on the Peninsula of Baja California Southwestern Journal of Anthropology* 17(1):81-93.

4 archaeological specimens with burial in cave, Las Palmas culture. Straight stick shaft ca 82 cm long, single fiber loop, fin shaped integral hook. Sees similarities to Caribbean S. Am. Spanish reports.

**Massey, William C. and Carolyn M. Osborne**

1961 *A Burial Cave in Baja California: The Palmer Collection, 1887. University*

of *California Anthropological Records* 16(8). University of California, Berkeley.

Associations with 7 burials included a cane dart shaft 92.5 cm [very short!] long, no foreshaft, with stingray spine point, and two compound pressure flakers, short wooden handles with lashed-on bone tips. Bull-roarer, pipe, feather cape suggest that one burial was a shaman. [No dates, precontact?]

**Matarazzi, Frank**

2003 Modern Outcast to Primitive Weapon. *The Backwoodsman* 24(3):52-53.

Making an atlatl out of old wooden clothes hanger.

**Matheny, Ray T., Thomas S. Smith, and Deanne G. Matheny** x

1997 Animal Ethology Reflected in the Rock Art of Nine Mile Canyon, Utah. *Journal of California and Great Basin Anthropology* 19(1):70-103.

Fremont area, NE UT. Bighorn sheep images show detailed knowledge of sheep behavior. Ethnographic hunting practices, uses, importance of sheep among Shoshone, Paiute, others. Ecology, subspecies, seasonality of sheep, elk, others. Nine Mile Canyon is type site for "Northern San Rafael Style" rock art. Sheep scenes include nursing, nose-touching, bird on back, details like split hooves, age/sex diffs in size and horns, linear herd travel but also non-realistic elements. Narrative scenes including hunts with multiple hunters with bows, and herds of sheep. Rare atlatls: one human figure throwing, one with looped grip atlatl beside [figures show probably right]. Comparisons to Coso Range art, (which has more atlatls). Hunting magic - maybe, but not all. Whitley: why did "people who principally ate seeds and nuts make art that emphasized mountain sheep and bows and arrows?" - rain shamans allowed males symbolic dominance while subsistence shifted from hunting. But why not shamanism more directly related to hunting success?

**Mathien, Frances Joan** o

2005 *Culture and Ecology of Chaco Canyon and the San Juan Basin*. Publications in Archeology 18H, National Park Service, U.S. Dept of the Interior, Santa Fe.

Major Chaco synthesis.

pp 78-84 descrip of Atlatl Cave, apparently not published previously but analyses in filed reports, excav before 1976. Large shelter with pictographs ("broad-shouldered" BMII anthropomorph + hands), organics, including atlatl fragment, assoc with yucca sandal, corn, and C14 dates  $2220 \pm 100$  B.P = 2,275 BP cal to  $2730 \pm 65 = 2900$  BP cal (Basketmaker II). Photo shows distal end of typical BM type *in situ*, short groove and slightly raised integral hook.

**Mathieu, James R.**

x

2009? Time Travel, Trebuchets, and Atlatls. *Expedition* 45(3):6-7.

Teaching archaeology hands-on. Claims student experiment demonstrated that javelin technique more appropriate analogy to atlatl than baseball throw. Experienced javelin throwers did better at accuracy and distance with atlatls than range of others. [Not enough details given to evaluate this experiment.]

**Matson, R. G.**

**o**

1991 *The Origins of Southwestern Agriculture*. University of Arizona Press, Tucson.

Summaries of Basketmaker research including sites with atlatl material such as White Dog Cave, Sand Dune Cave, etc. Some illustrations of foreshafts and points.

**Matson, R. G., and Sally J. Cole**

**x**

2002 Ethnicity and Conflict Among the Basketmaker II of the U.S. Southwest. In *The Archaeology of Contact: Processes and Consequences: Proceedings of the Twenty-fifth Annual Conference of the Archaeological Association of the University of Calgary*, edited by Kurtis Lesick, B. Kulle, C. Cluney, and M. Peuramaki-Brown, pp. 206-217. University of Calgary.

Evidence of 2 different ethnic groups in BM II: Durango (E) vs San Juan (W). House forms, perishables, diff basket weaving, projectile points. E atlatl points have broad corner notches, W (San Juan Dart Point) side notched. E BMII has similarities to Mogollon and San Pedro Cochise, supporting migration from S and probably Uto-Aztecan language.

Evidence of conflict - defensive sites eg N Road Canyon peninsula w 5 pithouses, Wetherill Cave 7 "massacre," scalps + body trophies, burials w missing parts. Rock art images of scalps + heads, figures w atlatls and darts, dart "arsenals," pierced anthros.

Wide similarity of rock art with continuity to Archaic, suggests immigrants to Colorado Plateau who became W BMII adopted a wider native tradition. Even with violence, groups maintain communication and common symbols. W BMII not linked to pre-existing plateau Archaic, but to Fremont + Gt Basin Archaic further W, could have come with maize or earlier. The San Pedro origin E BMII also arriving, displace Archaic with hostility, copy W BMII patterns but continue hostility.

**Mau, Clayton**

**x**

1963 Experiments with the Spear Thrower. *The New York State Archaeological Association Bulletin* 29:1-13.

Experiments with distance as criterion.

Points of copper tube, 1/8 to 1 oz, darts lengths 2.5-5.5 ft, atlatls 12-30 inches

long - 24" best.

Best distance (180-200' usual) with unfletched 36", 3/8" diam, wt 2.5 oz, pt 1 oz, balance ca. 31% from tip.

Fletched shaft allows use of lighter points, balance less important, reduced range. Speculations on prehist point styles.

Bannerstones - pipe of different weights at different places on atlatls. Best was moderate weight, ca. 5 oz, close to handle, which increases distance of throw 15-25%

[Interesting but subjective, experiments and results not given in enough detail to see if supposed improvements statistically real].

### **McCourt, Tom**

o

1975 *Aboriginal Artefacts*. Adelaide: Rigby Ltd.

Australian stuff. [Collectors book, but good illustrations, ethnography seems accurate]. Glass and stone flaking. Varieties of points. P.103 includes second hand "witness" of fire and water knapping! Almost nothing about spear throwers: p 39, photo 2 Kimberley area long forms with restricted handle, one shovel nosed spear point made of horseshoe, 1971 old folk still using these, and glass pointed composite spears for hunting.

### **McCreery, Patricia and Ekkehart Malotki**

o

1994 *Tapamveni: Rock Art Galleries of Petrified Forest and Beyond*. Petrified Forest Museum Association, Petrified Forest AZ.

W central Arizona. Atlatl depictions rare in area, "only a handful" p 8. [photo + drawing of well-detailed petro of BM atlatl w loops, groove, hook depicted. One has assoc 2 darts w solid oval fletchings - but no locational info]. Basketmaker anthropomorphs of "Palavayu Linear BM (Archaic + early BM) and Majestic BM styles related to San Juan Anthropomorphic and Turner's Style 5/Glen Canyon Linear style]. Some hold fending sticks or lines that may be atlatls [none clearly atlatls in his drawings]. P 35: atlatl may have continued an unknown time after bow. "Assoc w BM art, it is also sometimes present in rock art of seemingly earlier style and age." [But no examples shown.] Bird headed men occur [Fig 9.6 shows some with probable atlatl darts, but he seems to date them to PII.] P 152 "The atlatl image may have become ceremonially associated with the bird-heads in BM times, enduring as a ritual symbol into later periods." [Fine photos, serious discussion of chronology and meaning, though too fond of the shamanic interp of rock art, also talks about symbols' relation to rain etc].

### **McDavitt, Matthew**

1995 Lean Back and Say A'tlatl. *The Atlatl* 8(4): 8

How to pronounce.

**McDavitt, Matthew**

1998 Papuan Spearthrowers. *The Atlatl* 11(3):2.

Described briefly, photo. Female type, carved spear rest, 28-31.5 inches.

**McDermott, Jenny**

x

2006 Advocating Atlatl. *The Columbia Missourian* October 13, 2006. Electronic document URL: <http://columbiamissourian.com/news/print/php?ID=22138> accessed 10/15/06.

Vic Ahearn at Bass Pro teaches workshops, with R Mertz and R Madden lobbied MO, so now legal for small game. Atlatl basics, mentions WAA, ISAC, quotes Ahearn, Mertz.

**McDonald, Josephine J., Denise Donlon, Judith Field, Richard Fullagar, Joan Brenner Coltrain, Peter Mitchell, and Mark Rawson**

o

2007 The First Archaeological Evidence for Death by Spearing in Australia. *Antiquity* 81(314):877-885.

Narrabeen, N. Sydney, SE Australia, body, not burial, adult male, in dune sands, ca 4000 BP. With backed microliths, including 3 frags embedded in or between bones. Usewear consistent with hafted spear armatures. Anatomical, forensic, and artifact evidence consistent with death by spearing, ethnographically known as ritualized punishment using "death spears" barbed with stone flakes. [Spear thrower not mentioned, but likely used, see Gould 1970; also Fullagar 2011).

**McEtree, K. B.**

o

2005 Bannerstone Talk: Southeastern Style, er, Make That SE Alabama Style. *Indian Artifact Magazine* 24 (3): 46-49.

Variety of forms illustrated, but not too useful.

**McEwan, Colin**

o

2009 *Ancient American Art in Detail*. Harvard University Press, Cambridge.

Picture book, brief context and info texts, fine artifacts, many from British Museum, excellent color photos. Aztec atlatl, page of Codex Zouche-Nuttall with atlatl armed warriors, 18-19 C Eskimo-Aleut spear thrower from Nootka Sound, Canada, with sea otter image + beads.

**McEwan, Colin, and Lenoardo Lopez Lujan, eds.**

s

2009 *Moctezuma: Aztec Ruler*. British Museum Press, London.

Articles on M, illustrated with catalog of BM display, some of the finest photos of Aztec art. Includes several atlatl-related: a cinerary urn from Templo Mayor with

relief of Tezcatlipoca armed with two-hole atlatl and darts with fletching and triangular points (51) and several other depictions of gods with atlatls. The BM Aztec atlatl and the one in Ethnog Mus Rome (p204-205) [the Rome atlatl is the one that Beyer (1934) considers a fake - note that finger loop lashings are identical to those of BM specimen]. Figures on the Brit Mus atlatl - on back 4 serpents flank groove, often represent fired darts in Mexica iconography. On front, warrior entwined with rattlesnake, holds shield in one hand, thrusting a spear with other, probably held in an atlatl. Eagle feather headdress + face (deer hoof ear spools, vertical striped paint) identify as warrior god Mixcoatl (cloud snake). Mexica rather than Mixtec style narrative. Snake's head parallel to spear emphasizes weapon's supernatural power [or at least equates the two]. If read iconography vertically as in other atlatls, both figures are shooting from the sky, celestial darts.

**McFarling, Usha Lee**

**o**

2003 Treasures from Icy Tombs. *Los Angeles Times*, Jan 3, 2003. Reprinted in *The Cast Spring 2003*: 10-11. Reprinted in *The Dart* March 2008: 5-8; April 2010: 7-9.

Melting glaciers in Yukon and elsewhere exposed things like "Otzi," "Kwaday Dan Sinchi," Arctic animals, artifacts. Yukon darts with blood and caribou hairs, atlatl evidence from 7,300 to 1200 years ago, then bow dominates. [No details.]

**McGee, W. J., W. H. Holmes, J. W. Powell, Alice C. Fletcher, W. Matthews, S. Culin, and J. D. McGuire**

**x**

1900 In Memoriam: Frank Hamilton Cushing. *American Anthropologist* n.s. 2(2):354-380.

Some wonderful stories about young Cushing: from Holmes, how he met Hartt at Cornell, staggering up the hill to deliver a bag of stone tools. From Powell: as boy built wigwam in woods ... "were indeed a scientific workshop in which young Cushing laid the foundation of a system of investigation which has since proved of marvelous efficiency and which has been successfully developed by other laborers. This new method of research in prehistoric archaeology I shall call the method by experimental reproduction." 361

**McGuinness, Tim**

**x**

2009 Pre-columbian Atl Atl Spear Throwers. On web page The Online Museum of Weapons, McGuinness Publishing, electronic document, accessed 4/15/09 URL: <http://www.precolumbianweapons.com/atlatl.htm>

OK basic definition, Berg + Perkins theories of bannerstones. Photos of Aztec atlatl (British Museum) and others, Nazca atlatl, Moche copper dart points.

**McNichols, Charles L.**

**o**

1932 Indian Weapons: The Atlatl. *Street and Smith's Western Story Magazine*. 111 (3): 128-131. (March 12, 1932).

[Ugly racism, and odd mix of fact and mistake in early popular article]. Large stone points are for atlatl darts. Bow introduced “a very few centuries” before Spanish “found highly civilized Mexican races did not use the bow” [not true]. Same as wommera. “It propels the dart after it leaves the hand...giving same advantage as if thrower had an extra joint to his arm.” [Motion and use not clearly described, doubt he's ever tried it, no illustration]. Invented all over world, “black fellow and Asiatic Negroids both developed it...races no more than 3 or 4 jumps ahead of gorilla...” “Unbelievable” that “civilized Maya” had nothing better. Extreme range around 275 feet, much less than bow, large dart meant can't carry many. But “bow people were savages, less intelligent and advanced than the atlatl men [he means Aztec and Maya] so they only wiped out the Northern atlatl tribes. So immediate replacement - SW sites atlatl in older, bow in newer, never together. But Aztecs kept because atlatl is good one-handed weapon. N. Am. tribes fight by “bushwhacking” for which bow is better. Atlatl dart “couldn't penetrate an object any deeper than its 6-8 inch foreshaft - enough to kill a man or deer, but insufficient” for large game. “It's doubtful if a buffalo could be killed with an atlatl dart.” Still in use by Eskimo and on Mexican lakes because they need left hand to paddle canoes. Esk and Mex bird darts similar. Primitive S. Am. tribes use in jungle where greater range of bow not important, and S. Am tribes with bow still use long arrows same as their former darts.

**McTiernan, John, dir.**

**o**

1999 *The 13<sup>th</sup> Warrior*. Movie, VHS, DVD (2002). Touchstone Video.

From Michael Crichton novel *Eaters of the Dead*, with roots in a loose reworking of Beowulf's encounter with Grendel and his mother. Wandering Arab (Antonio Banderas) unwillingly becomes the 13<sup>th</sup> of a group of Vikings returning home to fight a great evil. These turn out to be Neanderthaloid monsters, but in a jumbled sort of way. They eat people, ride horses and use spear throwers and what appear to be metal weapons. They dress in bear outfits and use bear skulls as markers, but their symbol is an Upper Paleolithic “Venus” figurine, and their cave is decorated with Upper Paleolithic paintings. There are hundreds of them, but no idea of what they live on. Atlatls are not in the book and in the movie are mostly invisible. With stop action you can see them if you know they are there, but all you really see is spears zipping around in confusing, murky battle scenes. This movie had potential but ended up a mess. See Richard 1997, Crichton 1992.

**Meeks, Nigel**

**x**

1992 Report on the Scientific Examination of the Gilding on an Aztec Spear Thrower. unpublished ms., British Museum, London.

British Museum atlatl AM5226 gilded with gold foil, 5-7 microns thick, slightly

impure (8% silver and copper traces), consistent with prehistoric gilding, but not with European gold leaf.

**Meltzer, David J.**

o

2006 *Folsom: New Archaeological Investigations of a Classic Paleoindian Bison Kill*. University of California Press, Berkeley.

[A really nice tho technical book with lots of good info and discussion, including readable summary of Folsom history and current interpretations.]

Re-excavations 1997-99, analysis of original material from Figgins and Cook's 1920s work. Good chapter on historical context: Cook and Figgins credited with discovery but were never credited with resolving question of human antiquity - in part because C + F not among elite scientists, and had backed several obvious losers before. Barnum Brown (AMNH) and blacksmith Carl Schwachheim did most excav. CS diary appendix mentions several pts broken by picks, and pick marks visible in photo [so poor excav even if just for bones, and you have to wonder how and if the famous point really was found in situ as claimed]. Chapters on geology, environment, bison bone taphonomy. Butchering thorough, bones disarticulated but not smashed for marrow, few cut marks. Seems to be immediate kill + butchery site, as almost only artifacts are points. Early archs did not consider fluting important at first [perhaps because didn't know enough about knapping?], but soon began to speculate about its purpose. "Bayonet blood groove," hafting improvement, technological evolution in non-functional direction? Figgins considered arrowheads, Kidder suggested atlatl. Possible cache near site probably work of McCormick [documenting his activity by 1930s]. Variety of stone used, including Alibates up to 256 km distant, Tecovas jasper 200-375 km, others. Good illustrations of points. Breakage patterns considered and how points break, but "I only consider hand-thrown vs thrust, as the presence of atlatls in Paleoindian times is unresolved" [which makes the whole discussion a waste of time as they were almost certainly on atlatl darts, although we probably can't tell the difference between thrown and thrust from the points, and bending breaks do NOT "imply someone had a firm grip when the point broke."]

**Mendoza, Ruben G.**

o

2007 *Aztec Militarism and Blood Sacrifice: The Archaeology and Ideology of Ritual Violence*. In *Latin American Indigenous Warfare and Ritual Violence*. R. J. Chacon and R. G. Mendoza eds., pp.34-54. University of Arizona Press, Tucson.

Revisionist efforts attempt to refute accounts of Aztec sacrifice as "racist, colonialist" etc. But our understanding of large-scale sacrifice not based only on Spanish accounts, also arch evidence of ritual violence - experiments in heart excision, serological study of deposits, forensic analysis of skeletal remains, including numerous sites with evidence of peri-mortem mutilation and cannibalism, 170 crania from tsompantli skull rack at Tlatelolco associated with stone tools used to prep heads, etc.

**Mera, H. P.**

1938 Reconnaissance and Excavation in Southeastern New Mexico. *Memoirs of the American Anthropological Association* 51.

[Not very useful.]

Sketchy report of finds in caves in drainages in Guadalupe Mountains.

1 whole, 1 fragment atlatl.

Basketmaker type, loops missing, no evidence of weights, nock not described but looks like groove and flush hook mixed type. [Poor photo.]

Dart foreshafts with and without stone point or slot .

**Merbs, Charles F.**

1983 *Patterns of Activity-induced Pathology in a Canadian Inuit Population*. Archaeological Survey of Canada, Paper 119. Ottawa: National Museums of Canada.

Reconstructing activity from skeletal arthritis and ethnography. Suggests elbow and shoulder joint damage from throwing harpoons with and without throwing board. Complicated by other activities such as hide scraping (females), bow and arrow use, and dog sled driving.

**Meredith, D. R.**

o

1986 *The Sheriff and the Folsom Man Murders*. Avon Books, New York.

Novel. Obnoxious archaeologist is killed with atlatl and Folsom point as he reopens "original Folsom Man site." Suspects include collector/hotel owner, the hero's deputy, a cult of Folsom imitators living in a cave with their charismatic leader, the senior archaeologist, his graduate student, and others. [Badly written incoherent mystery, with too much soap opera and little in the way of logic. The archaeology is not really wrong, just slightly off, eg. atlatls described repeatedly as "lethal up to 300 feet," no realistic idea of site or archaeological procedure, site as well as culture repeatedly called "Folsom Man site," etc. Meredith probably has no real experience of atlatls or archaeology, but has hit on one interesting question that figures in the plot - an atlatl "balance stone" is claimed as evidence that "Folsom Man" used atlatls. The passage p76-77 is characteristic]:  
 "Dr. Hagan sighed...'It's a polished stone fastened to an atl-atl as either a weight or a fetish. Personally, I think it was used to give an atl-atl greater throwing power. Still, some believe it was a fetish stone, strictly for ceremonial reasons. Any time archaeologists can't decide the purpose of an artifact, they call it a ceremonial object. We've assigned so many ceremonial objects to the primitive American that he'd have had to spend twelve hours a day practicing his religion to use them all... If there is a balance stone connected with a Folsom Man site and found in the same stratum, then that would go a long way toward proving that he had developed the atl-atl.' .... Dr. Hagan looked aghast. 'Important! Young man,

was the development of the atom bomb important? The atl-atl was its primitive equivalent. A tall, strong hunter may be able to throw a spear fifty to seventy-five feet. A dart thrown with an atl-atl may travel two hundred to three hundred feet and still be lethal....”

**Merritt, Jim**

1993 Atlatl Renaissance. *Field & Stream* September 1993. Accessed 2/2002 BPS Engineering web page <http://www.atlatl.com>.

Account of Montana Mammoth Hunt event, focus on Bob Perkins of BPS Engineering, who has been making and selling atlatls for 7 years as his sole source of income. Says he makes “hundreds” every year. Describes his theory of atlatl weights as timing oscillation of atlatl and dart, and as silencer.

**Mertz, Ron**

o

2007 Hunting for Small Game with an Atlatl is Now Legal in Missouri. *The Atlatl* 20(2):7.

Official notice if changes to Wildlife Code appeared in Missouri Conservationist Feb 2007. [result of major lobbying and educational effort by Ron, Ray, and others].

**Mertz, Ron**

o

2010 Atlatl Deer Hunting In Missouri. *The Atlatl* 23(3):4.

MO Dept of Conservation allows trial atlatl hunt during Fall 2010, in firearms season.

**Mertz, Ron**

o

2011 Results of Missouri’s First Atlatl Deer Season. *The Atlatl* 24(1):12.

11 hunters reported, no deer taken. Hope to move from gun season to bow season next year.

**Mertz, Ron**

o

2011 Experiencing Missouri’s First Atlatl Weapon Deer Season. *The Dart*, April 2011:15-16.

**Mertz, Ron**

2011 Report from Missouri. *The Atlatl* 24(3):13.

Events and publicity. MO Dept of Conservation approves atlatl for hunting during deer archery season starting Fall 2012.

**Mertz, Ron**

o

2012 Two Atlatlists Harvest Deer in Missouri. *The Atlatl* 25(1):12.

Luke Boenker (from stand) and Scott Rorebeck (on ground), during second legal season in MO, first successes. 15 hunters replied to RM survey.

**Metcalf, Harlan G.**

1974 *Whittlin', Whistles, and Thingamajigs: The Pioneer Book of Nature Crafts and Recreation Arts*. Stackpole Books, Harrisburg.

[This guy should get credit as one of modern atlatling's forefathers.] Brief introduction, historical and ethnographic mentions. Considers Australian [central desert scoop woomera] form to be best type. Good photos of W. Australian throwing long spear. Kuikuru South American type recommended as easier to make [good photo]. Instructions for making simple cane spear and Kuikuru atlatl [but his are way too thick]. Recommends games, including atlatl golf. "With officially established dimensions for spears and spearthrowers of different groups and with official rules, this sport could become a popular and beneficial interscholastic and intercollegiate athletic event." Can use atlatl for fishing. Cordage, basketry, slings, bow and arrow and other things also covered.

**Metcalf, Harold**

2002 Ancient Spear Slings in Brazil. *The Cast Spring* 2002: 18.

Wauru' and Karaya tribes, mostly sport and ritual now. Photos: hour-glass form handle with index finger hole, on rod, with lashed on hook, feather decoration. 22-24 inches long.

**Metreaux, Alfred**

1949 Weapons. In *Handbook of South American Indians*, vol 5, Julian H. Steward, editor, pp. 229-263. Bureau of American Ethnology Bulletin 43. Smithsonian Institution, Washington D.C.

Survey of types and distributions of bow, arrows, pellet bow, blowgun, sling, bola, club, axe, dagger, spear, shield, and spear thrower. Spear throwers known in Peru from Inca and earlier. All South American spear throwers belong to male type. Three main categories known: 1) Ancient Peru and Ecuador, 15-24 inches, lashed on hook in groove, second hook at handle for index finger grip. Hooks of stone, bone, shell, copper in effigy forms. Similar in Argentina. Taino had similar: fish bone hook, braided loop at handle. Jivaro: straight stick with lashed on hook. 2) Round wooden stick with handle widened to allow hole for forefinger, attached hook. Ancient Peru, modern Caraja and Xingu River tribes. 'Amazonian' type. Among Xingu, displaced by bow, but still used in games and dances. Upper Amazon versions seem to be thick boards with pit for forefinger or split bamboo, used for war and turtle hunting. 3) Tapering piece of wood with deep groove, horizontal peg hook attached to narrow end. One



[This is the one Perkins copies, aka Nicolerson Cave, see Allely 1992]. Believed >8000 years old.

Hogup Cave, Utah (Dalley and Peterson 1970): integral hook and groove, single finger loop of rawhide, 56.5 cm long, max W 3.5 cm, max T .45 cm, attached stone weight. Also 3 fragments, apparently mixed type with finger notches.

Council Hall Cave, Nevada (Hester and Mildner 1974): flush integral spurs with groove [he calls it female, but it's not.]

Kramer Cave, Nevada: (also at Lake Winnemucca), groove with raised integral hook, flattened spatulate form with two sticks bound along side the proximal half, [he thinks might have supported dart, I don't see from his picture how that would have been possible, they're just to strengthen or stiffen.] Missing handle of proximal end, 38.1 cm long, max W 2.0 cm, max T 1.1 cm. Associated with contracting stem point and several foreshafts, one 59.0 cm long, dated C14 to  $3,720 \pm 100$  B.P.

Last Supper Cave, Nevada: groove and flush integral hook, missing grip, notched to attach weight.

Discusses atlatl weights and spurs. Spurs w C14 dates back to  $6360 \pm 400$  BC [uncal], foreshaft from Leonard Rockshelter dates  $7038 \pm 350$  BP [uncal]

**Miller, Doris I. and Carolyn F. Munro**

x

1983 Javelin Position and Velocity Patterns During Final Foot Plant Preceding Release. *Journal of Human Movement Studies* 9:1-20.

For coaching feedback, 27 throws filmed at up to 200 fps.

Running approach 30-36 m or 10-12 steps, then 3-7 step transition; final step begins as land on R foot while leaning slightly back, L foot swings through as hips rotate forward, L foot plants, jav released. During L foot plant .12-.15 sec, jav given 60% of its final velocity. Release velocity ca 30 m/s [ca 67 mph or 98 ft per sec]; world record distances 94-96 m.

**Miller, Doug**

2002 Copper Tipped Darts. *The Atlatl* 15(3):1-2.

Old Copper Culture points from Midwest, probably used because more durable than stone. Two major styles: flat, shaped like stone points [with tang or notches] and conical (most common). Conical easier to make, protects end of shaft.

**Miller, John J.**

x

2006 Throwing Sticks of the Stone Age. *The Wall Street Journal* January 18, 2006: D13.

Pretty good article, quoting M. Waters, G. Fogelman, M. Takoch, R. Vanderhoek. B. Perkins, J. Rowe, mentions WAA, possible PA legal hunting.

**Miller, Michael J.**

x



social upheaval (Civil War example).

**Minelli, Laura Laurencich**

**x**

1993 I due antichi atlatl messicani del Museo Nazionale di Antropologia e Etnologia di Firenze. *Archivio per l'antropologia e la etnologia* 123: 391-403.

“Two Ancient Mexican atlatls in the Firenze Museum” in Italian, English abstract. One 8040 is Aztec with Mixtec influence, depicts “mystical religious matters” other 8039 vice versa, depicts “history of Mixtec lords who lived from 1053 to about 1339”. Appendix analyzes gilding, may be European addition. 8039 is a bizarre double atlatl with paired grooves and hooks. Drawings of design [too small] and dimensions given.

**Moctezuma, Eduardo Matos**

**o**

1990 *Treasures of the Great Temple: Art and Symbolism of the Aztec Empire*. Alti Publishing, La Jolla.

[Fine photo book.] Good images of tzompantli, urn with Tezcatlipoca carrying atlatl, carved obsidian urn and other objects, personified tecpatl (sacrificial knife) chert biface with teeth and eyes glued on, skull mask with biface nose, carved stone deer head with solar dart and cloud - these three items found repeatedly associated [the dart point is similar to those shown in codices - triangular with flaring triangular stem]. And many more objects.

**Montell, Gösta**

**x**

1937 De etnografiska undersökningarna. *Ethnos* 2(4):300-318.

[In Swedish. Mexican ethnology. Includes poor drawing of British Museum Aztec atlatl, Patzcuaro atlatl, others.]

**Montoya, Donald G.**

**x**

2008 Hidden Village (42Sa2112): A Basketmaker III Community in Montezuma Canyon, Utah. Unpublished MA thesis, Anthropology Dept, Brigham Young University.

Large villages [well, only up to maybe 20 families...] developed in BM III, earlier than often suggested. GIS info used to argue that HV is one: clusters + stone circles, probably pithouses, maybe up to 30, with assoc middens, and possible community pithouse. Close to 4 other sites. P 74: “Clustering of residences and presence of public structures at BMIII sites suggest complex social organization beyond band level.” [He concludes from comparing layout to excavated large BMIII sites, but his data are weak here: only surface work on a looted site, number of pithouses poorly defined, no precise dating, etc. Important because at this site is fine petroglyph panel (not mentioned) including atlatl images - so either there is a BMII component, or atlatls continued into BM III,

or...].

**Moody, Bill**

**o**

2010 Some New England Bannerstones. *Indian Artifact Magazine* 29(4):74-75.  
Photos, mostly slate, variety of forms, mostly winged.

**Moore, Clarence B.**

**xo**

1916 Some Aboriginal Sites on Green River, Kentucky. *Journal of the Academy of Natural Sciences of Philadelphia* 16: 431-509. (Reprinted 2006 Gustav's Library, Davenport IA).

Reports on burials from "The Indian Knoll" and other sites.

Most attention to antler hooks and bannerstones, interpreted tentatively as "netting needles and mesh spacers", experiment shows they work.

Atlatl theory considered, but: 1) no definite evidence of atlatls in area

2) atlatl should be one-piece for strength, 3) no points associated [not

true, he reports lots of points from burials, including antler point in bone]

4) some crooked or have too small a hole, 5) if hooks are atlatl hooks, what are the stone "spacers" that are found with them for?

Full scale photos and plates of hooks and bannerstones, [but no burial photos showing position of atlatl parts.]

Shell weight described [but not recognized as similar to bannerstones.]

**Moorehead, Warren King**

1899 *The Bird-Stone Ceremonial: Being an Account of some Singular Prehistoric Artifacts Found in the United States and Canada*. Allen I. Vosburgh, Saranac Lake. (reprinted 2003 by The Relic Room and Knife Shop, Pigeon Forge).

Pamphlet, 31 pages, apparently aimed at collectors. Describes and illustrates some specimens, speculates on distribution and assumes a ritual or decorative function. [Not very useful even in 1899.]

**Moorehead, Warren K.**

1910 *The Stone Age in North America*, Vol 1. Houghton Mifflin Company, Boston and New York.

A large section on bannerstones and related forms, referred to as "problematical forms," "winged objects," and the like. Photos of unfinished specimens. Evidence that some were worn as pendants or gorgets. Not shuttles because "It has always seemed to me ridiculous to claim that the prehistoric peoples made use of objects, on which a great deal of time and hard labor were spent, for ordinary purposes." (410) Rare in burials and mounds, probably earlier than mounds. Probably used by shamans.

**Moorehead, Warren K.**

o

1917 *Stone Ornaments Used by Indians in the United States and Canada: Being a Description of Certain Charm Stones, Gorgets, Tubes, Bird Stones, and Problematical Forms*. The Andover Press, Andover. (Reprinted 2005, Gustav's Library, Davenport, Iowa.).

[Title tells it: bannerstones etc viewed as ornaments and “problematical,” but with a few more interesting notes. All outdated, but nice illustrations.]

C.H.Forbes produced Latin names like ‘geniculate’ for classif system. Manuf by peck and grind, drilling. Bar, bird, and boat forms = amulets. Birdstones mostly OH,NY, IN, MI, WI, Canada. Prob pre-mound. Winged objects [bannerstones] important because often repaired, well made, with dead. Unfinished ‘bipennate’ reused as hafted hammer by historic Inds. Bottle and tube forms = shamans’ tubes.

A. C. Parker chapter: Bannerstone breaks p 193: some struck, others broken by “internal pressure of shaft” Experiments with bs on end of light spear as fletchings – added 25% to distance thrown [I don’t believe it], breakage by jamming shaft in when struck tree. Purposes of bs p 194: “portions of more complex implements” works in expers as flywheel on drill or spindle, symbolic connections to fire drill and war club.

Moore bannerstone examples from Indian Knoll color plates. [Moore quoted at length on netting needle and spacer theory, arguments against atlatl theory.] But why make utilitarian objects so elaborate? Must be ceremonial.

Quotes G.B. Gordon (1916) – bannerstone as whale and axe symbol. G. H. Pepper communication p 379: Moore’s bannerstone and hooks probably joined by shaft, found near head of burials, used as hair ornament (sketch).

Unique and fraudulent forms shown, but some, e.g. Powell and Mason expected copper, fine pipes, etc from mounds to be work of Euros. Now know better, so fine work and unusual forms not necessarily frauds.

Author’s favorite theory: Bipennate or winged forms may be thunderbird effigy parts (sketch) more likely than whale.

**Morel, Philippe**

x

2000 Impacts de chasse et archéozoologie: Quelques observations expérimentales. In *La chasse dans la Préhistoire/ Hunting in Prehistory, Anthropologie et Préhistoire III*. C. Bellier, P. Cattelain, and M. Otte eds., pp. Société Royale Belge d’Anthropologie et Préhistoire, Bruxelles.

[In French. “Impacts of the hunt and archaeozoology: some experimental observations.”] Bow + stone pt arrow, and bone tipped atlatl dart damage on goat carcass bones, defining different types of damage.

**Moreno, Teresa K.**

o

2000 Accelerator Mass Spectrometry Dates from McEuen Cave. *Kiva* 65 (4): 341-360.

Rock shelter, SE Arizona, badly excav (Cummings) 1930s, then looted, material in ASM. Preceramic burials (Cienega Phase of Late Archaic-Early Agric period, 800 BC - 150 AD) plus Pueblo occupation.

Complete atlatl, assoc w adult burial in twined bag (also dated). Intact but very warped, possibly ironwood. Surface polished, red pigment traces. L 70.2 cm, W 2.4 cm, T 1.3 cm, slight taper distal to prox. Heart shaped groove 12 cm L, flush integral hook, rounded triangular dist end. Handle rounded, covered w pitch, notches w simple hide strip loops bound on w extensive wrap of yucca + human hair cordage. Small "charm" of skin + fur tied on w cordage. Sim to White Dog Cave specimen. Cummings also found a proximal frag [not described]. Refs for other SW + Gt Basin atlatls. Atlatl date on human hair from cordage  $2355 \pm 65$ BP = 761-260 cal BC. On twined yucca bag from same burial  $2240 \pm 55$  BP = 400-180 cal BC.

**Morris, Earl H.**

x

1925 Exploring in the Canyon of Death. *National Geographic Magazine* 48:263-300.

1923 AMNH expedition, Mummy Cave. Male burial with moccasins, buckskin sash, shell beads, spear thrower, flute, animal skin sack with pipe, bone tools. Basketmaker pithouses underlying masonry pueblo structures. Burnt cemetery pit. Much evidence of prehistoric grave robbing and disturbances.

1924 exped, "Burial of the Hands" severed arms with baskets, ornaments, and sandals. Old man with beads, baskets, sandals, pipe, flakers, "several spears, four handsomely wrought spear throwers, and three more flutes." "Basket Makers" preceded pueblos, "long headed people of medium stature...undergoing transition from nomadic to sedentary existence under the compelling influence of the cultivation of maize." "Three or more cultural periods intervened..." between BM and Chaco, including "roundheaded stock" beginning Pueblo culture. [Early outlines of SW chronology. Many photos, none of atlatls.]

**Morse, Dan F. and Phyllis A. Morse**

x

1962 A Critique of 'The Genuiculate Bannerstone as an Atlatl Handle' by Orville H. Peets. *Tennessee Archaeologist* 19 (1): 20-24.

Experiments are not dead in archaeology. [Then gives trivial examples and acts as if experimentation is just to help classify artifacts]. How long did Peets spend on atlatls [Implying waste of time]. What did Peets prove? "Demonstrating an object can function does not mean a priori that it did so function." [The last is true but otherwise an obtuse discussion which misses the point of experimentation entirely]. Artifact names may be useful even if not reflecting function. European bow-guards differ from Am. gorgets, which are often found in chest area of burials. [Interesting example of early theoretical arguments about typology, function, and experiment.]

**Morse, Edward S.**

o

1922 *Additional Notes on Arrow Release*. Peabody Museum, Salem, Massachusetts.

Follow-up to his 1885 definition of 5 major holds for drawing and releasing arrows. Primary release: pinched between thumb and knuckle of forefinger like a child. Secondary: pinched, with addition of 2<sup>nd</sup> + 3<sup>rd</sup> finger drawing the string. Tertiary: As 2<sup>nd</sup>, but with forefinger straightened. Mediterranean: no thumb, fingers pull string with arrow between 1 + 2. Mongolian: string pulled by thumb with ring, fingers bent over thumb. Surveys distributions: Mediterranean the usual modern form, goes back to ancient times, documented in medieval pictures, also occurs among American Indians and elsewhere. Form of arrow nock reflects release. Some ethnog accounts of shooting.

**Morwood, M. J.**

2002 *Visions from the Past: The Archaeology of Australian Aboriginal Art*. Smithsonian Institution Press, Washington D. C.

p. 164 illustrations of chronology of weapons in rock art, statement that prehistory of spears and throwers is known only from rock art. [Illustrations show a “spade-handled” woomera unlike anything I have ever seen.]

**Mountford, C. P.**

1941 An Unrecorded Method of Manufacturing Wooden Implements with Stone Tools. *Transactions of the Royal Society of South Australia* 65:312-326.

Pitjendadjara manufacture of woomera type atlatl using the adze stone which is often attached to the handle with gum. Stages: A. Cutting and splitting rough slab from living mulga (*Acacia*) tree, using local stones with natural sharp edges, and wooden wedges. The main stone was gneiss, weighed 7 lbs, abandoned after use. Took a couple hours, several men participated. B. Shaping and finishing. Removed bark and heartwood, using smaller unflaked stones (gneiss, 3 lbs), leaving it roughly finished. Then smoothed and flaked with adze stone in spear thrower handle, held and 30 degree angle and used with planing or scraping stroke, sometimes chopping. Adze stone retouched several times by “tapping with wooden blade of a spear to remove miniature flakes” while held in palm. Adze stone set into mass of spinifex gum with 1/8-3/16 “ of edge projecting. Any flake of suitable size with a cutting edge, natural or knapped. Often stored in owner’s hair! “Throwing peg” attached with gum and sinew, at about 30 degree angle. Whole spear-thrower rubbed with red ochre. Total time, 3-4 hours. [Diagrams and photos of process.]

Most important tool in their sparse material culture: serves as spear-thrower, cutting tool, small dish, firemaking friction saw.

**Movius, Hallam L.**

1950 A Wooden Spear of Third Interglacial Age from Lower Saxony. *Southwestern Journal of Anthropology* 6(2): 139-142.

Summarizes German info. Site at Lehringen, valley of Aller River near Verden, in marls of mild interglacial climate. Yew spear, 2.40m long, tip sharpened and fire-hardened, found between ribs of extinct straight-tusked elephant. Also a few stone flakes. Pygmies hunt by spearing elephant and following until it dies; this could be similar. [Drawing of spear only, no details or photo of association with the elephant, or of workmanship – everyone accepts, but I wonder... For instance, why no other reported organic preservation?]

**Mowrer, Kathy**

o

2006 Basketmaker II Mortuary Practices: Social Differentiation and Regional Variation. *Kiva* 72(2):259-282.

BM II 2000 BC - 500 AD. W concentration: Marsh Pass, Canyon de Chelly in NE AZ, Butler Wash-Cedar Mesa region SE UT. E concentrations: Navajo Reservoir NE NM, Animas R Valley near Durango CO.

Most burial goods reflect age, gender, economic roles, and personal achievement, as is consistent with band or tribal level of social organization. But some unusual burials known: 1. White Dog Cave female with atlatl + points (usually male goods) baskets, woven goods, digging stick (usually female), and dog, gaming piece, skin pouch, ceremonial wand (unusual). 2. Chief's Grave in Canyon de Chelly, male with 4 atlatls, antler wrench, flaking tools, shell necklaces, stone pipe, human hair, 4 flutes. 3. Cave 1 Kinboko Canyon SW of Marsh Pass, female with trophy head-skin on necklace thong, string apron, shell bead necklaces, stone pendant. But probably reflect achieved status.

Data from 391 burials [but problems of differential preservation and recording, for instance only 56 F and 81 M identified out of 180 adult burials.] Items grouped into subsets to counter this.

Results: gender not strongly marked by subsets, eg hunting subset (atlatls, bifaces, blades, snares, clubs, and proj. pts) not strongly assoc with males. Age however strongly marked (hunting subset with adults). [Works even worse when broken down by state, but of course each sample is smaller too, and only clear pattern seems to be AZ burials associate item subsets with age. This may be what creates the overall age pattern too]. Regionally W more likely to make multiple individual burials, randomly oriented, E favors single burials with head to E.

[Overall, this analysis is a good idea but the data just is too weak for strong conclusions.]

**Moyer, Timothy**

o

2009 How to make a Good Dart with Easily Found Materials. *The Dart* Dec 2009:10-12. Also posted <http://atlatl.timothymoyers.com/main.htm>

Instructions for simple wood dowel darts.

**Munger, Lynn**

1967 Premature Conclusions Concerning the "Atlatl Weight" Theory as Applied to Forms of Stone Age Artifacts of the American Aborigines. *Central States Archaeological Journal* 12-14: 71-74.

Questions blanket interpretation of "bannerstones" as "atlatl weights." Gives reasons why at least some specimens not functional as such.

**Murdoch, John**

1892 Ethnological Results of the Point Barrow Expedition. *Ninth Annual Report of the Bureau of American Ethnology, for 1887-88*, pp. 19-451. Government Printing Office, Washington D. C.

Expedition of 1881-83 to northernmost (top) of Alaska. Still some stone tools in use, although many heirloomed and slate knives etc now replaced by steel. Bow drill "universal among Eskimo." Muskets began arriving between 1837 and 1849, now old guns and modern Winchesters common, mostly superseding bows. Bows sinew backed, arrows fletched, points of flaked stone, metal, or barbed bone. "Hand board" or "throwing board" used to throw darts. Bird dart ca 5 ft long, .7 ft diam., unfletched, barbed bone tip or multiple tips, three barbs on shaft near base in case head misses. Considerable accuracy at 20 to 30 yards. Seal darts similar, although once used heavier ones, barbed bone heads attach to a float. [Seems odd that he describes darts before atlatls.] Throwing board is "flat narrow board 15-18 inches long with handle at one end and groove along the upper surface in which the spear lies with the but resting against a catch at the other end. The dart is propelled by a quick motion of the wrist, as in casting with a fly-rod, which swings up the tip of the board and launches the dart. This contrivance, which practically makes of the hand a lever 18 inches long, enables the thrower by a slight motion of the wrist to impart great velocity to the dart." [Fairly simple atlatl, two shown, like the one I made], spruce wood, hole for forefinger, groove, ivory hook "shaped like a flat headed [square] nail," long triangular shape with flared handle. [He describes the motion correctly too.] Metal also used for hooks, board usually painted with red ochre. Toggling harpoon heads with blades of stone or metal appear to be used only on hand thrown walrus or seal harpoons. Stone heads considered necessary for good luck in whale hunting, even when used in conjunction with metal or guns. Bird bolas also used. Still making stone tools, especially for sale to ethnographer. Pressure flaking into palm with short compound flaker tipped with ivory, iron, or stone. Bow drill formerly used for fire, now flint and steel.

**Murdoch, John**

1896 Dr. Nansen's "Throwing Stick." *Appletons' Popular Science Monthly* June 1896: 173-175.

Alaskan atlatl of Bering Straight type found on SW coast of Greenland 1886. Probably floated on current N through Bering St, then W across pole, then S between Iceland and Greenland, then N around tip of Greenland and up W coast. Inspired Dr. Nansen to think could do same thing in ship.

**Murray, William Breen, and Hector Lazcano**

2000 Atlatl Hunters of the Sierra Madre Oriental (Mexico). *The Atlatl* 13(4):3-5.

Rock art atlatls mark good spots for shooting at animals below in spring and similar areas. Tested several sites. Petroglyphs show “winged” atlatls, which may be transitional between bow and atlatl. [That makes no sense; maybe some sort of weight is what is shown.]

**Naedele, Walter F.**

x

2006 Game Agency Staff: Ban Ancient Weapon, Atlatl Deemed Inhumane. *Philadelphia Inquirer* January 11, 2006. URL <http://www.philly.com> accessed 1/27/06.

PA game commission staff recommends Board not vote to legalize atlatl deer hunt. Quotes Fogelman and Perkins.

**Nahanni River Adventures**

x

1994 Glacier Yields 500 Year Old body of Ancient Person in Tatshenshini/Alsek Region. *Northern Currents*, Fall 1994. URL: <http://www.nahanni.com/newsletter/archive/?page=1> accessed 9/13/06

Describes [Kwaday Dan Sinchi] find, Beattie involved, mentions possible atlatl but “further input from elders indicates that it may also be a tool used for snaring gophers.”

**Nalewajk, Robert**

x

2001 How the Length of an Atlatl Affects its Dart Throwing Abilities. class paper for J Whittaker, Grinnell College.

Tried three lengths, longer atlatls get greater distance [but small sample, limited experiment]

**Nassaney, Michael S. and Kendra Pyle**

1999 The Adoption of the Bow and Arrow in Eastern North America: A View from Central Arkansas. *American Antiquity* 64(2):243-264.

Regional survey of small point (= arrow) replacement of large points indicates likely earlier than previously thought - perhaps as early as 3000 BC in central plains with unifacial arrow points. Then some areas gradual transition with

decrease in size of dart points, and transitional forms. In AR, abrupt introduction of arrow shown by bimodality of metric traits and different form of large and small points, and by different manufacture techniques, but long period of overlap, 700-1100 A.D. Suggest different strategies of adoption and transition with experimentation all over until wide use of small bifacial points by A.D. 700.

**Neal, Guy R.**

**o**

2011 Frozen in Time: The Iceman Quiver. *Bulletin of Primitive Technology* 41:31-38.

Replic w stone tools. No attachments survive, so speculate: hung on left shoulder, with cross strap to R underarm, so access allowed in front of archer, flap protects arrows.

**Nebergall, Phil**

**x**

2007 Modern Prehistoric Hunters. Atlatls'N More webpage, URL <http://www.atlatls-n-more.com/IntroAtlatl/Default.asp?article=123> accessed 5/07.

Australian aboriginal cultural center demos. Light 7-foot spear. Atlatl not described, picture too small to see. Overhand motion like tennis swing. Aborigines making 50 yard throws with flat trajectory, high velocity, "spear drops 2 feet in mid flight and then rises back up and nails the target..." "Release spear with point 4-6 inches higher than tail end... spear thicker at front... no feathers to stabilize... getting aerodynamic lift to counter gravity..." Spears thus more effective than bow and arrow. [The "drop" and aerodynamic theory sounds really unlikely, so I'm not sure what he was seeing, maybe the dart flexing?]

**Nelson, Edward William**

1899 The Eskimo About Bering Strait. *18<sup>th</sup> Annual Report of the Bureau of American Ethnology, for 1897-98*, pp. 19-526. Government Printing Office, Washington, D.C.

Expedition to Western coast of Alaska 1877-1881, collected some 10,000 specimens, herein described, covering most of material culture. Still using some stone tools as well as metal, shows "flint flakers" [pressure], but no description of knapping. Drilling holes and friction fire using bow drill. Bow and arrow, sling, throwing board, and bolas all used. Seal spears 4-4.5 feet long, often fletched, barbed head attached to shaft by cord for drag, used with throwing board. Walrus and whale spears are about same length but heavier, unfletched, attached by cord to a float board or skin float for drag, more likely to have a toggling harpoon head. Bird spears are lighter, sometimes fletched, with two or three bone points. The "throwing sticks" have tapering shape with paddle handle, depressions and pegs for finger grips, sometimes a forefinger hole, groove with ivory peg hook. [Small photo shows 11 examples, similar but variable]. "The Eskimo are very expert in casting spears with the throwing stick. The small light spears used in

hunting seals are cast from 30 to 50 yards with considerable accuracy and force.” Practice “by the hour” at young waterfowl, very accurate. Bird spears generally cast overhand but sometimes with underhand throw to skim the water surface. “In using the throwing stick for casting the spear in a curve through the air by an overhand motion, the throwing stick is held pointing backward; the end of the spear shaft is laid in the groove on its upper surface resting against the ivory pin or other crosspiece, the shaft of the spear crosses the fingers and is held in position with the thumb and forefinger around the throwing stick.” Variants described for peg grips. Length is point of right elbow to tip of outstretched forefinger, or for whale, plus one forefinger width. Seal spear length is three times elbow to finger tip plus 2 left thumb widths plus width of left hand.

Bows are sinew backed. Muzzle loading guns becoming common.

**Neuman, Robert W.**

1967 Atlatl Weights from Certain Sites on the Northern and Central Great Plains. *American Antiquity* 32(1):36-53.

Interpretation of such artifacts as atlatl weights since Kidder + Guernsey finds. Data given on 60 weights of "boatstone" type, with measurements, weights, and some drawings.

Class I = loaf shaped, plano convex, often grooved across top center for attachment. Class II = end-ridged, like I but with bumps at ends. Class III = long ellipsoid. Class IV = zoomorphic, like II but bumps at ends form ears of animal head.

**Neusius, Sarah W., and G. Timothy Gross**

o

2007 *Seeking Our Past: An Introduction to North American Archaeology*. Oxford University Press, New York.

p 209 good drawing of Skagit atlatl carving from NW coast  
On accompanying CD, lengthy chapter D2 “Weaponry of Clovis Hunters at Blackwater Draw” by Anthony Boldurian accepts assumption that Clovis had atlatls, discusses hafting models for Clovis points and bone rods, and promotes idea of a socketed harpoon with C point as end-blade [for which the archaeological evidence is nil - model is based on one Archaic specimen and analogy to Inuit harpoons.]

**Nicholson, Desmond V.**

x

1980 The Atlatl Spur: A Newly Identified Artifact from the Lesser Antilles. Eighth IACA pp. 394-405. Tempe, AZ. online at URL:  
<http://www.thudscave.com/npaa/nicholson/nicholson.pdf> (accessed 3/3/04)

Indian Creek site, Antigua, from Terminal Saladolid levels, two “phallic” artifacts of shell and green stone, now identified as atlatl spurs similar to California types. Atlatl associated with hunting on water in several cultures, advantageous for

Maritime Saladolid boat use. Provides some historic refs, other possible arch examples.

**Nickell, Joe** **x**

2011 Poking Into Atlatl Hunting Can Have Risks. *The Missoulian*, Thursday March 3, 2011. Online version, accessed 3/4/11. URL: [http://missoulian.com/lifestyles/recreation/article\\_ddac0536-4545-11e0-ab0d-001cc4c002e0.html](http://missoulian.com/lifestyles/recreation/article_ddac0536-4545-11e0-ab0d-001cc4c002e0.html)

Montana Senator Greg Hinkle proposed new state law legalizing atlatl for big game. Atlatl explanation from Bob Perkins, Jay Laber, artist and teacher (“Reservation Arts”) at Salish Kootenai College. [Humerous, outcome of legislation not given.]

**Nielson, Jesper, and Christophe Helmke** **o**

2008 Spearthrower Owl Hill: A Toponym at Atetelco, Teotihuacan. *Latin American Antiquity* 19(4):459-474.

Mural in a residential barrio shows an owl superimposed on a stepped hill. Eyes and other features of owl probably represent double finger holes and hook of Mesoamerican atlatl, visible in other iconography from T and Maya sites. Common associations of atlatl or spear for atlatl, shield, owls or eagles, symbolic of warfare and warrior sodalities all over Mesoamerica. Argue that this should be read as a name for a place, perhaps the Pyramid of the Moon at T, and also known to be name of a ruler of Tikal, ultimately perhaps derived from a patron deity at T.

**Nishikawa, Kiisa and Michael I. Ratliff** **x**

2001 The Mathematics of the Atlatl. In NSF CCLI Grant #9980883 Enhancing Quantitative Reasoning Using Visualization. Accessed 6/21/2003 URL: <http://odin.math.nau.edu/~mir/ccligrant/Atlatl.html>

Formulae and math exercises using atlatl. Velocity model, range, kinetic energy.

**Noguera, Eduardo** **x**

1945 El Atlatl o Tiradera. *Anales* 5(3):205-238 plus plates. Instituto Nacional de Antropología, Mexico D.F.

[In Spanish. “The Atlatl or Spearthrower” Fairly detailed summary of atlatl info at the time, but nothing new or really useful now. He doesn’t cite sources properly or give full information in his bibliography, so it’s hard to tell where all his info is from.] Background definitions, consider 4 ethnographic regions: Australia, Melanesia, Micronesia; Arctic; the Americas; and France during the reindeer epoch [Pleistocene]. Three forms of hook: male, female, and mixed. Basic dimensions of some atlatls given, especially Mesoamerican ones. [Plates also reproduce images from other scholars.]

**Nuttall, Zelia**

x

1891 The Atlatl or Spear-Thrower of the Ancient Mexicans. *Archaeological and Ethnographic Papers of the Peabody Museum* 1(3):171-198. Cambridge.

[This paper is probably why we use term "atlatl"].

Surveys Mesoamerican evidence: codices, sculpture, 3 specimens, Spanish chronicles. Small drawings from Aztec depictions. Recognized them because of Mason (Arctic) and Uhle (Peru) reports.

Aztec myth: Given by Huitzilopochtli, or invented during Aztecs' wanderings = perhaps required for aquatic hunting on lakes in Valley of Mexico.

Briefly summarizes Spanish accounts - most atlatl descriptions vague.

Linguistics - sorting out old Spanish terms and mistakes, "Atlatl" relates to verb "tlaca", to throw, aim, cast. But originally used by fishermen (=atlacatl: atl=water, tlatcatl=men) - Atlatl synthesizes atl=water + tlatlacani=thrower, so atlatl = water thrower.

Usually depicted with spear and shield, which allows identification of stylized forms.

IDs types: I1) one finger hole; I2) two or 3 holes; I3) 2 side loops or attached rings; II) opposed lateral finger pegs. [She probably should add type III - simple grip handle, which seems to be shown in a few cases.]

Extant specimens: British Museum, London, and Museum fur Volkerkunde, Berlin - not described, and Museum Kircheriana, Rome: grip rings missing, hardwood, groove and spur, 56 cm L, 19-37 mm W, carved ornament including serpents (on other 2 also), gilded.

Symbolism: Huitzilopochtli depicted with blue serpent atlatl (Xiuatlatl or Xiucoatal) - turquoise ornamented atlatls in chronicles. Also with Xiutecuhtli, Tezcatlipoca, and Quetzalcoatl. Ceremonial atlatls depicted like bishop's crozier, associated with lightning.

So associated with all important gods, war, serpents and lightning.

**Nuttall, Zelia and Arthur G. Miller**

o

1975 *The Codex Nuttall: A Picture Manuscript from Ancient Mexico*. Dover Publications, New York.

Reprint of Nuttall's 1902 color reproduction, original in British Museum. Mixtec folding book, probably done in Oaxaca, slightly pre-conquest. Mythological history/geneology and biography of one lord "8-Deer Tiger Claw," second ruler of 2<sup>nd</sup> dynasty of Tilantongo, 1011-1063 AD. Warrior/deities depicted carrying shield with 2 darts and atlatl or thrusting spear. Hills representing towns are shown as captured by piercing with a dart. The atlatls are very stylized, but some clearly 2-hole type. Darts shown fletched and with large triangular stemmed points. Climactic scene has 8-Deer dressed as Death using atlatl to sacrifice captive tied to scaffold.

**Nuzhnyi, Dmytro**

s

2011 Experiments with projectile points of Upper Palaeolithic and Mesolithic industries of Ukraine. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

“Experiments with bow and arrows tipped with different microlithic projectile points hafted in various ways have been carried out by the author since 1977, using many kinds of targets (paper, wood, bones, freshly killed animals). Base data for recognizing diagnostic projectile fractures. Near three hundred lithic insets of composite and other projectile arrow tips were used.”

[He is old-style Soviet scientist, doing extensive experiments with little support or outside scholarly contact. Showed figures of dozens of damaged points on a page, carcasses bristling with arrows. Suggests using newspaper as standard for measuring penetration in number of pages penetrated.]

**Oberg, Chris**

2000 Atlatl Darts made with Gold Tip 75-95 Carbon Fiber Tube. *The Cast* Fall/Winter 2000:17-18.

Detailed instructions for light, durable but complex takedown dart. Weighs 2.25-2.75 oz (70-86 gm), about 66 inches long (168 cm), balanced at 31-38%.

**Oberg, Chris**

2001 New Guinea Spear Thrower. *The Cast* Spring 2001:6.

Short summary with pictures: bamboo thrower with female nock, used with long wooden pointed unfletched darts. [No references]

**Oberg, Chris**

2001 Darts for Carp. *The Cast* Spring 2001:7.

Carp with spear or bow legal in Michigan. Recommends practice on water filled plastic bottles in lake until refraction learned. Line on end of dart eliminates need for fletching, barbed point can detach with line also.

**Oberg, Chris**

2002 Woven Finger Loops: Why Knot? *The Cast* Spring 2002: 17.

How to make woven string loop. [But no info on attaching it to atlatl].

**Oberg, Chris**

2003 Home Grown Darts for Pleasure or Profit. *The Cast* Spring 2003:17.

*Arundo donax*, “Giant Reed,” imported ornamental grass from Mediterranean and far East is easy to grow in wide range of conditions.

**Oberg, Chris**

2003 The Remarkable History of Michigan Copper. *The Cast Spring* 2003: 16.

Brief background, photos of making Old Copper dart point from copper wire.

**Oberg, Christopher**

2010 Evaluation of Atlatl Darts Made with Gold Tip 75-95 Carbon Fiber Tube. *The Dart* Dec 2010:13-17.

Detailed manufacture instructions.

**O'Brien, Michael J. and W. Raymond Wood.**

1988 *The Prehistory of Missouri*. Columbia, University of Missouri Press.

General text, lots of info on point types, photos, other lithic info.

p. 93 Dalton pt functions - point/knife, resharpened by serration and beveling, reveals handedness, multifunctionality is why so many exist (Morse, Goodyear). More likely variability from different projectile uses, and "Dalton" is a lumped type covering lots of functional variation. E.g. large Sloan type Daltons hafted as spears, serrated type for different hunting. Beveled Daltons (most common) probably first atlatl points, beveling helped stabilize flight. Later in Early Archaic, around 6500 BC most beveling ends, prob because now added fletching to shafts. And points get smaller because don't need large heavy point to stabilize shaft once you have fletching. [Bad idea - beveling does not spin a dart.]

p 112-117 discussion of hafting, following Musil (1988) design models - trend from fluted lanceolates to contracting or stemmed, to notched increased efficiency of penetration and reduced damage to shaft and allowed more reuse of damaged points. Then organize Archaic points by hafting type. Mention R Madden and Virgil Hayes experiments with atlatl, cite Hayes (1994): bannerstone helps match spine of dart with force of atlatl, allowing most efficient recovery from flex; can adjust to accommodate different spears. [Nonsense.]

**Ochsenschlager, Edward L.**

1998 Viewing the Past: Ethnoarchaeology at al-Hiba'. *Visual Anthropology* 11(1):103-143.

[Unusually thoughtful and enjoyable discussion of problems and promises of ethnoarchaeology.] Biases in collecting data, relations with informants, differential preservation, attitudes toward artifacts shaped by gender, social status, morality, skill, etc. Info on toys, bitumen, reeds, houses, slings, etc.

Slings as example showing that skill in artifact use is valued and practiced: 2 different tribal villages each had young man of unusual skill, and conducted public rivalry over which got more game. Boys accepted as men because of skill, experimented with different lengths, weights of clay shot etc to improve their

skills.

**Odell, George H.**

**o**

1988. Addressing Prehistoric Hunting Practices Through Stone Tool Analysis. *American Anthropologist* 90:335-356.

Use wear ID's unretouched flakes used as pts at Woodland sites & Archaic Mid W. Compare with experimental breakage of formal pts. Argues earlier use of bow and arrow than usually believed.

**Ohtsuka, Ryutaro**

**x**

1989 Hunting Activity and Aging Among the Gidra Papuans: A Biobehavioral Analysis. *American Journal of Physical Anthropology* 80:31-39.

Hunting records of 1633 hrs, visual acuity and grip strength measurements. Gidra tribe, Papua New Guinea. Productive hunters aged late teen to 45, in weight of animals killed per time, efficiency of elder married men (35-45) is almost 4X higher than unmarried (16-late 20s). Horticulturalists, but most meat hunted, adult males eat average 30-36 gm/day [that's not much!]. Hunt wallaby, bandicoot, cassowary, pig, and introduced deer. Bow and arrow, a few shotguns, dogs, communal fire drives. Efficiency: Shotgun 2.77 kg/hr, B+A 1.01 kg/hr, communal .79 kg/hr. Elder males most different in B+A efficiency, less in shotgun. In 10 yr interval, younger men improved, elder men declined, but each individ performance correlated, ie good hunters remained consistently good, worse hunters stayed low. Visual acuity correlated with hunting success but grip strength did not; oldest men reduce hunting time. Boys less grip strength, use lighter bows. Skill in finding and approaching animals is more important than actually shooting skill, thus increase in success with age, and B+A more difficult than shotgun. B+A range about 20 m, ideally 10. Unmarried and married men scored similar in standard archery test, but elders have more hunt success.

**Ortner, Donald J.**

1968 Description and classification of degenerative bone changes in the distal joint surfaces of the humerus. *American Journal of Physical Anthropology* 28:139-156.

Describes arthritic changes to the capitulum of the humerus where it articulates with the head of the radius in both flexing and rotating at the elbow. He calls this "atlatl elbow" throughout. Compares Peruvian and Eskimo skeletal remains, and finds higher frequency of elbow arthritis in Eskimo, but he is not arguing that it is caused specifically by atlatl use, just that the symptoms of "atlatl elbow" are probably caused by stressful use of the arm.

**Osgood, Cornelius**

1940 *Ingalik Material Culture*. Yale University Publications in Anthropology

Number 21. Reprinted 1970, Human Relations Area Files Press, New Haven.

Inland S. Alaska Athapaskan (not Eskimo) groups on the Yukon River. Principle informant Billy Williams born 1884. [Complete entry p.201, atlatl apparently no longer used by 1939.] :

“Spear Thrower and Darts: te lakoi, water/to throw. The name apparently comes from the fact that the spear thrower is commonly used from a canoe on the water. [Fascinating parallel with “atlatl,” see Nuttall]. Men make spear throwers out of spruce wood, birch wood, or bone. My informant recognized illustrations in Nelson’s monograph on the Bering Sea Eskimo as being typical of those formerly used among the Ingalik. Darts associated with the thrower were also recognized. Darts are said never to be feathered nor to have points attached in the center of the shaft [like Bering bird darts]. The spear thrower and darts are used only for hunting ducks.”

Bows and arrows had more use. Bows apparently not sinew backed. Fire drill usually with a cord, rarely with bow.

### **Oswalt, Wendell**

1972 The Eskimos (Yuk) of Western Alaska. In *Modern Alaskan Native Material Culture*, edited by W. Oswalt, pp. 73-95. University of Alaska Museum.

One of a group of surveys of culture change in artifacts in 1970-71. Most other groups mention apparently not using throwing boards any more, but here: “It is something of a surprise that sealing and whaling harpoons based on aboriginal models continue to be important hunting weapons. Sealing harpoons have either a toggling head or a barbed head. In both instances the head is made from a solid piece of copper, brass, or aluminum which is hacksawed into rough form and filed into final form.” Foreshaft is a nail, shaft is cedar with modern paint, head is attached with cotton or nylon cord. “These weapons are always propelled with the aid of a throwing board, which usually has a wooden peg and is painted with a commercial paint.” Beluga whaling harpoons heavier, hand thrown. Harpoon still needed because shot seals sink, so they are harpooned and then shot, or if beyond harpoon range, shot and then harpooned as soon as possible. [Although the collections made in this project include throwing boards from several villages, there is no full description and no illustrations of any of the objects, which greatly lessens the value of this publication.]

### **Pafford, John**

2002 Back to Iowa After 65 Years. *Prehistoric American* 36(2):31-34.

Six large ferruginous quartz butterfly bannerstones found in field by workers in 1930’s, acquired by Ben Nussbaum. [“Nussbaum Cache” – but who knows if they were actually together, or what information was destroyed by finders or circumstances.] Full size color photos.

**Palencia, José Servin** **x**

1977 Las Artes Menores. In *Esplendor del Mexico Antigua*, edited by Carmen C. de Leonard, pp. 379-410. Mexico City, Centro de Investigaciones Antropológicas de Mexico.

Matricula de Tributos codex gives idea of diversity. Mosaic, feather, bone, wood discussed. Seems to think the late fine work could only be done with metal tools. Drawing of Aztec atlatl from Bliss Collection in Museo Nacional de Washington. [missing pages].

**Palmer, Jay W.**

2001 A Basketmaker II Massacre Revisited. *North American Archaeologist* 22(2):117-141.

Wetherill's Cave 7 site in SE Utah (see Hurst and Turner 1993). Ninety-six Basketmaker (ca 500 BC to AD 400) people killed with bone daggers, clubs, atlatl darts. Victims were Proto-Kiowa in conflict with recently arrived Penutian/Hokan/Dineh who later became Proto-Zuni. The killers are so identified in part by use of clubs and bow and arrow. [This is all a tenuous tissue of speculation based on very complex and problematic genetic and linguistic reconstructions. There are also problems with his understanding of Basketmaker in general, and with artifact information. In particular he considers some unnotched bifaces to be adzes used as weapons, and accepts the 19<sup>th</sup> century identification of two of the points in wounds as arrow points, which they almost certainly are not.] The site is notable for atlatl use in warfare, including one obsidian point reported to have "pinned the hip bones together" on one corpse [and thus an atlatl point rather than a "knife".]

**Palter, John L.** **x0**

1976 A New Approach to the Significance of the "Weighted" Spear Thrower. *American Antiquity* 41(4): 500-510.

No ethnographic weights, prehistoric North America only.  
Tests contradictory, his show distance decreases with heavier weight.  
Balance hypothesis: not necessary unless spear were heavy, why just N.A.?  
Weighted Basketmaker atlatls flat and flexible - Weight would augment flexibility. [Similar to theories of Perkins and Leininger 1989, Hayes 1994]  
Prehistoric specimens mostly less than 80 grams, rest may be non-functional.

**Palter, John L.** **x**

1977 Design and Construction of Australian Spear-Thrower Projectiles and Hand-Thrown Spears. *Archaeology and Physical Anthropology in Oceania* 12(3):161-172.

Ethnographic specimens: 33 hand-thrown and 293 spear thrower spears

[unfortunately not illustrated].

Hypothesized diffusion after 10,000 bp, but thrower not used all over Australia.

Two length groups of spear thrower spears: 1) average 160 cm, 2) average 260cm.

Hand-thrown spears average 267 cm.

Mass: Hand-thrown average 740 gm, thrower average 246 gm.

Decreased mass allows maximum velocity - led to composite reed spears, with hardwood points.

Balance: spear thrower spears: weight forward, 32-40% and 42-46% of length from tip, while hand-thrown spears typically 46-50%.

**Palter, John L.**

**xo**

1999 Slingspears: Recent Evidence on Flexible Shaft Spear Throwers. *SAA Bulletin* 17(2): 2-3, 16.

In 1976 believed bannerstone exploited flex of spear thrower. New evidence from communication with Strischek, who says flexible atlatl hurts his wrist less and gets more distance, and most modern US atlatlists use them. Europeans prefer rigid atlatls - will they change if flexible are more effective? [Interesting that older archaeologist has found non-academic atlatl community.]

**Palter, John L.**

**o**

2009 Slingspears: Recent Evidence on Flexible Shaft Spear Throwers. *The Dart* Dec 2009:19-20.

Sweatman 1840s observed Australian use of two types: broad rigid throwers for heavy spears, long light whip-like throwers for birds and small animals.

Rigid atlatl strains wrist in throw, flexible less, allowing force to be applied longer, gives slight increase in distance from not losing momentum in throw. Flex acts as shock absorber, weight keeps flexible dart from causing wobble at spur, improving control and accuracy.

**Parker, Arthur C.**

1917 Notes on the Banner Stone, With Some Inquiries as to its Purpose. *New York State Museum Bulletin* 196: 165-176. Albany.

Found just before and after white man, in villages and mounds [incorrect info]. Experiment: winged form serves like fletching on spear, works also as spindle whorl in drilling.

Perhaps part of effigy bird forms associated with fire and lightning, maybe head ornament as on copper cut-out of falcon dancer from mound.

Moore's "mesh spacer" theory also possible, also idea of atlatl weight.

Manufacture described from specimens.

**Parsons, Elsie Clews**

**x**

1918 War God Shrines of Laguna and Zuni. *American Anthropologist* n.s.

20(4):381-405.

Ritual use of arrows and stone points in shrines, and miniature bows. At one Laguna shrine in extinct geyser, found a couple possible dart fragments. [Based on comparison with Pepper, and Kidder + Guernsey finds, but unlikely to be that old and not a positive ID anyway.]

**Pastrana, Alejandro, and Kenneth G. Hirth** **o**

2002 Biface Production and Craft Specialization: A View from Sierra de las Navajas, Hidalgo. In *Mesoamerican Lithic Technology: Experimentation and Interpretation*, K. G. Hirth ed., pp. 197-207. University of Utah Press, Salt Lake City.

Standardized manufacture of bifacial points for Aztec military use - large cores worked at quarry for large flakes, made into bifacial preforms, or tabular pieces ditto, stored until sent to city for finish work there. Point forms from Tenochtitlan, Texcoco, and Tlatelolco illustrated: [3-7 cm long, triangular forms with shallow side notches and usually concave bases, sizes suitable for arrow to dart, regular pressure flaking - these should be the form of Aztec dart points]. Article describes methods, but has little conclusion.

**Pasztory, Esther** **s**

1983 *Aztec Art*. New York, Abrams.

Drawing from Saville and good color photo of carving on British Museum atlatl, color photo of another gilded atlatl.

**Patterson, Alex** **o**

1992 *A Field Guide to Rock Art Symbols of the Greater Southwest*. Johnson Books, Boulder CO.

[Generally good brief info on many motifs. P. 44-45 "Atlatl or Spear Thrower" adequate definition from Grant 1979, but illustrations mostly Coso Range, not typical of SW depictions.]

**Patterson, J. T.** **o**

1937 *Boat-Shaped Artifacts of the Gulf Southwest States*. University of Texas Bulletin No. 3732, Anthropological Papers of the University of Texas Vol 1, No. 2. University of Texas, Austin.

Studied 359 boat-stone specimens from various collections from TX, AR, OK, LA. Typology of 38 varieties preferred to lumping into larger types. [Not a very useful typology - no meaningful spatial distribution of varieties, includes some things that plainly don't belong, and fails to group things that are obviously similar. Many photos, but no two of same artifact, so can't see how some details

relate to each other or replicate specimens. Dimensions given, but not weight, the most meaningful measurement if he interprets them as atlatl weights.]

Mostly bar, cup or boat shape in outline, and usually with concave base. Various different stones used, mostly local and soft - sandstone more often than any other, but also some chert or flint, and some quartz or quartzite. Sometimes notched, only rarely perforated for attachment.

Usually assumed charm or ornament. Source of "boat-stone": Wilson and Moorehead connect to Mohawk belief that witches use to cross rivers or as charm against witches. Other early interpretations. Rare use as container, rarely in graves. End notches and keel grooves suggest attachment to other object - suggest atlatl charm or weights as seen in SW. Hollowing base to regulate weight or allow large attractive stone. None yet found in association with atlatls in Gulf region, but older points are too large for arrow, so atlatls should have been in use, and some atlatl + dart finds from caves in TX.

**Patterson, L. W.**

x

1975 The Atlatl Function: Some Comments. *The Record* (Dallas Archaeological Society) 31(3):5-7.

Added leverage and increased angular momentum through a rotational motion is closer to the actual function than Howard's (1974) added force-time with a level atlatl. He diagrams, and calculates average 47% increase in leverage over hand throwing.

**Patterson, L.W.**

1977 Atlatl Functions: Comments on Howard's Views. *Plains Anthropologist* 22(76 pt 1): 159-160.

Critiques Howard 1974, 1976. Atlatl *does* work by adding rotational energy. Butler's idealized model is also wrong; functional length of atlatl is not complete arm + atlatl. Dart *must* rotate on spur, even for Howard's model. Question should be easily resolved by physics and high speed photography.

**Patterson, Leland W.**

f

2005 Additional Comments on Unifacial Arrow Points. *Houston Archeological Society Journal* 128: 7-9.

Small flake pts with unifacial retouch by either raking or serrated pressure. Begin in Middle Archaic (3000-1500 BC) before bifacial arrow pts which are Late Prehistoric (post 600 AD), and contributed to pop increase in Archaic. [This would be very early for bow - why such a long gap before bifacial points since other Archaic pts were bifacial, and the b + a was successful and important?]

**Patterson, Leland W.**

x

2007 Hunter-Gatherer Violence in Southeastern North America. *The Chesopaeen*

45(4):21-23.

Ignoring evidence for bow and arrow in Archaic (refs) is like ignoring evidence of Pre-Clovis. H-G violence lacks size and organization characteristic of warfare. One of several possible responses to competition for resources.

**Pauketat, Timothy R.**

o

2009 America's First Pastime. *Archaeology* 62(5):20-25.

Chunkee as widespread sport, possibly began at Cahokia, maybe used by elite there to unite regional system, express identity and membership. (See DeBoer 1993).

**Payen, Louis A.**

1970 *A Spearthrower (atlatl) from Potter Creek Cave, Shasta County, California*. University of California, Davis, Center for Archaeological Research Publication No. 2: Papers on California and Great Basin Prehistory.

Cache in cave, with basketry, feathers, stone tools, shells.

Nearly complete but poorly preserved atlatl. One-piece wood, 35.3 cm L, 3.3-1.65 cm W, .8-1.2 cm T. Opposed finger notches, no loops, flat palm grip, single groove on hook side, 2 parallel grooves on other, but hook end is rotted off. [He is confused about dorsal and ventral – ventral, not dorsal is the hook side, but it is not clear if he can really tell which side had the hook anyway.] Very similar to Lovelock Cave atlatl (Loud and Harrington 1929).

Fragments of 3-part compound darts, tangential fletching on hardwood endshafts with socket, light wood mid shafts, hardwood foreshafts with and without stone points. Gives details of shafts. Points are small obsidian, stemmed or leaf shape, 2-3 gm weight, which is “arrow” size (Fenenga 1953).

C14 dates for darts from other sites: Gypsum Cave 950 BC + 80; Leonard Rockshelter 5188 BC + 350; La Brea 2500 BC + 200. Potter Creek should compare to Lovelock Culture, so suggest 1000 BC – AD 300 but no C14 yet.

[Atlatl, points, foreshafts illustrated]

**Peabody, Charles** [sic from Kellar]

1904 Explorations of Mounds, Coahoma County, Mississippi. *Peabody Museum of American Archaeology and Anthropology Papers* 3(2):?

Apparently first to suggest antler hooks from SE were part of atlatls.

**Peck, Rodney M.**

1989 Pick Type Bannerstones: The Atlatl Weight of the Stanly Culture. *The Chesopiean* 27(3):14-17.

Manufactured by peck, grind, scrape, drill, polish in that order, from a variety of

materials. Drills solid or hollow. Broken specimens often reworked. Stanly Culture = Archaic VA and Carolinas, est 7000 BP, assoc with Stanly + Kirk Stemmed pts, introduction of full grooved axes. [see Coe 1964]

**Peltier, Martin**

x

1988 Au Mexique, J'ai Fete la Toussaint de Tous les Dieux. *Le Figaro* 451 (12 Nov 1988):134-142.

Tarascons of Janitzio, Michoacan, Mexico hunting ducks on Lake Patzcuaro with atlatl for Day of Dead, Nov. 30. [no detail, dark photo]. Decorate cemetery, feast, mixed Christian and pagan heritages.

**Peets, Orville**

1959 A Butterfly Bannerstone as an Atlatl Weight. *Ohio Archaeologist* 9(3): 83-87.

Fragile but functional, his replica survives atlatl weight/hook use.

Possible evolution from hand, throw with finger on end of dart, use short "palm" atlatl like Santa Barbara which adds force but is hard to balance, to lengthened atlatl or weighted atlatl to balance spear.

[No description of how he used his bannerstone, but photos show he put it on extreme end of atlatl and used edge of butterfly wing as hook for dart.]

Recommends a "brake" in motion as dart leaves atlatl rather than follow through [that is really poor form, no wonder he has no accuracy].

[No mention of flex, his atlatl seems rigid.]

"To attain accuracy I should have started 70 years ago" [He can't hit human-size target at 20-40 yards, so I would not judge experiment a success.]

**Peets, Orville**

x

1960 Experiments in the Use of Atlatl Weights. *American Antiquity* 26(1): 108-110.

Weight makes no difference to distance of cast.

Weights probably for balance of spear on hand.

[Motion not described, but inaccuracy mentioned. Recognized problems of consistency in throwing, but sample size is not mentioned.]

**Peets, Orville H.**

x

1962 The Genuiculate Bannerstone as an Atlatl Handle. *Tennessee Archaeologist* 18 (2): 85-90.

"For several decades" experiments have been out of favor in arch. But "the most meaningful questions are not to be solved by using meaningless names" of artifacts. If we fail to recognize 'bannerstones' as atlatl weights, and 'gorgets' as wrist guards, we lose info on transition to bow. Genuiculates are hook shaped with

oval and oblong perforation. Thin shaft fits firmly in hole, hook up supports dart, held with either two-finger [split] or [hammer] grip. Similar to beak on birdstone atlatl handles. [His photos with geniculate handle and antler hook show additional bannerstone weight in between – no arch evidence of this]. Not a combined hook and weight as Webb suggests, and weights do not improve atlatl force. Weight might help balance, but not necessarily. [see Morse and Morse 1962].

**Penders, Thomas**

x

2002 Bone, Antler, Dentary, and Lithic Artifacts. In *Windover: Multidisciplinary Investigations of an Early Archaic Florida Cemetery*. Glen H. Doran, editor. Pp. 96-120. University Press of Florida, Gainesville.

Atlatl “hook/cups” (5) of antler, short cylindrical with hook projecting from lip of cup. [So a “male” hook, cup is only to fit on end of atlatl shaft]. Hooks often reworked, worn. “Atlatl weights/handle/club heads” (5) of deer antler and 1 of manatee rib. All elliptical, transverse biconical hole for shaft. All but one have one splintered end from hammer use. Hole diameters average 17 mm. [There is no reason to call these “handles.” They appear to be weights. At least one hook and weight are from same burial (155), another pair have same numbers, but incredibly, association not discussed, nor do any seem to have been connected by wooden shaft, although photo in Dickel shows the Burial 155 weight on its shaft. I can’t believe this was not examined. No mention in chapter on wooden artifacts either]. Six antler tine projectile tips, 3 barbed points [I wonder if these are not atlatl hooks too]. Suggest “twisted on” for pts and atlatl hooks since no evid of adhesive [but could have been animal based glue].

**Pepper, George H.**

x

1902 *The Ancient Basket Makers of Southeastern Utah*. Guide Leaflet 6, American Museum of Natural History, New York.

Description of objects from collections of Wetherill, Graham, and McLloyd, mostly from Grand Gulch. Physical and cultural differences between “Basket Makers” and “Cliff Dwellers.” Basketmakers had crude or no pottery, lacked bow, used throwing stick or atlatl similar to Mexican, “a form of weapon unknown in the SW, either in ancient or modern time, save in this restricted area.” [No illustration of examples.] Baskets - include one with duck designs [similar to BM rock art.]

**Pepper, George H.**

1905 The Throwing-stick of a Prehistoric People of the Southwest. *Proceedings of the International Congress of Americanists*, 13th Session, 1905. pp. 107-130.

Describes atlatls associated with Basketmakers, pre-Cliff Dweller, no bow and arrow.

Comparisons - Mexico, Cushings Florida finds, others.

Several SW specimens described, mostly Utah, with some dimensions and a few illustrated.

Snake and lightning symbolism.

Spears - often cane, many wood foreshafts from Utah, with stone points, bone bunts, one hardened wood in cranium.

Mentions some experiments with atlatl and fletching, but not described.

**Péquart, Marthe and Saint Just Péquart**

**x**

1942 Récente Découverte de Deux Oeuvres D'art Magdalénien au Mas D'Azil. *Révue Scientifique* 80:91-95.

[In French. "Recent Discovery of 2 Magdalenian Art Works at Mas D'Azil"]. French Upper Paleolithic. 1937 Mandement found 3 chambers in the cave, one with mammoth and cave bear bones, one with engravings, one with a living area. Excavations by authors. Baton de commandement of antler with horse head sculpted on palm. Propulseur à sagaies (spear thrower) of reindeer antler, complete, faun aux oiseaux form, good photo. Holes in proximal end [probably to attach to longer shaft] interpreted as allowing hunter to attach to self. Fragile, beautifully made, no sign of wear in holes, 3 holes not necessary - probably not intended for use, a "propulseur d'honneur" made for an important person. Unique, only complete specimen, original subject - first prehistoric humor: probably a young chamois, looking back at rear, where it expels a dropping in the form of a bizarre sausage, with two stylized birds sitting and pecking on it, which forms the hook. [Two more pages of wordy description of the artistic brilliance of the piece.]

**Perkins, William R.**

**o**

1990 Old and New World Atlatls: A Study of Similarities in Form and Function Centering on the Nazca Culture of South American and Tribes of Papua, New Guinea. *The Atlatl* 3(3):3-4

"Miscue" when dart comes off nock and is struck by atlatl can be prevented by "dart guard" on atlatl - found in both New Guinea and South America.

**Perkins, William R.**

**o**

1992 Stealth Technology 1992 B.C. *Bulletin of Primitive Technology* 1(4):67-69.

Atlatl weights have 2 functions: 1) force flex of atlatl to store and release energy 2) silence sound of movement thru air [I don't find either convincing].

Dismisses argument that serve as counter-weight when aiming - arm goes to sleep. [He's probably right, if you picture hunter crouched in aiming position for an hour!]

**Perkins, William R.**

**x**

1992 The Weighted Atlatl and Dart: A Deceptively Complicated Mechanical

System. *Archaeology in Montana* 31(1):65-77.

Began experiments as engineering student 1984, presented this paper Montana Arch Soc 1989, Perkins and Leininger 1989.

Atlatl is to propel light flexible dart, not heavy spear, tip of atlatl moves faster than hand, so dart faster than hand-thrown spear. Force is applied at end and dart flexes, similar to arrow.

Flex of dart is essential to spring spear off hook before atlatl decelerates and swings down, or would just slip off hook [which in effect *is* what happens.]

Dart flex stores and uses "harmonic oscillation and transverse waves" [a more complex explanation of concept of dart as spring]. Dart mass and distribution of mass affects flex, projectile point mass important part of this. "The dart is a missile which works very much like a spring."

Recommended darts: Red ossier dogwood saplings, 160 cm long, 1 cm thick, 100 grams mass.

Atlatl length affects arc length: longer atlatl better for long distance.

Weighting an "average" atlatl (= 1/3 dart length) compensates and allows adjustment for distance.

Atlatl flexes, influenced by weight, which by affecting flex, times separation of dart and atlatl, so tuning proper flex of dart to atlatl makes system efficient.

[This theory was quite reasonable at the time, but relies on a couple incorrect assumptions: 1. that the atlatl decelerates, allowing dart to release spring tension and jump ahead of atlatl, 2. that dart flex acts as compressing spring (in fact most of the available energy is released side to side by oscillation, not forward).

Accordingly, weights may or may not influence flex of the atlatl but that is irrelevant, and while a flexible dart is necessary, it is not a spring system, and to speak of the dart "propelling" its point is quite wrong. See Whittaker and Maginnis 2006]

### **Perkins, William R.**

o

1993 Atlatl Weights: Function and Classification. *Bulletin of Primitive Technology* 1(5):58-61. *The Atlatl* 15(2):10-11 (2002)

Confined to N. America. Theories: counter-balance, greater distance, hunting magic.

Weights not heavy enough to influence speed of swing and thus dart velocity [not true, they often are, and depends on how placed]. No steadying effect. Flexible dart most important part of system. Purpose of weight is to resist acceleration, allowing atlatl to store more spring energy, and time release to spring of dart.

Types: I - ca. 65 grams in one or two points, [where does he get this 65 gm?] II. 65 grams distributed by long weight, III. "stealth" weight or bannerstone. Mass ca 80 gm on atlatls ca. 40 cm, (shorter than 60 cm western weighted atlatls). Work mechanically like I, but silences noise of atlatl swing. Measured with microphone.

### **Perkins, William R.**

o

1995 Effects of Stone Projectile Points as a Mass Within the Atlatl and Dart Mechanical System. *Bulletin of Primitive Technology* 10:69-72.

1997 Effects of Stone Projectile Points as a Mass Within the Atlatl and Dart Mechanical System. *Indian Artifact Magazine* 16(2):18-19, 65.

Dart is most important part of "spring mass mechanical system" - it flexes, and mass of point resists force, helps flex dart and store energy. Longer darts need bigger pts with more mass to flex efficiently.

Distance tests - variation  $\pm 1.5$  gm around a 9 gm mass is ok

Temporal trend to smaller points reflects faster darts, but more sensitive, so need more standardization of points in each local tradition [inadequate example given, and what about resharpening?]

Stone points preferred to other materials because more mass.

Really long darts like Australia - large points, or none if enough dart mass to flex without.

Ideal proportions of system:  $\text{DartLength} = \text{Atlatl Length} \times \text{Pi}$

[Dart flex is necessary, but he greatly exaggerates the importance of dart flex as stored energy – try flexing a dart against a stop and letting it spring forward. How far does it go? Does weight of point really affect flex, or mostly balance?].

### **Perkins, William R.**

o

2000b Effects of Stone Projectile Points as a Mass Within the Atlatl and Dart Mechanical System and its Relationship to the Bow and Arrow. *Indian Artifact Magazine* 19(2):8-9, 78-79.

Projectile advances all make smaller go faster, because  $\text{Energy} = \frac{1}{2} \text{Mass} \times \text{Square of Velocity}$ , and flatter trajectory more accurate.

Archaeological studies show arrow pts  $< 3$  gm, dart  $> 4$  gm.

Mass of points is important because in flexible shaft, energy is stored by flexing at launch, needs mass of point to resist push and cause flex, whether bow or atlatl.

Also, to develop skill, need to use consistent points. Principles are same whether bow or atlatl, so bow evolved from atlatl. [Wrong!]. Foreshafts develop to tune system, and to minimize loss of length and thus flex with breakage.

Specific point masses are most efficient with a given dart length and flex, with limited (2-3 gm) range of variation possible. Tests at ca. 120 yds show a shaft designed for a 9 gm pt lost 3-7 yds of range when point varied by only 1.5-2.5 gm. [Given the variability inherent in the test, is a 2.5-6% variation really meaningful? – Doubt it.] Later points are generally lighter, so need more sophisticated gear, and also lighter shaft materials. But small point needs shorter shaft, needs shorter atlatl, which reduces possible range. Bow makes such small projectiles work. Small points have even more limited possible variation, large early points much more. [This is really just a numerical effect.] Very large darts have enough mass without points.

[Perkins is looking at interesting variables, but I'm not convinced. He exaggerates the effect of flexing the shaft – as in bow and arrow, the shaft flex is necessary,

but its contribution to the energy of the flight is very minor. He exaggerates the need for consistency too – human variability in each throw is so great that it far outweighs the effects of small changes in point mass, or dart mass or flex for that matter, both for accuracy and distance (see Couch et al 1999). Despite his archaeological example, point consistency is low, even in small arrow points – and my experience shows it doesn't matter. For instance, I have often broken a couple inches or more off a dart, re-pointed it, and used it with little change observable.]

**Perkins, William R.**

**o**

2000a Archeological, Experimental, and Mathematical Evidence Supporting the Use of the Atlatl as a Primary Big Game Procurement Weapon of Prehistoric Americans. *Bulletin of Primitive Technology* 20: 69-72.

“Atlatl is not a spear thrower, it is a dart launcher.” – requires flex of dart to spring off hook. [Unexplained concept of oscillations invoked too. And a bizarre and incorrect mathematical argument to show the atlatl is not a lever, and in fact “the force applied by the atlatl to the dart is inversely proportional to the length of the atlatl.”] Flexing force proportional to length of dart, shorter dart requires less, thus needs smaller point. Most efficient is  $L_{\text{Dart}} = L_{\text{Atlatl}} \times \pi$ , best at middle ranges, so shorter for closer, longer atlatl for longer distance [which demonstrates right there the lever nature of atlatls!]. Archaeological evidence of multiple lengths from rock art [not reliable]. Flexible atlatl adds efficiency, but hard to adjust by changing flex or length. Atlatl weight allows adjustment by influencing flex [contradictory], function same as dart point. Archaeological evidence and experiments show atlatl effective as hunting weapon. Eskimo use short, rigid harpoon thrower, not real atlatl – at short range ok to throw rigid dart from end. Eskimo effective at ranges less than 15 m, atlatl dart oscillation means it's not [not true]. [Perkins doesn't explain his physics well here, and is incorrect in many assertions.]

**Perkins, Bob**

**x**

2004 Atlatl Archaeology: Precision Atlatl and Dart Systems. BPS Engineering webpage, URL <http://atlatl.com/archaeology.html>, accessed 2/13/2004

**Perkins, Bob**

**x**

2004 Atlatl and Dart Mechanics. BPS Engineering webpage, URL <http://atlatl.com/archaeology.html>, accessed 2/13/2004

**Perkins, Bob**

**x**

2004 Instructions for the Atlatl and Dart System. unpublished flyer sent by Perkins to accompany his darts and atlatls.

[Good throwing instructions, but strange drawings of sequence showing dart flexing with point going way up instead of staying on target while proximal end



bundles with offerings. Patterns suggest institution for social, political and religious leadership among Topara leading to their dominance, beginnings of Nasca tradition. Bundles of embroidered textiles + cotton shrouds include tools and weapons such as slings, stone headed maces, and estolicas (atlatls). Large bundles of elder males with regalia clothing = high status specialists. Embroidered designs show supernatural figures carrying weapons, and heads (which rarely are found in bundles). Atlatls in both high and lower status bundles. [No illustrations or atlatl details, presumably the basic Peruvian form].

**Peters, Brian, and Glenn Sykora**

1998 Physics and the Atlatl, Part I. *The Atlatl* 11(3):3.

Dean Pritchard Type III atlatl vs hand throws, speed estimated from distance: Atlatl (60.1 m; 24.2 m/sec), hand thrown (16.9 m; 12 m/sec) which suggests atlatl stores and imparts elastic energy similar to bow and arrow. [No details, promised follow-up which never appeared.]

**Petersen, H. C.**

x

1986 *Skinboats of Greenland*. Viking Ship Museum, Roskilde.

pp 69-97 section on harpoons and throwing boards with drawings. [Lots of descriptive detail, but remains rather unclear how things are thrown, and no photos of action] Also mentions hand grip and throwing strap as alternatives to throwing board. Knob and winged harpoons, bird darts and bladder darts mostly thrown with throwing board, sometimes the same, but sometimes each has own. Three types: 1) side-positioned [two bone pegs on harpoon fit holes in thrower, one prox, one distal], 2) with an end hook, and 3) combination of both. Made of wood, preferably same as harpoon. Flat, tapered shape, narrower at “forward” or “lowest” end [=distal], broader at “back” or “highest” end [grip, proximal]. “Top” [= underside] and “underside” [= upper] is grooved for harpoon shaft. Bone ends, decorative for proximal, necessary for distal. “Side-positioned” thrower used with knob harpoon and lance, which are held firmly in place on board by pegs and holes, also ensuring exactly same position each throw, can modify them to adjust throw. End hook throwers for winged harpoons, bladder darts, bird darts. No pegs, socket in bone cap on end of projectile, but there are some that use both together. Different sizes and details for different types. “Using a hook throwing board requires a different technique to the one used with a side-positioned one... When using a side-positioned throwing board the hand moves forward and down with the throw; with a hook throwing board it is extended as far as possible forward.” “When throwing with the throwing board, the arm and hand move in the same way as when throwing a stone, first forward and then down.” [The projectiles all seem pretty rigid, although Petersen does not say. Is he describing a motion with less flip of the atlatl, less lever action for more rigid “side-positioned harpoons and more flip for more flexible lighter darts used with “hooked” board?]

**Pétillon, Jean-Marc, Olivier Bignon, Pierre Bodu, Pierre Cattelain, Grégory Debout, Mathieu Langlais, Véronique Laroulandie, Hugues Plisson, and Boris Valentin**

2011 Hard Core and Cutting Edge: Experimental Manufacture and Use of Magdalenian Composite Projectile Tips. *Journal of Archaeological Science* 30:1-18.

Previous experiments mostly on lithic points. Many Upper Paleolithic points of antler or bone with groove for microliths along edge, this use of bladelets supported by finds and use-wear. Experiments 2008 to assess performance and produce use-wear examples. Lower Magdalenian: bladelets with retouched edge and sharp edge, microbladelets similar but often twisted. Reindeer antler points with “massive” [= thick round] bases or single-beveled. Upper Mag Pincevent Level IV20: small backed blades, long antler points with grooves and double-beveled base [i.e. thinned], one frag with microliths in place on both edges [but mastic not identified].

Experimental points: 10 no microliths, 24 with one or two edges of microliths, beeswax/resin/ochre or birch bark pitch mastics. Diameters (above 8=9 mm) and weights (above 15 g) of most are in range of spear, not arrow; Mag atlatl hooks known. Experimental spears of wood, 2700 mm long and 150-200 g. Two deer carcasses shot with atlatl thrown spears (throwers Cattelain, P + T Chauvaux, Demoulin) from 12 m. Crossbows used in other experiments don't duplicate dynamics of spear thrower lever action. 34 spears, 74 throws, 44 hits. 30/44 hits penetrated flesh + hide, 14 left impact trace on bone. Mean penetration for unbladeletted points was 148 mm. Little damage to antler, only a couple of crushed tips if hit target, but misses usually damaged. Penetration with bladelets varied, some stripped off the point and failed to penetrate hide; but mean depth for those with microliths was 283 mm. Microlith often detached at impact or within body. Microwear poorly developed. Probably need better setting of microliths.

Compound points are a good combination of toughness and cutting power. Adding flint edges doubles penetration. Interface between components (point/shaft, and antler/flint) are the weak spots. [good article]

**Pétillon, Jean-Marc, and Pierre Cattelain**

x

2004 Nouvel examen de l'armature composite Magdalénienne du Tuc d'Audoubert (Montesquieu-Avantès, Arriège). *Bulletin de la Société Préhistorique Française* 101 (1):45-53. URL: <http://usersskynet.be/fa057790/prehampetuc.pdf.zip> accessed 10/25/05.

[In French. “New study of a Magdalenian compound weapon from Tuc d'A.”] Antler foreshaft 344 mm long beveled and shaped to fit split-base antler point found nearby. Recognized by H. Begouen, excavator 1926. Associated with living floor, other artifacts including ornaments, parietal art, clay bison sculptures. Date on bone 14350 +160 BP or 15900-14600 BC. Study of 549 split-base pts

shows great regularity of size. Foreshafts and points cut from hard exterior of antlers, roughly square cross sections with rounded corners shaped by scraping. Give greater weight and strength to most stressed part of spear than wood, simpler to replace parts than whole if damaged. Foreshaft is 14-9 mm diam, too large for arrow, although the points could be.

**Pétillon, Jean-Marc and Hugues Plisson** **s**

2011 Thirty years of experimental research on the breakage patterns of Upper Paleolithic bone and antler projectile points: methodological problems and current perspectives. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Since the 1980s, replicative projectile experiments document the characteristic breakage patterns of Upper Paleolithic projectile points of bone and antler. Two main methodological problems: First, the most common type of impact macrofracture – beveled breaks, or bending fractures – is not diagnostic of projectile use, as it also occurs on other osseous tools used in a longitudinal percussion or pressure motion (e.g., needles, awls, and especially wedges). Second, the extent and level of damage on projectile points appears usually higher in the archeological assemblages than on experimental points used as projectiles. This discrepancy means that the Paleolithic points were subject to stronger stresses than the experimental ones, and/or that they were more breakable. Recent experiment shows that in previous experiments, the use of unrealistic experimental settings might have downplayed the amount of damage caused by missed shots hitting the environment around the target [they had a rocky background, damaged a slightly higher rate]. But other possible factors – such as heavier projectiles, progressive fatigue of points used over long periods of time, greater brittleness of points under low temperatures, etc. [I suspect that struggling animals do more damage than carcasses.] [Bone points are very tough!] Most damage small tip crushing. Proximal fractures rare. Some shattering when hit bone.

**Pettigrew, Devin** **o**

2008 Light versus Heavy Darts: Hunting Strategies of the Basketmaker and Other Atlatl Wielding Indians. Unpublished senior thesis paper, University of Arkansas, Fayetteville.

Summarizes mechanics: lever action, not spring effect, needs flexible dart. Modern hunters using 8 oz (250 gm) darts, but BM equip was light. Penetration experiment on cow carcass. Wooden darts heavier than cane, but dart can be changed by different foreshaft + point combinations. Tried different woods to split, and saplings. Chose Dogwood with oak foreshafts for heavy darts (Berg 8 oz, Frison 12 oz) and box elder for lighter White Dog Cave dart replicas. Distribution of BM atlatls. BM atlatls curve upward slightly, and hook clears



Need to test complete systems: atlatl plus darts used with it.

Variation in weights and handle length. 1) small or no weights, long handle. 2) functional weights, long handle retained. 3) weight, further from grip, short handle (not gripped in throw).

Broken Roof Cave as example of 3: short handle, loops only attached at upper lashing, large weight distal to center. So “loose wrist” throw [as I have seen JG do], which is easy and natural. Other examples are Spring Creek Cave and McClure atlatls without lower handle.

Experiment on weight function on BM forms: test accuracy, not power. Each author made and used weighted and un versions of same atlatl with same dart. Wt atlatl about +50% of unwt versions, darts 78 and 87 gm. Throw at 13.7 or 15 m, measure distance of hit from target center. DP 145 throws each atlatl, JG 210. Wt improved accuracy, but JG difference diminished with practice. So maybe weight is more for “customizing” atlatl to user than overall improving accuracy.

**Petzinger, Genevieve, and April Nowell** ○

2011 A question of style: reconsidering a stylistic approach to dating Palaeolithic parietal art in France. *Antiquity* 85(330): 1165-1183.

Dating of art mostly stylistic, and assumed increase in sophistication. No sites are dated to Aurignacian (early) on stylistic grounds, i.e. art is only called Aurig if definite early dates, biasing view of development. Should base dating scheme on fewer, better “anchor” sites with good C14 and stratigraphic evidence. Example: Font-de-Gaume - well stratified Mousterian, Chatelperronian, and Aurignacian deposits, but all the art assigned stylistically to Solutrean + Magdalenian, despite lack of artifactual presence in cave. [May affect dating of some spearthrowers.]

**Phillips, Phillip, and James A. Brown** ○

1984 *Pre-Columbian Shell Engravings from the Craig Mound at Spiro, Oklahoma*. Peabody Museum Press, Cambridge.

Mostly looted material, so dating imprecise. Plate 9 shows only depiction of atlatl in SE art, on a fragment of a shell cup with a scene of multiple warriors. Two fingerholes (although the hand is just gripping it below the holes), a boatstone lashed on in the middle, and hook are clearly shown. Probably dates around 1200 A.D., 2 centuries after atlatl weight evidence from other contexts at the mound, so could be very late use along with bow and arrow, or an antique. See Brown 1996.

**Phillips, Wendell** ○

2008 Inughuit: Hunters of Greenland. *Sea Kayaker* 124 (June 2008):36-42.

NW Greenland Narwhal hunting in kayak with throwing board and harpoon. [Kayaks described in some detail, atlatls not. Equipment visible in some photos - rigid harpoon with pointed bone butt end, thrower attached at middle; thrower is flat trianguloid rigid form with finger notch. One shot of a throw from kayak -

harpoon is overhead, not flexing, with butt still behind the atlatl, which the thrower has flipped over into follow-through. So even though atlatl doesn't flex and hooks to mid of spear, it is still flipped - how much lever action is there?] Harpoon head is 4.5 inches long, 1.5 wide, fitted with metal blade, detach from harpoon on hit, connected to 25-yard nylon line [so that is max throw distance]. One hit reported - at 15 feet.

**Philyaw, William L.**

x

1972 The Atlatl. *Newsletter of the Missouri Archaeological Society* 254:7-8. Columbia, MO.

[brief, mostly ok summary, but "atlatl gave a whip-like action and added push to the end of the dart" and "in addition to spears, atlatl was used to propel large arrows or darts" - what distinction he implies is not clear. Describes Peets (1960) experiments to conclude that weights don't help distance, but might balance dart, bannerstones etc could be atlatl weights. Drawings of both "two finger grasp" and "pinch grasp".]

**Picat, Iris**

o

2009 Experts Declare Ancient Carving Genuine. *American Archaeology* 13(3):10.

Mammoth or mastodon carving on Florida bone from Vero Beach - marks look weathered and carved when bone was fresh, date >13,000 ya. [I still bet it's a fake! No context, non-scientific collector, who noticed marks "2 years" after finding bone, and hopes to sell it for over \$80k. And it is just too pat - like all good fakes, fits what some want to find, totally unique in US and looks too much like Euro Upper Paleolithic engravings.]

**Pickering, R. B.**

1984 *Patterns of degenerative joint disease in Middle Woodland, Late Woodland, and Mississippian skeletal series from the Lower Illinois Valley*. PhD thesis, Northwestern University, Evanston.

Compared skeletal populations using atlatl with those using bow, was unable to find significant differences in arthritis (atlatl elbow) or other markers attributable to weaponry.

**Pickering, Robert B. and Maria Teresa Cabrero**

x

1998 Mortuary Practices in the Shaft-Tomb Region. In *Ancient West Mexico: Art and Archaeology of the Unknown Past*. R. F. Townsend, ed., pp. 70-87. The Art Institute of Chicago.

Since 1990s some unlooted tombs found, variable mortuary treatment becoming visible. Tomb at Huitzilapa contained 6 related individuals + many artifacts.

Adult male with healed R elbow fracture had 2 jade rings = atlatl handle. Jade hook and rings with a burial [same one or another?] Exotic goods in form of tools include obsidian point and carved stone axe (photos). Discusses regional burial patterns. Mineralized fly puparia on ceramics may allow season of burial to be determined. Figurines may relate to individuals and their life cycles. Ca. 2000 bp.

**Pine, Lloyd**

1997 Pascal Chauvaux Best in the World. *The Atlatl* 10(1):1-2.

Reports International Standard Accuracy Contest scores for 1996.

**Pine, Lloyd**

1999 Garry Fogelman: Top Thrower. *The Atlatl* 12(1):1-2.

Top ISAC scores for 1998: G. Fogelman 93-2X, C. Birkett top woman 67.

**Pine, Lloyd**

2004 Target Backings for the ISAC. *The Atlatl* 17(1): 14-15.

**Plog, Stephen**

**o**

2007 *Ancient Peoples of the American Southwest, 2<sup>nd</sup> edition*. Thames and Hudson, New York.

[Nice popular/text archaeology, lots of illustrations. Uses Driver drawing of atlatl throw from Fagan (p 45), drawing of Broken Roof Cave atlatl and hand holding dart + atlatl redone by Amy Elizabeth Grey from Guernsey 1931 and Woodbury and Zubrow 1979].

**Pokines, James T.**

**x**

1998 Experimental Replication and Use of Cantabrian Lower Magdalenian Antler Projectile Points. *Journal of Archaeological Science* 25:875-886.

Spanish Upper Paleolithic, transition from Solutrean to LM included intensification of deer, ibex, salmon, mollusc use and shift from lithic points to antler. Points are unbarbed, with beveled bases. Experiment to determine use-life factors. Used fresh N. Am. elk antler, 20 pts made with modern tools. Beveled, modern glue join to hardwood shaft, all used with same mainshaft, round, 31 mm diam, 2 m long. Hand thrown at 3-5 m at goat carcass. Total 249 throws, of which 51 were complete misses, 48 missed but penetrated soil, and 150 hit carcass [rather poor accuracy]. Point survival averaged 9.9 throws into soil or carcass. Only 2 pts snapped, others suffered only minor tip damage. Most carcass hits penetrated full length of pt + foreshaft, ca 25 cm to mainshaft. 1/3 of carcass hits penetrated rib cage, only 3 pts damaged, some broke ribs and penetrated.

Antler points more effective and durable than stone pts in other published tests. Shift from Solutrean stone to Magdalenian antler pts is shift from less costly but

easier to maintain kit to more costly but more reliable one, reflecting critical needs for a seasonal (short opportunity) but intense (long planned) focus on big game.

[No atlatls in experiment, but these pts probably were used with them, and could be - in fact, modern French atlatlists often do. Lots of refs to other point + some atlatl experiments.]

**Pomstra, Diederik**

o

2011 A Quick Way to Make Mesolithic Archery Tackle. *Bulletin of Primitive Technology* 42:67-70.

Fast curing of wood for arrows and bow over coals. Plea for others to experiment with it.

**Pope, Saxton**

x

1918 Yahi Archery. *University of California Publications in Archaeology and Ethnology* 13 (3):103-152.

Hunting distance 10-20 yards p. 126.

**Pope, Saxton**

o

1923 A Study of Bows and Arrows. *University of California Publications in Archaeology and Ethnology* 13(9). Reprint 1962 *Bows and Arrows*, University of California Press, Los Angeles.

Extensive experiments, mostly flight distance using museum bows from all over. Velocity, measured by shooting 100 yds timed with stopwatch: Ishi, 45lb bow, 100 feet per second. English longbows 120-135 fps.

Striking force, determined by depth of penetration into parafin block, [clever but crude controls]: 50 lb bow, blunt 1 oz arrow, 1" penetration = 20 foot pounds. 75 lb bow, same arrow, 25 ft-lbs. 50 lb bow, 1.5 oz arrow, 22.5 ft lbs, so heavier arrow increases penetration.

Spine measures (lbs press on nock necessary to spring arrow 1" out of line) [= modern spine measurement not yet devised?]

Fletching: Native Am arrows lashed 3 feathers with sinew, usually no glue. Warped contour of 3 feathers from same wing forces rotation of arrow for stability. Spiraling fletching is "an unnecessary exaggeration and retards the velocity and striking force of the arrow." Experiment in parafin penetration shows. [also shows drop from 1 3/16" to 14/16" penetration from 10 yds to 50 yds, which contradicts statements in *Hunting* that arrow remains equally effective throughout range.]

Rotation: observed by shooting 2 arrows at once off same bow, attached by thread that wound. 50 lb bow, arrow rotates 6 revolutions per 20 yds or 15 per second, but lots of variation in individual arrows, fletching + weight affect rotation. A single feather from opposite wing may prevent rotation [in other words, it doesn't



throwing stick acts as a long lever...” [He understands how it works, although accompanying photo looks partly faked with dart in odd flight position and unflexed.] Also info for cord + whip stick to throw shingle dart, a more elaborate Maya atlatl [there is a drawing of a Maya warrior perhaps cribbed from National Geographic] and a [rather crude flat] Australian “woomerah.” [These are all kind of ugly, but would probably work and his instructions are ok, although no mention of need for dart to be flexible, which was why my atlatls didn’t work as a kid.]

**Precourt, Prudence**

1973 The Archaic Banner-Stone: A Social Category Marker. *The Lambda Alpha Journal of Man* 5(1): 1-26.

Banner stones were atlatl weights, but also symbol of social category in ranked society.

Burial information analysed from Green River sites like Indian Knoll: few have goods, fewer have bannerstone, which is mostly with other goods as well, and with all age and sex, but mostly young adult males.

Possibly seasonal leadership [no evidence].

**Prins, Harald E. L.**

**o**

2010 The Atlatl as Combat Weapon in 17<sup>th</sup>-Century Amazonia: Tapuya Indian Warriors in Dutch Colonial Brazil. *The Atlatl* 23(2):1-3.

Tapuya were recruited by Dutch in colonial wars against Portuguese, painted by Dutch artist Eckhout. Famous painting [shown] now in Danish National Museum shows dancers with atlatl and darts. [Odd form atlatl: Straight, concave surface like hollowed cane (but it’s hardwood), tapers slightly from prox to distal end, with fiber lashing and feather ornament at distal. The lashing and the taper makes it look like the hook is at the grip! Darts unfletched, with stone or more likely bamboo or wood points.]

**Prins, Harald E. L.**

**x**

2010 The Atlatl as Combat Weapon in 17<sup>th</sup>-Century Amazonia: Tapuya Indian Warriors in Dutch Colonial Brazil. Electronic Document, World Atlatl Association Webpage, URL:

<http://www.worldatlatl.org/Articles/Tapuya%20Atlatl%20Article%20by%20Harald%20Prins%2025%20May%202010.pdf>

Expanded version of that in newsletter. Adds identification and photo of atlatl specimen in Danish National Museum, which may have come to Europe with group of Tapuya.

**Proulx, Donald A.**

**s burling**

2001 Ritual Uses of Trophy Heads in Ancient Nasca Society. In *Ritual Sacrifice*

*in Ancient Peru*, edited by Elizabeth P. Benson and Anita G. Cook, pp. 119-136. Austin, University of Texas Press.

Trophy heads part of shamanistic ritual controlling natural phenomena, major goal of warfare. Examples from art and archaeological specimens. Atlatls mentioned as prominent in warfare, no detail.

**Purdy, Barbara A.**

1991 *The Art and Archaeology of Florida's Wetlands*. Boca Raton: CRC Press.

Photo of two atlatl hooks, short cylindrical sections of antler with tine as spur, from Bay West site, ca 6000 B.P.

Also photo of shell hook from Warm Mineral Springs, possibly PaleoIndian in date [see Claussen et al. 1975, Cockrell and Murphy 1978]. Skeleton [is this the one associated with shell hook?] dated 7140-7580 B.P. so Middle Preceramic Archaic.

**Pyszczyk, Heinz W.**

x

2003 Aboriginal Bows and Arrows and Other Weapons in Alberta: The Last 2,000 Years, Or Longer? In *Archaeology in Alberta: A View from the New Millennium*, edited by Jack W. Brink and John F. Dormar, pp. 46-71. The Archaeological Society of Alberta, Medicine Hat, Alberta.

Information sources: ethno-historical records, problems of analogy, artifacts, rock art. Inferring projectiles from points. Problems of point size, co-existence of different weapons. Mummy Cave (Hughes 1998) shows rapid replacement about 1300 years ago, but survived in Mexico, has good penetrating power. In Alberta, Avonlea pts ca 1800 BP believed to signal bow, but Dyck (1979) says variation in Oxbow (4500-5500 BP) and Pelican Lake (3000-1900 BP) pts might indicate bow with atlatl. Thomas, Shott methods applied by Dyck and Morlan to Sjewald site, Saskatchewan, support this. Besant and Avonlea overlap could represent diff ethnic groups with diff weapons. Children's toys possible too. Concludes point size ambiguous, but applies Shott formula to Alberta point assemblages, plots ratio of arrow to dart thru time. Back to 8000 BP pts small enough for arrows with those large enough for darts, general increase in proportion of small points thru time. [Seems to want early bow, but point size is just not good enough evidence.] Quotes Heday account 1754 mentioning "bows, arrows, spears, and darts" as possible atlatl survival [No, "dart" would have meant 'javelin' in Heday's time.] Pictograph Cave, MT shows both guns and atlatls, but chronology ambiguous. Writing-on-Stone site, Alberta shows one possible atlatl, but undatable. Also horsemen with long, fletched spears held or thrown from end - maybe hold-over from atlatl darts, also bows with spears on end. [Don't read too much into vague and stylized rock art images.] Bow might dominate because more versatile and especially suited to small game.

**Quilter, Jeffrey**

o

2008 Art and Moche Martial Arts. In *The Art and Archaeology of the Moche: An Ancient Andean Society of the Peruvian North Coast*. Steve Bourget and Kimberly L. Jones, eds., pp. 215-228. University of Texas Press, Austin.

Nothing to suggest coordinated formations, or attacks on fortification, most agree essence of M war was one-on-one combat for captures. Larco (2001) major source of info; in his museum distinguishes darts from lances (over 2 m long), no dart specimens. Darts always shown as compound weapons with long pt and thicker shaft. Lances or long spears rarely shown in M art. Copper spikes 25-50 cm long Larco thinks lance pts, but could be dart pts, would need counter weight on shaft to balance properly in spear-thrower. [Maybe, no weight info given unfortunately]. But perhaps too heavy, too expensive for expendable darts. No barbed ones found, no darts with copper pts found either. More likely these spikes were bottom of maces [good idea, but no photos, so far not found on clubs.] Hand combat depicted, but projectile weapons imply more. Best against massed enemy. "Experiments with replicas should help determine ranges of M spear-throwers and their darts" and types of combat. P 222 Deer hunt as symbolic of warfare. Art may depict only elite warriors and neglect masses of common folk, comp to Greek warrior art. [Excellent article].

**Quimby, George I.**

s

1944 *Aleutian Islanders: Eskimos of the North Pacific*. Anthropology Leaflet 35, Chicago Natural History Museum.

[Exhibit guide, general info, not too useful], "The spear-thrower is like a rigid sling...it acts as an extension of the arm and therefore enables the hunter to throw the spear with greater momentum and force. Modern experiments have shown that the spr and sprthr lack the accuracy of the bow and arrow but possessed greater penetrating power...advantage in hunting tough-hided sea mammals. Other advantages...are its lack of recoil and fact that it does not require use of both hands." Different kinds of darts used [all apparently rigid], including multi-pronged bird dart. [no useful illustrations]

Whaling [not with atlatl?] using aconite root poison.

**Railey, Jim A.**

m

2010 Reduced Mobility or the Bow and Arrow? Another Look at 'Expedient' Technologies and Sedentism. *American Antiquity* 75(2):259-286.

Parry + Kelly (1987) proposed that as people shifted to agriculture and sedentism from Archaic hunter-gatherer lifestyles, stone tool kit became more expedient, oriented toward flake cores. Mobile folk preferred bifacial formal tools because bifaces more versatile, resharpenable, biface blanks produce more cutting edge per weight, thus less to carry. Two main problems: 1. Temporal disconnects in shift to exped technol, agric, and sedentism. 2. Prascunias (2007) exper shows bifaces not

more efficient cores.

Reviews arguments about antiquity of bow and arrow; supports general intro ca 500-700 AD, atlatl may have continued in places, point size not good indicator.

Expected technological changes with bow + arrow: 1. fewer biface thinning flakes if pressure flaking pts on flakes, and fewer biface failures because small point failure less [last not true, espec if overall # of pts manuf increases with arrows as he argues earlier] 2. recovery of pressure flakes low, assemblages thus proportionally more large ordinary flakes 3. proportionally poorer materials from emph on better stone needed for larger bifaces.

In S New Mexico sites, 1000 yrs of continuity with no change in mobility or subsistence, but lithics change anyway to more flakes, fewer bifaces, poorer materials. This correlates well with change to generally smaller points that class as arrow points by Shott's measures. So in this region at least, change in weapon technology seems more responsible for lithic assemblage change than changes in mobility. [Good paper, although some of the overgeneralization evident in all large explanatory theories - nothing in complex systems is that simple or without exceptions.]

**Ransome, Jay Ellis**

x

1946 Children's Games Among the Aleut. *Journal of American Folklore* 59 (232): 196-198.

Current school policy to teach "American" games reduces traditional, but some survive. "Today spearthrowers have no value except to aid in the hurling of rocks and small hand-made spears. In ancient times before the advent of the Russians the true spearthrower was in common use to give range and power to the harpoon. Fragments of old spearthrowers may be found in almost every old village site. Today they are badly made and serve only as minor playthings for children."

**Rapaport, Matthew**

x

1998 Review of the BPS Engineering Atlatl. MJR webpage, URL: <http://www.sonic.net/~quine/bpsrev.html> accessed 11/15/2005

**Ratzat, Craig**

o

1992 Atlatls: Throwing for Distance. *Bulletin of Primitive Technology* 1(4):62-63.

Need flex in both atlatl and dart.

Fletching not necessary if dart balanced, and not same diameter for its full length. Recommends short light dart, tapered and point-heavy, unfletched, and long light flexible atlatl. Achieved distances of over 500 ft.

**Ravines, Rogger**

x

1967 A Pre-Columbian Wound. *American Antiquity* 32 (2): 230-231.

Peruvian lumbar vert w embedded obsidian point. Prob atlatl dart, but no good context.

### **Ray, Jim**

1996 A Brief Coverage of Atlatl Styles, Construction, and Usage. Xerox pamphlet privately distributed. Also posted on WAA webpage, URL: <http://www.worldatlatl.org/AtlatlNewsletter.html> accessed 4/14/06.

Brief how-to make atlatl and darts, plans for his “Shooting Star” atlatl styles.

### **Raymond, Anan**

**x**

1986 Experiments in the Function and Performance of the Weighted Atlatl. *World Archaeology* 18(2): 153-177.

Atlatl makes arc, but not with the diameter = arm + atlatl, i.e.nock and spear follow straight line, with handle going down while spur and dart do not rise higher than the hand. [Based on Howard, not a correct throw, lacks power – he misunderstands normal atlatl mechanics, although he is right about diameter (apparently responding to Butler). His drawing of the throw shows that he does in fact flip the atlatl, but to keep to his model, bends his body forward at the waist, bringing the arm down – very poor form.]

Velocity of 70 gm dart consistently 20-21 m/sec measured with high speed photos, and 20-27 m/sec measured with radar speed gun, thrown with replica Basketmaker atlatl with/without 40 gram weight.

Weights give some speed/distance advantage. [He claims 8.2% higher speed measured with radar gun, and 5-11% greater distance with weighted atlatl, but his means and graph show there is absolutely no statistically valid difference in mean velocity or mean distance thrown. Measured with photos, there is no velocity difference even to him.] Atlatl flexes and recovers during throw; film speed not enough to capture “acceleration of atlatl as it recoils in last few milliseconds of throw.” Weight may affect recoil. [Reasonable at the time, but wrong.] Weight stabilizes by increasing angular momentum (gyroscope effect), improves accuracy. [This is probably the correct explanation for weights - but angular momentum, although a product of angular velocity, does not mean increased velocity.]

Atlatl survived against bow because produced more force than primitive bow and allowed one handed use in Eskimo fishing from kayak.

### **Red Hawk, Jay**

**o**

2009 Itazipa Glogli: Bringing Back the Bow. *Primitive Archer* 17(2):23-27.

Teaching values to kids on Cheyenne River Lakota reservation using archery. Primitive skills as tradition and identity.

**Redmond, Brian G. and Kenneth B. Tankersley** o

2005 Evidence of Early Paleoindian Bone Modification and Use at the Sheridan Cave Site (33WY252), Wyandot County, Ohio. *American Antiquity* 70 (3): 503-526.

Bone rods, single-beveled and pointed, assoc with Gainey fluted pt and fauna espec Pleistocene peccary. Suggest slight impact damage on bone rod = projectile use.

**Reed, Alan D.** x

1990 Evidence of Arrow Points from Basketmaker II Sites in Southwestern Colorado. *Utah Archaeology* 3:139-141.

Geib + Bungart (1989) identify arrow pts as early as 100 AD at Sunny Beaches site and Cowboy Cave in Glen Canyon, associate with Fremont occupation distinguished from BMII by arrow pts + single rod foundation basketry. But small pts of Rosegate form also in BMII at Tamarron site N of Durango, and SW CO, so b+a use should not be used to distinguish Fremont from BMII.

**Reeves, Joseph** o

2005 Naqaq Hunters on the Yukon Delta. *The Atlatl* 18 (3): 9.

Brief notes on interview with school board members. Naqaq still primary seal hunting weapon because prevents seal sinking in fresh water. Learn as children, throwing grass stems, catch first seals ca 12, women as well as men. No details on gear.

**Reid, Jefferson, and Stephanie Whittlesey** o

1997 *The Archaeology of Ancient Arizona*. University of Arizona Press, Tucson.

[Nice, readable prehistory, but they work a bit too hard with some bad evidence because they want to do social archaeology, and there are some odd gaps, including no mention of Chaco or its influence.]

p. 154 Accepts Lorentzen's idea of bow not adopted at Grasshopper Spring site until after 1200, increasing hunting effectiveness. [That's absurdly late, R + W 1999 explains why they like it).

**Reid, Jefferson, and Stephanie Whittlesey** o

1999 *Grasshopper Pueblo: A Story of Archaeology and Ancient Life*. University of Arizona Press, Tucson.

[Another nice readable account of an important site and long project, but again with some interpretations that don't really work if you know the data.]

p. 43 They accept Lorentzen's idea that different ethnic groups are indicated at Chodistaas and Grasshopper Springs sites, ancestral to Grasshopper Pueblo. At C,

Mogollon people used bows and arrows, while at GH, Anasazi immigrants use atlatls. A nearby pictograph shows a woman with hair whorls (= Anasazi because Hopi, who dress hair that way, think they are Anasazi descendants), and a figure throwing a spear with an atlatl [it's way too vague to tell] is on same panel, so that must be Anasazi too, right? [This overwrought social archaeology is why they like Lorentzen's dubious conclusions.]

**Reinhard, K. J., J. R. Ambler, and C. R. Szuter** x

2006 Hunter-Gatherer Use of Small Animal Food Resources: Coprolite Evidence. *International Journal of Osteoarchaeology* 17:416-428.

Methodology reviewed. Small animal bone often digested, in coprolites preserved best in dry conditions. Better representation of small animals than midden remains. Archaic Hinds Cave, TX, diverse taxa of rodents, especially packrat, plus birds, reptiles; warm season occupation. Archaic Dust Devil Cave AZ (near Sand Dune Cave), cold season occupation, emphasis on cottontail. Vertebrae + rib common, also skull, all fragmented = pounding of complete body for consumption, perhaps after eating legs. Rabbit-consumed fungal spores = internal organs eaten too.

**Renaud, Etienne B.** x

1925 Propulseurs et Sagaies Préhistoriques des Indiens 'Basket-Makers.' *Bulletin de la Société Préhistorique Française* 22:297-312.

[In French. "Prehistoric Spearthrowers and Spears of the B-M Indians."] Two chronological divisions in W N. Am.: Basketmakers followed by Cliff Dwellers, former with atlatl, latter with bow, parallels Paleolithic and Mesolithic in Europe. New tribes succeeded in part by superiority of long-range weapons. Simplified engravings of BM (Marsh Pass), Mexican, and Florida forms of atlatl.

Recent discoveries by E. Morris in Canyon del Muerto, now at U. CO Museum: 4 propulseurs, one so well preserved it looks new. L = 63, 65, 70, 75 cm, longer than other BM specimens, but all of similar form with individual variations. [Compares with others: Kidder + Guernsey specimens, Grand Gulch, Sayodneechee, Kinboko, many details of description and measurement, but no pictures of any]. Always a spur within notch or channel, grip notched with hide finger loops lashed on, hard wood, generally oak. CdM examples lack the weight of stone or bone found on some. Probably stabilized and balanced, maybe added to force of throw. Well-evolved, so sources probably in South. Primitive forms from Tenochtitlan Great Temple excavations, Ozarks, and far W US, also ethnog Lake Texcoco - simple stick with hooks and no grip or with cross-pegs.

Patzcuaro duck-hunting, Cushing Florida form both with 2 holes in wood. Also single-hole with rabbit, recalls Upper Paleolithic atlatls with tail as hook. For these, and the 10 known Mexican carved and gilded ones, "their beauty prevents all supposition that they were engines of war or for hunting" (306).

Canyon del M specimens dated by Morris 1500-2000 BC, but so evolved, more likely only 1000 years old [both these guesses are wrong.] UCM also has 4 'reed arrows,' L = 84 cm without point, painted decoration, sinew wrap to support fore-shaft, narrowed proximally, sinew tied on missing feathers. Not long enough for spears, lack socket for hook, thus arrows made after fashion of atlatl darts as two cultures came in contact. Kidder + Guernsey have atlatl darts, ca 1.4 m long [described].

**Reyes, Tony**

1999 West Texas Atl-Atl Cache. *The Texas Cache* 5(2):cover, 4-5.

Parts of 3 atlatls from looted TX cave. Poor photos and information, but looks like Basketmaker style with mixed type integral hook, finger loops. Some decorative marking, one drilled, slot on one for lashing weight, mark of weight on one. Supposedly with "paleo" points [but since it's a looted site, can't trust the information, date, or even be sure they are not fakes].

**Reyes, Tony**

1999 The West Texas Atlatl Cache. *Indian Artifact Magazine* 18(3):6-7.

Similar to above, but good photos. Parts of 3 atlatls from looted TX cave, bought by author. Description is brief, but with photos can tell that: "Paleo" points are concave base forms. Atlatl 1: complete but missing loops. Odd squared hook. 20.9 inch long, 1.25 W, .375 T. Two long slits through groove lengthwise. Handle grip carved. Atlatl 2: handle fragment, simple straight form, groove for hook, zigzag decoration on back.. Atlatl 3: handle fragment, simple straight form but hollowed. Loops are twig lashed on with cordage, rather flimsy. Two drilled holes. [Interesting, too bad they were looted].

**Rhodes, Jill A. and Steven E. Churchill**

x

2009 Throwing in the Middle and Upper Paleolithic: Inferences from an Analysis of Humeral Retroversion. *Journal of Human Evolution* 56:1-10.

Humeral retroversion (measured as degree of difference between orientation of elbow and head of h at shoulder, i.e. twistedness of humerus) reflects evolutionary differences in activity, and also activities during life. Differences between Neanderthals and modern humans may imply diffs in tool use etc. But "... any increase in upper limb activity prior to skeletal maturity will lead to increases in humeral retroversion." Modern athletes tend to have higher retroversion angles in their throwing limb. Greater retroversion allows more external rotation of h at cocking phase, thus longer time to accelerate the projectile. Compare Neanderthals vs moderns (Upper Paleolithic) assuming: no bow and arrow, amount of throwing is enough to affect bone, begin throwing as juveniles, right handedness normal, males hunted (and females may have too). Expect if Up Pal used throwing spear/atlatl, and Neanderthals thrusting spears, then UP males to

show R humeral retroversion angles more sim to athletes, more assymetrical than Neanderthals, similar to modern throwing groups. Small samples: N's: 6 males and 2 females (only 2 M have both humeri), Middle UP: 15M, 5 F, Late UP: 14 M, 7 F. Up Pal M not different from non-throwing modern pops, differs from Aleut (throwing atlatl etc), but M/F Aleut similar [so Aleut values may not relate to throwing at all]. Fossil humans all show assymetry sim to throwing athletes, while modern non-throwing pops less [does this make sense if fossils are not really different from those same mod non-throw pops?]. Sex diffs only in mod Euro-Am pop, LUP males (with archaeol evidence of throwing = spearthrowers) have low torsion angles, although even more assymetrical than athletes. [so is there *any* real effect of throwing in any of these pops?] "... data is equivocal..." [they say and show this several times, but then conclude Neanderthal pattern is consistent with no projectile weapons, Up Pal consistent with variable use of such. But in fact, this paper is a glaring example of interpretations pre-determined and based on biases, ignoring the lack of usable evidence.]

**Rice, David G.**

1972 *The Windust Phase in Lower Snake River Region Prehistory*. Report of Investigations No. 50, Laboratory of Anthropology, Washington State University, Pullman.

SE WA, Windust Cave and Marmes Rockshelter and others, primary report. Windust Phase is early occupation, Paleoindian, 10 C14 dates on shell from Marmes between  $10,810 \pm 275 - 7,400 \pm 110$  BP, followed by Cascade Phase. Both sites since destroyed by damming river. Series of stemmed projectile points [probably equivalent to Eden, Hell Gap, Pinto], basal notched and lanceolate pts, flake tools, choppers metates, grooved bola stones. Three bone atlatl hooks – small flat pieces with flat beveled surface and projecting stubby hook. One from Marmes, 2 from Granite Point open site. Two drawn [not too distinctive, could be misidentified]. [Lots of point drawings and a chronology of styles, but not an interesting lithic analysis.] [Cited as early date for an atlatl part, but impossible to tell precise association or date of Marmes specimen, assuming that it is an atlatl hook (probably is)].

**Richard, Russell**

o

1997 In the Movies. *The Atlatl* 10(4):1-2.

On being atlatl consultant for movie "Eaters of the Dead" [released as "13<sup>th</sup> Warrior"], with fictional primitives using atlatl from horseback. Possibly the only time anyone has tried equestrian atlatl use. See Crichton 1992; McTiernan 1997.

**Richard, Russell**

o

2011 Hello Friends of the Atlatl. *The Atlatl* 24(3):16-17.

Wyoming events, including Saratoga Museum event honoring Rod Laird as

Grandfather and Leni Clubb as Grandmother and Saratoga as Birthplace of the Modern Atlatl.

**Richards, Michael P., Sheila Greer, Lorna T. Corr, Owen Beattie, Alexander Mackie, Richard Evershed, Al von Finster, and John Southon** o  
2007 Radiocarbon Dating and Dietary Stable Isotope Analysis of Kwaday Dan Ts'inci. *American Antiquity* 72(4):719-733.

C14 dating of bone collagen complicated by evidence of marine diet (which affects C14 concentrations) - calibrated range of 3 dates A.D. 1480-1850. Clothes and "hand tool" assoc w body also give wide range. Conclusion: 1670-1850 [more recent than previous estimates.] Date ranges for other artifacts suggest multiple use site. [Artifacts listed in table that were previously considered possibly atlatl and dart now labeled "throwing or snare stick" and "arrow? shaft fragment"] Isotopic analysis indicates strongly marine diet, but also shift to terrestrial resources in year before death, although he also had fish + crustacean (coastal) food in stomach.  
[Commendably, they were allowed to do analysis of the body before it was destroyed, but there is still no useful info available on the artifacts, see Beattie et al. 2000]

**Richardson, Mike**

2010 Other Types of Atlatls: Loop, Fork, and Cord. *The Dart* April 2010:5-6.

**Richardson, Pat**

o, x

2007 Army Corps of Engineers Makes Important Archaeological Find. *The Atlatl* 20(3):15. (from electronic document <http://www.army.mil/news/2007/05/23/3311-army-corps-of-engineers-makes-important-archaeological-find/>)

Nome harbor work, Alaska, finds Inupiat pit houses ca 300-350 BP. Inupiats not expected in this area until after gold rush. Finds include cache of hunting gear, atlatl [no details]. Margan Grover archaeologist.

**Richardson, Thom**

x

1998 Ballistic Testing of Historical Weapons. *Royal Armouries Yearbook* 3:50-52.

Reports velocity tests on variety of weapons including atlatl, sling, bow, crossbow, early guns. Atlatl velocity: average 15.82 m/sec (35.47 mph) max 17.9 m/sec. Compared to spear 12.5 m/sec, slings and bows in 30-40s m/sec, arquebus bullet ca 400 m/sec. [But no info at all given on the atlatl, or the thrower, and these velocities seem really low, not enough better than hand thrown spear, see Whittaker + Kamp - our velocities 20-25 m/sec. So did they really know what they were doing with an atlatl?]

**Richardson, Thom**

x

1998 The Ballistics of the Sling. *Royal Armouries Yearbook* 3:44-49.

Range shorter than historic accounts: ca 100 m with stones, 115-150 m with lead slingshot or lead balls, velocities around 30 m/sec. [Sounds like his accuracy was low, he admits his may not be a fair test.]

**Riddell, Francis A. and Donald F. McGeein**

1969 Atlatl Spurs from California. *American Antiquity* 34(4):474-478.

Three types described, with distributions. All similar forms, with flat bottoms, rounded spur head attached to flat or grooved extension for lashing to atlatl.

I) "Snakehead", usually stone. II) "Acorn" bone or antler. III) Variant of I?.

[Type distinctions not explained, nor evident in illustrations].

Associated with Central CA Early Horizon - Martis Complex, Lovelock period in Great Basin, 3-4000 B.P. (Archaic). One with associated C14 dates ca. 7500 B.P.

**Riede, Felix**

o

2009 The Loss and Re-introduction of Bow-and-arrow Technology: A Study from the Northern European Late Palaeolithic. *Lithic Technology* 34(1):27-45.

Large tanged Bromme pts + Bromme techno-complex sandwiched between earlier Federmesser and later Ahrensburgian, both with small points. Experiments by Fischer show Bromme pts usable as large arrowheads. Rozoy says bow allowed recolonization of N Europe. But B pts more likely reversion to atlatl with loss of cultural knowledge at population bottleneck after eruption of Laacher See volcano 12, 920 BP. Fischer experiments not quantified enough, show typical projectile fractures on B pts, but not whether arrow or dart. Studied 632 complete pts from L Paleo N Europe. Shott discriminant function analysis classes almost all B pts as dart, Federmesser + Ahrensburg pts as arrows [But it really does NOT apply here - Shott/Thomas samples too small and not European.] Ahrensburgian evidence - wooden arrowshafts and possible bow frags, faunal data suggest rapid fire techniques [?huh?]. Pt size ranges suggest bow + atlatl coexist in Federmesser. Atlatl may have been used against large game - elk (=moose) and giant deer *Megaloceros* because of greater impact power (Baugh) and effective distance (Churchill). But why lose the bow? Social disruption and loss of transmission of technology, only dramatic enough event is eruption of Laacher See at junction between Feder + Bromme periods - Bromme lithic tech simplified. [Interesting, possible - BUT it all relies on point size arguments - not good enough. For instance, we don't know anything about the bows - could they not have changed? And no finds of atlatl parts either. And even a small population of hunters is unlikely to unlearn bow technology.]

**Riemersma, Len**



TCSA combined with tip plan and section angles, side edge angles, curvature, weight and basal thickness), 2. Technological analysis of point production processes (blank production, retouch, rejuvenation) leading to final morphology of point. 3. Experiment with ballistic features of different morphologies of points and hafts. 4. Use-wear analysis with special attention to impact scars. 5. Experimentation to characterize impact scars and to discriminate between projectile vs thrusting impacts. 6. Collection analysis

We have IDd probable projectile points in Iberian assemblages (Axlor, Amalda), French (Combe Brune I) and in one Northern African site (Irhoud) and analyzed them with this protocol to compare them with indisputable Upper Paleolithic points (Chatelperronian, Gravettian, Solutrean).”

Spear throwing experiment with inexperienced thrower [bad idea], demonstrating that can be thrown on spears [so what, that’s obvious]. Lateral deviation increased with haft length, distances up to 20+ mm, all sim but better with lighter shaft. No impact fracture [but bad experiment – what surface, how did it land with poor throw, what is balance point of his spears, etc.].

Arch record: M pts usually rare, but up to 8% of formal tools in W Pyrenean region sites. Some very light, basally thinned, impact flutes on some. Concludes: exper shows throwing possible, arch shows impact evidence common.

**Rivera, Mario, and Vjera Zlatar**

x

1982 Las estolicas en al desarrollo cultural temprano prehispanico del Chile. Actas del IX Congreso Nacional de Arqueologico, *Boletin Museo Arqueologico* 18:14-34. La Serena, Chile.

“The spear thrower in the early prehispanic cultural development of Chile.” In Spanish. There seem to be 31 examples tabulated, with descriptions of specimens from a series of sites, to define a number of types. Poor illustrations show several forms: curved stick with raised integral hook, a straight shaft with short groove and hook missing and handle wrapped, a flat lath form with deep groove and handle both wrapped and notched. [These two are reminiscent of Gt Basin forms]. Another form is a flat shaft with raised integral hook and handle wrapped with a small cross stick. [this one looks BM or Ozark related]. And a couple incomprehensible drawings.

**Roberts, Frank H. H.**

1929 Recent Archeological Developments in the Vicinity of El Paso, Texas. *Smithsonian Miscellaneous Collections* 81(7).

Short article, describes cave finds by amateurs, discusses SW connections, pictographs. Finds include sandals, rabbit or fending sticks, netting, mosaic armband.

Several atlatl darts described [with photo]: ca 5 ft long, socket at proximal end for hook, at distal end for foreshaft. All had cordage and sticks tied to proximal end, making them unusable/ritual? Foreshafts mentioned but not described.

**Robins, Michael R. x, disk**

1997 Modeling San Juan Basketmaker Socio-economic Organization: A Preliminary Study in Rock Art and Social Dynamics. unpublished MA Thesis, Northern Arizona University.

**Robins, Michael R. o**

2002 Status and Social Power: Rock Art as Prestige Technology Among the San Juan Basketmakers of Southeast Utah. In *Traditions, Transitions, and Technologies: Themes in Southwestern Archaeology*, edited by Sarah H. Schlanger, pp. 386-400. University Press of Colorado, Boulder.

A “big-man” society with aggrandizing individuals who controlled best agric land in wash mouths, where large rock art panels occur - perhaps sites of feasting and redistribution. Status associated with control of agric, ritual, warfare. Rock art depicts individuals with elaborate hairstyle which relates to whole head scalps. Warfare as part of elite competition. “Differential” burials include atlatls, shafts, fending sticks.

**Robins, Michael R., and Kelley A. Hays-Gilpin s**

2000 The Bird in the Basket: Gender and Social Change in Basketmaker Iconography. In *Foundations of Anasazi Culture: The Basketmaker-Pueblo Transition*. Paul F. Reed, ed., pp. 231-247. University of Utah Press, Salt Lake City.

BM II (2000 BC-AD 200) rock art features “heroic” anthropomorphs, BM III (AD 500s-600s) more variable, narrative, frequent depictions of animals, birds, humans, ritual items, tools, including atlatl although “use as weapons prob diminishing due to intro of bow and arrow in this era.”

**Robins, R. P. x**

1980 Wood Identification of Speartrowers in the Queensland Museum. *Queensland Museum Occasional Papers in Anthropology* 10:50-62.

Material studies for conservation and research of 515 specimens, better documented than most of ethnographic collections. Very small clear sections cut across end grain of wood, 90% ID to some genus or better, listed by spearthrower type, date of collection, location, and wood ID. [Bulk of collection from around 1900] Lots *Eucalyptus*, *Erythrophleum* [“Red Ebony or Cooktown Ironwood”- very hard dense wood], *Acacia*. Documentation of collections by non-anthropologists leaves problems -e.g. do woods from an area represent varied past resources, transit of people, exchange, or collector choices and biases?

**Romey, Kristin o**

2001 Aim, Fire, Thwack!: Atlatl Devotees Show Off Their Stuff. *Archaeology*

54(5):20-21.

Information from WAA annual meeting at Flint Ridge, C.Brown, L. Clubb. Good description of atlatl, [but it was not used by *H. erectus*, nor does it have force of .357]. WAA formed 1987, now 436 members. Mentions weights, dart flex, record of 848.56 feet, pleasures of society.

**Rosny, J. H.**

**o**

1982 *Quest for Fire*. Ballantine Books, New York. (Originally published 1967, Pantheon Books, but originally out as *La Guerre de Feu*, 1911.)

[The book that inspired the movie, but the movie is better in all ways. The book has poor plot and character, not much but blood and thunder, clunky writing style, no understanding of prehistory or attempt to use archaeological information even to provide vivid details. Atlatl description, p 100 is typical: "The Thin Men hurled short javelins, not directly, but with the aid of an object the Oulhamrs had never seen. It was a thick piece of wood or horn ending in a hook; this object gave the javelins a much greater range than when they were thrown by hand." No stone tool description whatsoever. No reason to believe the author knew anything about prehistory or early technology, even at the level available in 1911. See Anneau 1981.]

**Roth, Walter E.**

**x**

1901 *North Queensland Ethnography, Bulletin 3: Food, Its Search, Capture, and Preparation*. Home Secretary's Department, Brisbane, Australia

Lots mention of spears in hunting various game, no details. One figure showing hunter in water to shoulders with brush on head and hand while stalking ducks with Queensland type thrower poised.

**Roth, Walter E.**

**x**

1902 *North Queensland Ethnography, Bulletin 4: Games, Sports and Amusements*. Home Secretary's Department, Brisbane, Australia.

Little boys play war with reed spears and toy wommera made by selves or adults. Woomera shown is simple stick w hook type of "Wellesly Is + coastal blacks W of Burketown." Or a toy type made from reed with a knot to hold the spear instead of hook. Toy spears also thrown with string. "Prun" tournament/dispute settling event where groups meet to argue and fight, using boomerang, spear, shield, club. Spears usually thrown at legs.

**Roth, Walter E.**

**x**

1904 *North Queensland Ethnography, Bulletin 7: Domestic Implements, Arts, and Manufactures*. Home Secretary's Department, Brisbane, Australia.

Wood work by stone or shell. *Ficus* leaves for sanding. Fire by twirling or sawing. *Canarium* brown cedar tree gum for hafting and woomera handles. Other resins include ironwood *Erythrophloeum* and spinifex grass *Triodia*. Lengthy descrip of knapping. Harpoons described, shown hand thrown. Wommers shown, leaf-shaped type with stone set in gum at handle, but manuf or use not described.

**Roth, Walter E.**

**x**

1909 North Queensland Ethnography, Bulletin 13: Fighting Weapons. *Records of the Australian Museum* 7(4):190-211, plates lviii-lxi, figure 12.

Spears used with spear thrower or hand thrown may be made from bamboo, sapling, or split from tree. Some are compound. Points may be wooden, stingaree spine, tri-pronged for fishing, barbed with wood, bone or wire, or with multiple stone flakes fixed on each side of the shaft with gum. [Gives names of spears, wood, and supposed uses of different types in different areas. In some areas, no spear throwers are used.] Similar details for different types of wommers [his spelling; different native names also given]. Lacking in E. coastal districts and Brisbane. Most primitive form is hooked stick in Wellesley Islands and adjacent mainland, 2.5 feet long, round in section with raised flattened end forming hook. "Arai-i" is flat blade with attached peg hook and handle with shell. [Common N. Australia form, straight rigid vertical blade, quite long]. Used as spear guard as well as thrower. Localized variation in handle, peg, wood, names, decoration described. Bloomfield River area has a short curved or "moonshaped" version ("ballur") which is used for fish spearing, as well as the straight form. Grip on ballur: "blade rests in fork between the first finger and the thumb, instead of, as in the ordinary style, between first and second fingers." Two other types brought in, not local: plain stick with lashed on wood hook, tassel of hair at grip, and flat lath with attached hook, narrowed grip, usually painted.

Boomerangs, shields, throwing clubs, and wooden "swords" all given same detailed treatment. [Boring, long descriptions of minute details, but useful material].

**Rothschild, Nan**

**o**

1979 Mortuary Behavior and Social Organization at Indian Knoll and Dickson Mounds. *American Antiquity* 44 (4): 658-670.

Archaic gatherers (IK) egalitarian "segmentary soc systs" vs Mississippian farmers (DM), hierarchical. As soc gets more complex, so do burial practices.

IK 6100±315 – 4508±365 BP uncal, 880 Webb burials

DM 850-700 BP, 1100 burials

Mauss – presence of goods w dead implies social relationships

Egalit expect low freq child goods (achieved status), relative lack of difference

Heirarch – some goods cross cut age/sex, child w goods (ascribed status), major diffs among individs and grps

Multivariate analyses – clustering (groups of burials) and factor analysis (recurring groups of goods). Scored 1. presence of each type of good 2. raw material type, But NOT quantity of artifacts, which means only used 133 burials to form clusters, mostly children – only burials with multiple artifact types.

[Her clusters are thus worthless, contain very small numbers, mostly children, e.g. her two important ones (disk beads and pts),(disk bds and other beads) have 7M and 6M each, no F, 8, 14 kids]

Concludes: Status marked by multiple grave goods, open to men and children but not women. [Nevertheless there are some F with multiple goods, including one cluster of 4 with pendants and disk beads, and the cluster of atlatl wts and disk beads has 3F,3M, 3 kids]

### **Rots, Veerle** s

2011 Projectiles and hafting technology. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

“Hafting is an essential part of projectile technology, has major impact on performance of projectile. Hafts adapted to the intended task, careful selection and manufacture of the shaft and fixation agent. Morphology of stone point adapted to hafting arrangement. A projectile can be identified based on macro- and microscopic use-wear traces, and characteristic hafting wear also forms, sufficiently diagnostic to distinguish between hafted and hand-held stone tools. Inferring hafting important to infer stone tool’s use mode. For projectiles, identification of hafting adds to the use identification based on impact wear - no stone projectile can be projected without its attachment to a shaft. Hafting wear formed due to the counterpressure within the hafting arrangement at the moment of impact, and wear resulting from the direct contact with the shaft and/or fixation agent (e.g., bindings).”

Small detached flakes in hafting create bright polish spots on point, often associated with originating microscar. Resin leaves residues, also friction spots from rapid detachment, but also protects areas from use-wear. Thrust spears show less wear than thrown spears. Levallois points show projectile type haft wear at Biache St-Vaast, 200 kya. Bettencourt L pts show impact wear, intentional base thinning, lashing wear on edges. Mousterians were systematically hafting all sorts of tools, and had both thrusting and thrown spears.

### **Rousselot, Jean-Loup, William W. Fitzhugh, and Aron Crowell** o

1988 Maritime Economies of the North Pacific Rim. In *Crossroads of Continents: Cultures of Siberia and Alaska*, edited by W. W. Fitzhugh and A. Crowell, pp. 151-181. Smithsonian Institution Press, Washington D.C.

Discusses darts and harpoon heads. Two kinds: barbed, and toggling. Toggling common in ice areas because less likely to break off, freeing animal. Toggling harpoon was adopted by European whalers from Eskimo in 17<sup>th</sup> C. [Nice but small] color photo of 4 atlatls: Bering Sea Eskimo, Aleut, 2 different Koniag

Eskimo, and three darts: Aleut light sea otter dart, Bering Sea seal dart (heavier) and multi-pronged bird dart.

**Rutter, Clark H.**

**x**

1935 Target Practice with Mayan Throwing Sticks. *Popular Science Monthly*, August 1935. Online 11/23/98 at <http://www.crl.com/~mjr/stick5.html>.

Simple atlatl inspired by Mayans, for sport, to throw arrow. Simple instructions, claims range 500 ft.

**Sahagún, Bernardino de**

**s**

1975 *General History of the Things of New Spain: Florentine Codex, Book 12: The Conquest of Mexico*. Arthur J. O. Anderson and Charles E. Dibble, trans. University of Utah Press, Salt Lake City.

p 56 after the Spaniards massacre celebrants at feast of Toxcatl: "Thereupon there was shouting: 'O brave warriors, O Mexicans, hasten here! Let there be arraying - the devices, the shields, the arrows!'.... Quickly there was a marshalling of forces; it was as if the brave warriors each were determined; they bore the arrows and the shields with them. Thereupon there was fighting. They shot at them with arrows with barbed points, with spears, and with tridents. And they cast at them barb-pointed arrows with broad, obsidian points. It was as if a mass of deep yellow reeds spread over the Spaniards." [the original Nahuatl is given also. Surely the yellow reeds are the shafts of atlatl darts, although the word atlatl does not appear in the text. The illustrations, reproduced small, are ambiguous. I think some show atlatls in use, but you can't really tell, the warriors may just be grasping spears. See also Leon-Portilla 1962 and Lockhart 1993]

"Nima ie ic necalioa, qujmomjna in jca tlatzontectli, in jca tlacochtli, yoan in mjnacachalli, yoan in tlatzontectli, izpatlacio in contlaca: iuhqujn cozpul ommoteca in acatl, in impan Espanioles."

[Using Freelang.net Nahuatl dictionary, <http://www.freelang.net/online/nahuatl> selected words: tlacochtli = arrow/spear/dart; itz = obsidian; acatl = reed/dart/arrow; quimina = shoot or spear (verb).]

**Sahagún, Bernardino de**

**s**

1982 *General History of the Things of New Spain: Florentine Codex, Volume 1: Introductions and Indices*. Arthur J. O. Anderson and Charles E. Dibble, trans. University of Utah Press, Salt Lake City.

Sahagun wrote the Conquest section probably in 1555, published a revised version in 1585. He used native informants and young scribes that he had trained in Latin and writing Nahuatl in Latin letters. Madrid Codices are his early drafts and revisions. The Florentine Codex is believed to be a bilingual version known as the Sequera manuscript of 1578-79.

**Salls, Roy A.**

1986 The La Brea Atlatl Foreshafts: Inferences for the Millingstone Horizon. *Pacific Coast Archaeological Society Quarterly* 22(2): 21-30.

Four foreshafts: 1 bunt, 3 wooden points, [poor photo].

Found with extinct fauna but also Millingstone Horizon artifacts (ca. 6000 BC - 1000 AD), strata mixed, darts not with fauna, C14 on one 2500 BC.

Confirms atlatl use in Millingstone Horizon.

**Sanchez, Lynda A.**

o

1998 The Atlatl: Weapon of Choice for the Ice Age. *True West* 34(4):28-29.

Basics, nothing new. [ok, but used Perkin's spring theories off his webpage.]

**Sanders, Geoff, and Tom Walsh**

x

2007 Testing Predictions from the Hunter-Gatherer Hypothesis - 1: Sex Differences in the Motor Control of Hand and Arm. *Evolutionary Psychology* 5(3):653-665.

HGH = sex differences in task performance arose from natural selection favoring hunting-related skills in men and gathering related skills in women. Men should do better at throwing (arm muscles) and visual input from afar, women better at visual input from close, and fine hand manipulations. Test with computer cursor tracking test using hand or arm alone, and ball throwing and peg-board tests. As predicted males do better with throwing and arms, females with hands and pegs. These tests correlate with non-motor word association test favoring females, and mental rotation test favoring males.

**Sanders, Geoff, Kamila Sinclair, and Tom Walsh**

x

2007 Testing Predictions from the Hunter-Gatherer Hypothesis - 2: Sex Differences in the Visual Processing of Near and Far Space. *Evolutionary Psychology* 5(3):666-679.

Laboratory based puzzle task in which participants saw their hands and puzzles in far or near space. Women performed better in near than far, men vice versa. Far and near space processed in ventral and dorsal cortical regions also known as "what" and "where" visual systems, so potentially sexually dimorphic cognitive abilities favored by evolution.

**Sano, Katsuhiko, Yoshitaka Denda & Masayoshi Ohba**

s

2011 Experiments in fracture patterns and impact velocity with replica projectile points from Japan. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Recent studies indicate anatomically modern humans first to use long-range projectile hunting, while Neanderthals' hunt may have required frequent close encounters with prey animals. Study of tip cross-sectional area based on aerodynamics suggests possible to successfully shoot stone points emerging after 40-50 ka in Africa, Levant and Europe by using spearthrower. To confirm we conduct controlled projectile experiments with calibrated crossbow to accurately control loading conditions according to estimated impact velocities of thrusting, throwing, spearthrower, and bow respectively. A total of 280 lithic replicas including 40 trapezoids, 40 backed points, 40 leaf-shaped points and 160 microblades which are all representative Palaeolithic armatures from Japan are shot against target of deer hide + pork flesh + deer scapula." Thrust too slow, mostly failed to penetrate hide, little fracture. Throwing speed – all penetrate to bone but not thru, more fracture, but small. Spear thrower speed – more + larger fracture, burin-like, impact energy greater. Bow speed – even larger fractures all with linear micro traces, burin fract etc. Longer fracture, >10 mm only with spearthrower and bow speeds. [Problem is that this is all with crossbow, not real weapon type.]

**Saraydar, Stephen C.**

o

2008 *Replicating the Past: The Art and Science of the Archaeological Experiment*. Waveland Press, Long Grove, IL.

[Nice short text on experimental archaeology.] Atlatl experiments mentioned, no details, some refs.

**Sassmann, Bruce**

o

2008 Rabbit Hunting with an Atlatl. *The Atlatl* 21(1):18-19.

Small game now legal in Missouri. R Mertz, R Lyons, with beagles handled by Sassaman, and C McGeehan from MO Conservation Commission hunted rabbits, no kills.

**Sassaman, Kenneth E.**

1998 Crafting Cultural Identity in Hunter-Gatherer Economies. In *Craft and Social Identity*. C. L. Costin and R. P. Wright, eds., pp. 93-107. Archaeological Papers of the American Anthropological Association Number 8.

Even in egalitarian societies, crafts serve to delineate cultural boundaries and express identity and power relationships. Stallings Island Late Archaic in Savanna River Valley, GA and SC had earliest N. Am. pottery (4500 BP), large populations, relatively complex social order, including major split between coastal (with early pottery and shellfishing) and riverine groups (without). Left handed pottery decoration frequencies distinguish different subregions; failure of piedmont groups to adopt pottery suggests women and their crafts did not marry out (to neighboring ethnic groups). Bannerstones may be atlatl parts, but



**Saunders, Ellen**

o

2004 It Took Two Generations. *Mammoth Trumpet* 19(3):6-7.

Greg Hare and Ruth Gotthardt say 40 yrs for bow to replace atlatl and antler to stone points in Yukon ice. Atlatl 9000 RCYBP to 1260, first bow artifact dates 1300. Also one heavy projectile notched like arrow at 3600. Birch and other wood darts, ave 195 cm long, flexible, tapered and front-heavy. Foreshaft w stone pt illustrated. No atlatls found. Arrow pts all barbed antler.

**Saunders, Jeffrey J. and Edward B. Daeschler**

x

1994 Descriptive Analyses and Taphonomical Observations of Culturally-Modified Mammoths Excavated at "The Gravel Pit" near Clovis, New Mexico in 1936. *Proceedings of the Academy of Natural Sciences of Philadelphia* 145:1-28.

Two butchered Columbian mammoths associated with the "type" specimens of Clovis points (2). Cotter, the excavator, assumes atlatl use, bone rods as foreshafts. Reinterpret sediments to indicate butchery event occurred on erosional surface during dry period, not in wet (pond) conditions. Mammoths were adult, M + F, stood 12-13 feet tall. Bones show 2-3 yrs of weathering after death. Cut marks and other damage to bones at joints, including marks interpreted as from prying apart footbones using the bone rods (gouge + compression marks from beveled tips). One rib fragment has engraved lines interpreted as abstract design [but looks pretty unconvincing in the photos.] Smoothed gnaw marks interpreted as work of dogs. Elephant joints easy to dismember while fresh, so cut marks here suggest working with rigid (ie scavenged) carcass, as does the attention paid to feet. Points in upper front of body, butchery tools assoc with head and lower limbs also suggests scavenging of animals previously wounded and carrying points in their bodies.

**Saville, Marshall H.**

o

1925 *The Wood-Carver's Art in Ancient Mexico*. Contributions of the Museum of the American Indian, Heye Foundation, Vol. 9. New York.

Describes atlatls briefly, including 12 from Mexico (Aztec and Mixtec) plus 5 miniatures from Templo Mayor (Tenochtitlan, Aztec capital in Mexico City), and 6 from cenote at Chichen Itza (Maya). Forms are mostly like the British Museum specimen, flat slightly expanding shaft with deep groove full-length or to grip, all but a couple lack grips, which should be shell or stone loops sewed or lashed on. Hooks are integral, horizontal cylinder form lying in groove, sometimes decorated. Ornamentation usually on both faces, most elaborate on underside, several gilded as well as carved. A couple are in form of snake, with hook in feathers behind its head, and seem not to have loop grips. The miniatures are not grooved, have raised hooks, and two have cross bars instead of loops, others are just straight wood handles. A couple specimens in Mexico, several in Europe, a couple at Heye Foundation in New York. Adequate illustrations - engravings and

mediocre photos of most. Mentions atlatls as part of loot Cortez sent to Charles V of Spain in 1519 (p42-43); he was crowned emperor in Germany, so some of loot distributed in Italy, Germany, Flanders, Austria. Cortez atlatls, described in original documents as “crooks” or “scepters” were turquoise mosaic. (P43) surviving specimens “being elaborately carved, unquestionably were not intended for hunting or use in actual warfare, but were for ceremonial purposes.” Often depicted in hands of deities or priests. Bows often depicted in codices, but no authenticated specimens survive.

Atlatl List from Saville (pp43 ff):

1,2 Heye Foundation Mus Am Indian, recently discovered so details given: hard finegrain wood like rosewood, no gilt

1. L = 21 3/8” good drawing of designs - some resemblance to BritMus, less elaborate but finer than Florence. 4 warrior/god figures carrying darts w shield and spear, with Tlaloc [or Earth Monster?] at bottom whose circular eyes may represent an “inverted atlatl”, entwined serpents on sides of groove, undecorated spur. No loops or visible attachments.

2. different style [but same entwined design on upper], cruder figures on underside, with date glyphs for 10 calli, animal day signs, symbols of new year, probably 1489 L = 20 3/8”

Other 10 already published, few details given. Six recovered in 1890s from a family in Oaxaca - heirlooms: 2 to Ethnog Mus Berlin, 1 Dr. Lenck, 1 Consul Dorenberg then to Frankfurt, 2 to Nat'l Mus Mexico

3. Dorenberg - see Seler

4. Berlin

5. Berlin both similar, this one 24 3/8”

6. Nat Mus Mex L = 17 3/8” illustrated, carved end damaged

7. Nat Mus Mex [is this a slip - he implies 2, but maybe means only one, which would make the count right - only illustrates one, perhaps the second is the same as 13?]

8. Brit Museum, gilded, shell loop

9. Prehist + Ethnog Mus Rome - see Bushnell, gilded 24 3/4” dark wood like NY specimens, gold mostly worn off, carving intricate, anthro hook w headdress

10. Florence Mus Nat Anthro + Ethnol - see Bushnell L = 23 3/4”

11. Florence ditto, both gilded, red-black wood L = 22 5/8”, complicated carving, double grooved, hooks anthropomorphic

12. Lenck specimen L 22 5/8” serpent form

13 Dorenberg or Nat Mus Mex, but now missing, serpent form

[He repeatedly says 12, but this count is 13 !!]

Other atlatl forms in codices include expanded shaft w 2 fingerholes like current Patzcuaro, and peg-grip form. From Great Temple area in Mexico City, 5 miniature wooden atlatls, 3 have hooks, all have holes and 2 have cross pegs for grips. [Photo shows simple form with integral raised hook on rounded shaft, cross peg.

1994 Trance and Transformation in the Canyons: Shamanism and Early Rock Art on the Colorado Plateau. In *Shamanism and Rock Art in North America*, Solveig Turpin ed., pp. 45-71. Rock Art Foundation, San Antonio TX.

Time gap between San Juan Anthropomorphic and Barrier Canyon Styles to ethnog SW means generalized shamanic models better than detailed ethnog analogy. By ca 600 AD shamanic imagery phased out in Anasazi art, quality of work also declines. BCS long figures = shamans in hallucinogenic state transforming man-animal, ref death, spirit helpers, espec birds. SJAS = Basketmaker II, maybe early BMIII, no bow and arrow hunters depicted, bow arrived BMII-III. Dominant figs = static large human w drooping hands + feet - suggesting trance state, elab hddresses + stuff at L ear = communic w spirit world. Duck or Turkey on head. Pueblo ethnog D = liminal travel sky + water, T = underworld, dead, clouds + rain. Some holding atlatl or darts, or speared = shamanic combat, ethnog shamans deflect arrows or spiritual projectiles. Death of animals = trance, access to power. Crook staves + med pouches depicted, found in sites.

**Schaefer, Jerry**

1998 Building a Life-Size Mammoth. *The Atlatl* 11(3):6.

Atlatl target for Minnesota event - styrofoam over wood frame, fake hair.

**Schele, Linda, and David Friedel** ○

1990 *A Forest of Kings*. William Morrow, New York.

Maya. Atlatl introduced from highland Mexico in 4<sup>th</sup> C AD, led to new kind of territorial-based conflict.

**Schiffer, Michael B.** ○

2009 Ethnoarchaeology, Experimental Archaeology, and the “American School.” *Ethnoarchaeology: Journal of Archaeological, Ethnographic, and Experimental Studies* 1(1):7-26.

The “AS” developed among Smithsonian researchers in late 19C, focused on importance of ethno and exper info for interpreting prehistoric culture, with evolutionist roots. Prominent figures briefly profiled: Rau, Mason, Cushing, Holmes. The approach waned in 1900s with growth of “culture history” and diffusionism, which used artifacts as markers of cultures rather than evidence of activities, and many intial “what is it?” problems had been solved. Revived or reinvented with “processual” and “behavioral” archaeology in the 1970s.

**Schmidt, Robert N.**

1984 Another Look at the Bannerstone. *The Wisconsin Archeologist* 65(1):83-95.

Early crude forms not likely ceremonial objects (Knoblock).

Webb atlatl theory flawed because "no drilled stones actually found on an identifiable spearthrower assembly," some antler hooks "quite fragile...do not seem suited for atlatl service."

Battering and breakage of hole ends not from atlatl use.

New hypothesis: sliding hammerstone for flintknapping.

Indirect percussion easiest to learn, better yet if hammer and punch linked - hammer slides down shaft to strike shoulder of punch at end of shaft ca 85 cm long.

Some bannerstones wouldn't work; simpler ones would.

Polish in hole on experimental stone - but might be "erased by time" on archaeological specimens [how, without damage to exterior polish?] Damage to ends similar to experimental [but also mentions alternative sources, i.e. manufacture].

Photos of 18 points made, experimental bannerstone, device in use.

[Hard to tell how effective this really is, but I am highly skeptical that it is effective knapping tool. Most bannerstones lack hammer wear, and evidence of atlatl association is good.]

**Schmitt, Daniel, Steven E. Churchill, and William L. Hylander** x

2003 Experimental Evidence Concerning Spear Use in Neanderthals and Early Modern Humans. *Journal of Archaeological Science* 30:103-114.

Argues that Neanderthal humeri are asymmetrical, with right more robust. They are wider front to back, compared to Upper Paleolithic humeri which are rounder, consistent with (torsional) throwing loads. Neanderthal asymmetry more likely to result from thrusting spears, and the Lower and Middle Paleolithic spears so far found are large and heavy, better for thrusting than throwing. In an underhand thrust, the strong hand is at the back, and takes most of the (bending) stress. Experiment used 8 untrained subjects thrusting. Showed asymmetrical stress on trailing arm, high enough load to stimulate bone remodeling. So experiment and skeletal studies are consistent with belief that spear thrower did not appear until into the Upper Paleolithic.

[Probably right, but problems with conclusions include small sample of experimental subjects, small sample of relevant prehistoric bones, and the many other asymmetrical things right-handed people do with their arms, including throwing. All this really shows is that thrusting affects trailing arm more than leading arm. Does a hunter really thrust often enough to affect arm strength? Aren't other things going to be much more important?]

Claims Neanderthal and early Up Pal "right-dominated strength asymmetry... prepared to withstand bending in the parasagittal (anteroposterior) plane." With lack of projectile evidence, best conclusion = "thrusting spear use one of principle sources of osteogenic stimuli" in humeri. But Late Up Pal humeri "more equally resistant to bending moments in multiple directions (and torsion, as generated during throwing) as well as right-dominated strength asymmetry." With evid of

throwing weapons, so throwing in LUP was important.

**Schoville, Benjamin, Kyle Brown, Simen Oestmo, & Curtis Marean** s  
2011 The Potential of Pre-Howieson's Poort MSA Backed Blades from Pinnacle Point, South Africa as Projectile Armatures. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Microlithic backed blades from Pinnacle Point Cave 5-6 (Brown, et al. 2011) dated by OSL to ca 71kya. Backed blade technology is often considered composite, allowing for replacement of worn and broken components while maintaining the haft for continued use. Ethnographic observations of backed blades hafted as tips of arrows in southern Africa and occurrences of backed points within animal remains from later archaeological sites indicates backed pieces are effective in many contexts." Experiments using a calibrated crossbow and heat-treated silcrete, radar gun velocity measurement. > 110 experimentally reproduced backed pieces compared to the assemblage of pre-Howieson's Poort backed blades from Pinnacle Point. Location of >250 individual experimental shots at prey targets were combined into a preybody GIS model to model distribution of point breakage probability. Poor haft performance, large haft had little penetration, in thrusting did not get enough velocity. Simpler haft, one stone element, <100 g, arrow speed worked [but accuracy was pretty poor even with crossbow on stand]. Hits closer to vitals had higher breakage – more bone there. Experiment suggests pre-Howieson's Poort backed blades function effectively as projectile armatures. Arch specimens similar – 27% show impact fractures. Bushman used 9 kg draw weight bow, crossbow was 18 kg. Bushmen used poison, maybe compensate for weak bow, not need to hit vitals. Earlier rock art shows more powerful recurve bow, which may be what was used in Howiesons Poort (aka SADBS).

**Schroeder, Indira Montt**

x

2004 Elementos de Atuendo e Imagen Rupestre en la Subregion de Rio Salado, Norte Grande de Chile. *Chungara (Arica), Revista de Antropologia Chilena* 36, special supplement 2: 651-661. Online version URL:  
[http://www.scielo.cl/scielo.php?script=sci\\_arttext&pid=S0717-73562004000400010&lng=es&nrm=iso&tlng=es](http://www.scielo.cl/scielo.php?script=sci_arttext&pid=S0717-73562004000400010&lng=es&nrm=iso&tlng=es) accessed 2/08.

Chilean rock art includes anthropomorphs armed with atlatls and darts.

**Schultz, Harold**

o

1966 The Wauru: Brazilian Indians of the Hidden Xingu. *National Geographic* 129(1):130-152.

Photos show men using atlatl against scarecrow in practice for intertribal game. [No mention of hunting or real warfare. Darts look a head taller than the men,

with blunt “stone” tip. Thrower has flat flared handle with single central finger hole, feather tuft at hook end, hook not visible.]

**Schuster, Angela M. H.**

x

1999 Who’s Buried in the Ice? *Archaeology Online* URL: <http://www.archaeology.org/online/news/iceman.html> accessed 9/13/06

News brief on Kwaday Dan Sinchi find, mentions body found with “a hunting spear and atlatl”, photos of artifacts [from BC govt or tribal web page] include “a hand tool of unknown use” which is a short flattened piece of wood with a rounded handle end and a hook-like protrusion apparently lashed on the other, with hide pouch in which it was found. [Looks superficially like an atlatl, but too short - is this the “atlatl”? Other suggestions include snare tool, and I think it could as well be a pressure flaker, but you can’t really tell from the photo. see Beattie et al. 2000]

**Scolforo, Mark**

x

2005 Penna. May Let Hunters Add Ancient Weapon to Arsenal. *Philadelphia Inquirer* November 24, 2005. URL <http://www.philly.com> accessed 1/27/06.

PA Game Commission discussing legalizing atlatl deer hunt. Quotes Fogelman, Perkins, Carr (archy) and Lyons. Commission generally supportive.

**Scolforo, Mark**

x

2006 Hunters May Get to Go Stoneage. *Associated Press/Tampa Bay Online* January 8, 2006. URL <http://www.printthis.clickability.com> accessed 1/27/06.

Pennsylvania legalization proposal. Similar to 2005, generally supportive tone.

**Scott, Jim**

x

2010 10,000 Year Old Weapon Unearthed in Ice Melt. *Futurity*. Electronic Document, accessed 7/3/10, URL: <http://futurity.org/science-technology/ice-melt-unearths-10000-year-old-weapon/>

In Rockies near Yellowstone, Craig Lee archaeologist. Birch sapling with notch for point. Similar to University of Colorado 2010, but with errors. Find is called atlatl at first, more correctly dart in caption, then “When it was shot, the 3-foot-long dart had a projectile point on one end, and a cup or dimple on the other end that would have attached to a hook on the atlatl.” [But this appears untrue, the object is too short for a dart and lacks the “cup” and is probably a foreshaft. Photo shows that it was minimally worked, still has twig nodes unsmoothed, now broken in several places.]

**Scott, Karen West**

x

1980 Antler and Bone Artifacts from the 1980 Season at Colha, Belize. In *The*

*Colha Project Second Season, 1980 Interim Report*, T. R. Hester, J. D. Eaton, H. J. Shafer eds., pp. 317-326. Center for Archaeological Research, University of Texas, San Antonio.

Possible atlatl spur (drawn), Late Classic. [bipointed and grooved, unclear to me whether it is really an atlatl hook or not].

**Seler, Eduardo**

x

1890 Altmexicanische Wurfbretter. *Internationales Archiv für Ethnographie* Band III: 137-148. [plus plate]

“Ancient Mexican Spearthrowers” in German [so I can’t read]. Illustrated mostly from codices. [Morons at Evans Library interlibrary loan did not copy plate] but it should show Berlin specimen and others.

**Seong, Chuntaek**

o

2008 Tanged Points, Microblades, and Late Paleolithic Hunting in Korea. *Antiquity* 82(318):871-883.

Tanged pts on heavy blades, some bifaces, back to 30 kya, interp as knives or spear pts. After ca 17 kya, microblade assemblages without tanged pts, interp as spear point inserts. Ca 10 kya, “arrowheads” (small triangular bifaces) appear. Early focus on large game with thrusting or hand thrown spears. Later shift to smaller game, with lighter microblade points, plus contemporary bifacial points for large game. Finally bow and arrow for small game, better in wooded environment. [Relies heavily on US lit, overgeneralization about functions and game. No atlatl suggested, but small pts probably do represent beginnings of bow.]

**Setzler, Frank M.**

x

1933 Prehistoric Cave Dwellers of Texas. *Explorations and Fieldwork of the Smithsonian Institution in 1932*: 53-56.

SW TX, Chisos Mts, Sunny Glen Canyon, nr Alpine. Dug 5 caves [minimal info given]. No pottery or stratification [recognized, anyway]. Basketry and sandals differ from Basketmaker examples. Atlatl foreshaft notched for pt, bunt pt, prox frag of atlat [looks BM type in photo] . Maybe shows similar age to BM, but arrow shafts + foreshafts also, so maybe transitional [and maybe unrecognized stratigraphic differences]. [Useless list of other artifacts suggests interesting sites poorly reported.]

**Shafer, Harry J. and Thomas R. Hester**

x

1991 Lithic Craft Specialization and Product Distribution at the Maya Site of Colha, Belize. *World Archaeology* 23 (1): 79-97.

Good extensive info on lithic production and specialists. In Terminal Classic, making stemmed proj pts on chert blades, “presumably used on spears launched by spear-throwers (atlatls) and their intensive production could mark a period of warfare within the region.” [Which is rather stretching the interpretation].

**Shaw, Robert D.**

o

2002? *Carving a Traditional Chugach Throwing Board*. VHS, Chugachmiut Curriculum Development Project, Anchorage, AK.

Shaw (PO Box 233823 Anchorage, AK, 99523-3823, 907-345-5416).

Begins with kids throwing (none very well) and lots of safety warnings. Then Shaw carves an arctic style throwing board, with spatulate grip, inserted bone hook, central first finger hole. Copies from a book (Murdock?) but doesn't give source. [He does nice work, speaks clearly, shows each step, but a very slow video with excruciating and excessive detail, sometimes necessary for teaching kids, but boring for experienced atlatl maker. Unfortunately, no information on the traditional dart, and no scenes of any competent throwers.]

**Shea, John J.**

x

2006 The Origins of Lithic Projectile Point Technology: Evidence from Africa, the Levant, and Europe. *Journal of Archaeological Science* 33:823-846.

Pre-Upper Paleolithic projectile use is debated. Criteria for recognizing stone projectile points is subjective - tool shape and microwear. Tip cross-sectional area is ballistically important, discriminates N Am dart tips and arrowheads from spear points. Comparing TCSA values of ethnog N Am points to possible Middle + Up Pal points from N Africa (Aterian tanged points), Levant (Levallois and Mousterian points), and Europe does not support presence of projectiles before 40,000 BP - these points seem to have been on thrusting or hand thrown spears. In Levant and Europe, the L + M pts contrast with Up Pal Ksar Akil + El Wad, and Chatelperron + Font Robert + Solutrean pts, which do appear to be projectiles. In the New World and Aust, ethnog record of stone projectile points shows they are used in big game hunting and war. One or both of these may have played role in adoption of stone proj pts after 40 Kya. [Some problems: Neanderthals + kin certainly hunted large dangerous animals, so projectile not necessary. Some Australian ethnog stone blade points on woomera thrown spears are very large, like Levallois points.]

**Shea, John J. and Matthew L. Sisk**

x

2010 Complex Projectile Technology and *Homo Sapiens* Dispersal into Western Europe. *PaleoAnthropology* 2010:100-122. Electronic Document, URL: <http://www.paleoanthro.org/journal/content/PA20100100.pdf> accessed 5/2010

H.s. expansion at 50,000 years ago with complex behaviors earlier seen only

occasionally in Africa. “Complex projectile weaponry” is “niche-broadening” allowing new resources, reduced costs. P 102 CPWs store energy extrasomatically to propel low mass projectiles at high speeds: “bow and arrow stores energy in flexion of the bow. The spearthrower stores energy in the flexion of the dart.” [Whittaker 2010 comment corrects this last]. Sites in the Levant with Late Middle Paleolithic and Early Upper Paleolithic assemblages. LMP points i.e. Mousterian and Levallois points, not suitable for CPW tips, but EUP lots of small narrow stone + bone pts. Tip cross-sectional area TCSA (.5x MaxW x MaxT) [which does not consider hafting additional to this] compared to ethnog + arch specimens of known use including Thomas and Shott examples of darts (ave 58 sq mm, N = 40) and arrows (ave 33 sq mm, N = 118). Levallois points much larger than either dart or arrow TCSAs, experiments show they bounce off animal targets as arrows, work as thrusting spear tips. EUP points [on blades] in range of ethnog points [all but Ksar Akil ElWad pts are in dart range], work experimentally as arrow pts. So are earlier Middle Stone Age pts in Africa, suggesting pre-50 kya development of CPW there.

Best model is that CPW came to Levant 50 kya with populations of early H. s. dispersing from Africa. Why not used by earlier Neanderthal and H. s. pops in Levant, although they were highly carnivorous? Big game most efficient; small game, and better CPW technology to take it, may have been too costly in time for Ns. High calory requirements of Ns left them no time to develop technology. CPW also promote aggression, which promotes communication and social organization to identify friends and enemies. Ns may not have been good at symbolic behavior. CPWs gave H. s. advantage in exploiting more niches than Ns, and in violent encounters.

### **Sheridan, Alison**

1996 The Oldest Bow ... and other objects. *Current Archaeology* 149:188-189.

Dating organic objects in National Museum of Scotland. Longbow from bog C14 dated to 4040-3640 BC (Neolithic).

### **Shippee, J. M.**

o

1966 The Archaeology of Arnold Research Cave, Callaway County, Missouri. *The Missouri Archaeologist* 28:1-107.

Excav 1955-1958 of ca 40%. Sandstone cave 120 x 70 feet, some dry deposits with organics - cloth, sandals, wooden artifacts. Material from Archaic to L Woodland, no contact period artifacts, historic use for saltpeter extraction. Good quality flint in local limestone. Fill in cave 6' deep, much disturbed, excav in arbitrary 6" levels, screened ¼" mesh [not bad for the times]. Talus deposits included mixed fill leached and discarded by saltpeter works, over loess suitable for local pottery.

Top of cave had burned wooden troughs of saltpeter leaching ca 1825. Process described. Cave deposits have Dalton, Graham Cave and unnamed thick



and resharpening.

Ethnographic data questions assumption that bow and arrow is more efficient than spear hunting – more likely complementary. Hard to judge from experiments whether bow more efficient or effective than atlatl.

**Shott, Michael J.**

1997 Stones and Shafts Redux: The Metric Discrimination of Chipped-Stone Dart and Arrow Points. *American Antiquity* 62(1):86-101.

Extends Thomas 1978 approach to classifying points as atlatl dart or arrow (using discriminant function based on ethnographic and archaeological specimens) by increasing the sample of darts to 39, almost all SW [plus 1 Aust, 1 Arctic, 1 Peruvian which should not have been included] (Thomas had 10). Cautions with sample: knife vs dart vs spear not perfectly distinguishable since no foreshaft was attached to original shaft, although most known knives flatter handled. Eliminated also possible modern hafts on old points, and darts for marine hunting. Some of Thomas arrows, eg. Menomeni, made after no one knapped any more, so may not be good examples.

Discriminant analyses tried using length, width (shoulder width), thickness, and neck width. All variable means significantly different. Shoulder width of points turns out to be the most important variable for discriminating between arrow and dart points. Formulae with shoulder width alone as good as multivariate; improve rate of successful classification to 89.4%, (33 of 39 darts = 84.6%). Independent test classified 81 of 83 Great Basin Numa arrows and 3 random darts correctly.

Cautions: may not work well in all areas, or at time of transitions.

Shoulder width threshold between dart and arrow around 20 mm - that alone classifies correctly 122 of 132 arrows (92.4%) and 30 of 39 darts (76.9%).

Neck width thresholds of 9 mm (Beck 1995; Corliss 1972) or 10 mm (Fawcett and Kornfield 1980:72) do OK for darts, but poorly for arrows.

Arguments by Odell for Archaic flake arrow points and by Amick and Patterson for Paleoindian bows briefly discussed - unconvinced.

(The Peruvian specimen was found with atlatl and apparently rest of shaft, made of reed, and all together 400 mm long)

**Shott, Michael J.**

o

2002 Weibull Estimation of Use-Life Distribution in Experimental Spear-Point Data. *Lithic Technology* 27(2):93-109.

Statistical technique applied to distribution of failure rates in samples of experimental points suggest that in small points, failure rates are related to chance breakage, but heavier points with more obtuse angles survive better because they resist chance breakage and use-life relates more to cumulative attrition. Small sample of published data (3) with numbers of throws for individual points, varying techniques and goals, and differing materials.

**Shott, Michael** s

2011 Weibull and Gompertz-Makeham Analysis of Experimental Spear/Dart Data: Implications for Stone-tool Survivorship. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Many points show evidence of repeated use and reworking – useful to know use-life. Implications for curation, utility or value, distribution. Death-age distributions in faunal remains applicable to points as cumulative survivorship curves. Hunzicker 2008 Folsom replicas shot at carcass with calibrated crossbow – reusing and resharpening points with resin cast at each stage, up to 8 uses.

**Shriver, Phillip R.**

1983 The Expanded Center "Gorget": A Late Adena Bar Atlatl Weight. *Ohio Archaeologist* 33(4):4-8.

Contextual evidence from burials that these are not ornaments, but atlatl weights, diagnostic of Late Adena.

**Shriver, Phillip R.**

1990 Conventional Wisdom and Archaic Atlatl Weights. *Ohio Archaeologist* 40(4):8-9

Conventional wisdom is that E. Archaic saw introduction of atlatl and weights, which give much more power.

Brief summary of Webb's work at Indian Knoll - Webb reconstructed atlatl with tubular weight at hook end. Indian Knoll also had bar atlatl weights, as do other sites. Probably are weights, but our ideas change. [Point of this article is not clear.]

**Sims, Toni S.**

1987 Atlatl Weights from Intermountain Locales in Montana. *Archaeology in Montana* 28(1):69-71.

2 grooved oblongs, Neuman Class I, probably associated with Pelican Lake and Besant points.

**Sisk, Matthew** s

2011 A critical assessment of simple proxies for projectile plausibility. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Determining the function of a tool type - direct data from use wear or residue analysis, not always preserved, hard to collect. Often compare morphological characters to recent tools for which use is known. With projectiles, simple

measurement-based approaches can show whether a pointed stone object is physically capable of serving as a projectile armature. Ballistically significant measurements can then be compared to ethnographic or experimental data from functional stone points. Techniques range from relatively simple, like mass or tip cross-sectional area (TCSA) to more computationally complex, like tip cross-sectional perimeter (TCSP) or convergence angle. No single measure can be used, but trend of these measures being applied without proper concern for their limitations. In reality, a suite of physical characteristics contributes to the efficiency of a stone projectile point. It is only through understanding underlying physics of stone projectiles and morphological controls on their use that we can begin to disentangle what relevant information each of these proxies can yield.”

Simple weapons in Lower + Middle Paleolithic e.g. Um el Tlel, Schoningen. Up Pal Lascaux depictions of spears and spearthrowers. Ethnog points usually complex + variable – early forms may be simpler. Ideal pt cuts skin, penetrates, light in weight, durable. From experiments, Tip Angle of Levallois pts correlates little w penetration but a high angle is likely to break. TCSA correlates w force needed to penetrate, but in exper penetration correlates more w width than thickness. Perimeter may be better than TCSA – as increase W increase perimeter but increase in T does little to increase perimeter. Cautions on TCSA + TCSP = trade off between penetration and durability. Ethnog analogs from only small samples. Use together to ID plausible points, but not good for atlatl vs bow.

**Sisk, Matthew L., and John J. Shea**

**x**

2010 Defining Complex Projectile Technology: A Reply to Whittaker. *PaleoAnthropology* 2010:L9. Electronic document, URL: <http://www.paleoanthro.org/journal/content/PA2010L0009.pdf>

refines definitions to exclude throwing sticks and javelins: “composite, multi-part tools where human energy is mechanically enhanced or stored by a non-projectile part.”

**Sizemore, Bob**

**o**

2004 PVC Atlatl Design. *The Atlatl* 17 (3):12

**Skov, Eric**

2012 The Forgotten Weapon: Experimentation in the capabilities of slings and slingstones. Poster presented at 77<sup>th</sup> Annual Meeting, Society for American Archaeology, Memphis, TN, April 19-22, 2012.

Widespread in N. Am.: 22/42 societies in HRAF sample used. Only 4 previous experimental studies. 2 Yrs practice before exper. Golf simulator to measure velocity. Single sling, 4 techniques, 4 different clay projectiles. Velocities 32-43 mps. Calculated range for 32 g projectiles launched at 43 mps: Clay sphere 105 m, clay biconical 150 m, lead sphere 150 m, lead biconical 170m. [Demonstrating superiority of biconical form, but these are only calculated ranges, not

experimentally verified.] Kinetic energy/impact area to assess damage using forensic info. Lead biconical projectiles would pierce skin, clay might at release velocity, spherical would not. Biconical leads would fracture any bone at all ranges, others some fracture capability but less. Slings more effective than previously thought.

Durable “synthetic bamboo” atlatl for <\$1.00

**Slater, Donald A.** x, pdf

2011 Power Materialized: The Dart-Thrower as a Pan-Mesoamerican Status Marker. *Ancient Mesoamerica* 22:371-388

Basics described. Dart-thrower is best term, not local, flexible projectile, not throwing stick. Possible PaleoInd origins. Wide distrib often explained as conquest by or imitation of Teotihuacan. Possible earlier Olmec period depictions are equivocal, earliest clear atlatl image is on greenstone figurine, Oaxaca, E Formative ca 400 BC, inscribed w costumed figure holding darts + atlatl. By end Formative (100 AD) atlatls in W Mexico tombs. Images become abundant in Classic + Post C times. Teotihuacan, early assoc with rain and lightning, deity and elite warrior garb. Only symbolically important to Maya after Teo influence, when rulers adopting atlatl could show access to exotic (in time + space) powers, including supernatural associations, and depict selves as warriors. End of Classic thru PostClassic – increase militarism in art, many atlatl depictions, Chichen Itza has many on architecture, objects from Cenote. Associations with serpents, sacrifice, war, Tlaloc and other rain gods, lightning. Dart-thrower was important symbol, but even elaborate specimens may be functional: elab Berg replica of Cenote specimen worked even though hook was off center. Also tested Nolf replica of Bushnell’s double atlatl: it worked, close simultaneous hits on ISAC target. Should test replicas of Dumbarton Oaks greenstone atlatls.

**Slifer, Dennis** o

2000 *The Serpent and the Sacred Fire: Fertility Images in Southwest Rock Art*. Museum of New Mexico Press, Santa Fe.

Fertility connections with hunting magic mentioned. Only one good atlatl image shown, p 157 - Johns Canyon UT petroglyph, dart throwing and pierced animals.

**Sliva, R. Jane** o

1999 Cienega Points and Late Archaic Period Chronology in the Southern Southwest. *Kiva* 64(3):339-367.

Late Archaic - San Pedro + Cienega points - refined typology.

SP = large, corner to side notched. C = smaller, triangular, corner notched, expanding stem, pressure flaked. Cienega subtypes: C Flared, C Long, C Short, C Stemmed. Rework could make C Long become C short or stemmed, but average C Short not fit model.

Temporal seriation: C Short, C Long, Stemmed, Flared - C14 from 2800-1600 bp. Thomas/Shott discriminant analysis says all Short and Stemmed, some Flared and Long = arrow points.

San Pedro phase (early) - only large points, then starting early Cienega Phase, small points too. Larger SP points may have knife functions as they coexist with arrows. So folk were experimenting with bow and arrow by early Cienega Phase (800 BC).

[She thinks she sees fluctuations in popularity of bows and atlatls, but neither dates on sites nor point sample is adequate to say more than that large and small points coexisted after SP. Lack of small points in SP is also result of too small a sample of both points and sites. Suggests earlier bow and arrow than most would agree - possible but point size alone is not adequate evidence.]

**Sloan, Chris** x

2009 Mammoth Art in America, or Mammoth Fraud? *National Geographic NGM Blog Central*. Electronic document, URL:  
[http://blogs.ngm.com/blog\\_central/2009/06/mammoth-art-in-america-or-mammoth-fraud.html](http://blogs.ngm.com/blog_central/2009/06/mammoth-art-in-america-or-mammoth-fraud.html)

Vero Beach mammoth image. Hopeful but skeptical, see Picat 2009.

**Smith, Arthur George** x

1953 Beveled or "Rotary" Points. *American Antiquity* 18(3):269-270.

Beveled points do not produce "rifling" effect or spin on dart or arrow. Most points too big for arrows. Experiment observing flight of unfleched arrows with beveled points showed no rotation [crude experiment but probably right]. Beveling easiest way to shape point of poor material, sharpened held between thumb and forefinger and flaked upward [doubt he was much of a knapper either.] Beveling is result of resharpening while in haft, shown by examples of same base form with blades from excurvate + lenticular to steeply beveled and incurvate edges. Personal experiments: in short haft beveled points work well for skinning, wood work etc.

**Smith, Jackie**

1999 Spears, Spear Throwers, Boomerangs, and Arrows. *Experiment in Archaeology* No. 1: 21-22. Newsletter for Experimental Archaeology, Lydney, Gloucestershire, UK.

Experiences of a class. Crude spears and spear throwers, achieved 30 m throw with 250 gm spear 130 cm long . [Not very useful.]

**Smith, Martin J., Megan Brickley, and Stephany Leach** x

2006 Experimental Evidence for Lithic Projectile Injuries: Improving Identification of an Under-recognized Phenomenon. *Journal of Archaeological Science* 34:540-

553.

Stone point wounds in bone hard to identify without embedded point. Experiments show can be done both macro and microscopically, and stone points often leave embedded fragments.

Used longbow + flint points, shot into bones with some soft tissue [carcasses would have been better]. Also points attached to mechanical striker calibrated in joules (kinetic energy) to compare penetration and tangential strikes on cattle scapulae (structurally similar to human cranium). Several characteristic damage types produced by both experiments; compared to arch specimens. Internal beveling - exterior slot, interior expands [like a concoidal fracture in stone]. Embedded fragments - 14 of 32 impacts, sometimes only microscopically visible, deep and hard to remove, so likely to remain despite medical treatment. Internal striations - microscopic, inside cut, parallel to impact direction, not seen in metal slicing marks. Tangential strikes can produce wounds resembling cut or butchery marks.

### **Sophie13**

o

2008 How Did David Kill Goliath? With an Atlatl, Physicists Say. On heywood.com webpage, Electronic document, URL <http://heywoodgould.com/pages/?m=200805>, accessed 4/20/10.

Printed in The Dart April 2010:13.

According to “physicist” Ken Gehagen-Verren of the Intelligent Design Institute of Military Science, David “reinvented” atlatl. Slings are just for small animals, couldn’t kill giant in armor.

[Nonsense, dumb enough to be a parody. He knows nothing of either atlatls or slings. No evidence of atlatl use at that time. R Madden comment: Bible clearly says slings, which are deadly and for which there is evidence.]

### **Spangler, Duane**

o

1998 The Broken Atlatl. *The Atlatl* 11(4):8-9.

Hinged a broken atlatl, expecting it to act as extra elbow for more power, but found no advantage, and discovered that “the dart left the atlatl before the hinge came forward.” [Nobody, myself included, noticed that this was early evidence that atlatl does not work as spring, for same reason.]

### **Spencer, Baldwin and F. J. Gillen**

s, L

1938 *The Native Tribes of Central Australia*. MacMillan and Co. Ltd, London.

Old fashioned ethnography, focus on ritual life. Spear throwers [woomera scoop type] discussed. Hunting (p.20): skill varies, but “takes an exceptionally good man to kill or disable at more than 20 yards.” Two blurry photos of throwing. Butchery: flint at end of spear thrower used. P.28 spear thrower described, “most useful single thing the native has.” Hollowed out piece of mulga, 2 ft to 2’6” long,

tapers to narrow handle with lump of resin holding sharp flint or quartzite, other end blunt point with sharp bit of wood fastened with tendon, fits into hole in end of spear. Ordinary spear 10' long, Tecoma wood, with mulga tip spliced on and bound with tendon, some with additional attached barb.

More details p. 574 ff. Different kinds of spears, some with barbed wood heads, or stone flake heads, some with reed shafts. Wood shaft, stone tip specimen 2.89 m, 538 gm. Cane shaft, stone tip specimen 3.13 m, 397 gm. Wood shaft, barbed wood point specimen 3.12 m, 340 gm. [Examples, others given, similar]. Three types spear-throwers among various central tribes (photo): 1. "Wanmyia" [lathe type] used by Warramunga and northern tribes, flattened stick 105 cm long, 4.8 wide at grip, finger notches, hook attached with resin and string. 2. Nulliga of Wambia tribe [stick type] smooth round stick 87 cm long, hook attached with resin and string, large tassel at handle. 3. "Amera" of Arunta, Urabunna, Luritcha, and Ilpirra tribes (whites call Wommer) as described earlier. Used for bowl, cutting tool, making fire (by rubbing edges on shield), musical instrument. Rarely decorated.

### **Spencer, Lee**

o

1974 Replicative Experiments in the Manufacture and Use of a Great Basin Atlatl. In *Great Basin Atlatl Studies*, R.F. Heizer ed., 37-60, figures 13-19. Ramona: Ballena Press.

Using stone tools, replicates a NV atlatl with weight. See Hester 1974 (site NV-WA-197).

Very detailed description and evaluation of manufacture, tools and materials. Some throwing experiments – average 50-60 yards, feels good accuracy attainable, despite few trials and inexperience. [Good paper.]

### **Spencer, Lee, and Eric Burke**

x

1994 A Reanalysis of Four Northern Great Basin Atlatls. *Journal of California and Great Basin Anthropology* 16(2):271-285.

Plush and Roaring Springs Caves, Oregon, excavated 1940 (Cressman + Krieger 1940). Poor provenience, but associations with artifact suggest Middle Archaic age. Original measurements incorrect. Plush Cave - Basketmaker type, possibly willow, notched but no loops, groove and integral spur, 545 mm L, 10 mm T, slight flexibility "would not constitute significant energy storage." [So they believe the spring theory?]

Roaring Springs 1: Large and wide, unusual form, 595 mm L, 61 W. Large integral hook with keel, not groove, groove on dorsal side, shaft widens toward distal, grip flares with wide notches [like half finger loops], handle wrapped with hide. Perhaps juniper, red pigment coating.

Roaring Springs 2: Smaller 447 mm L, 42 W. Similar form to RS1 but not as well preserved, perhaps juniper.

Roaring Springs 3: Spur fragment, probably from atlatls like 1, 2.

[More detailed measurements and drawings]

**Spranz, Bodo** **x**

1956 Die Speerschleuder in Amerika. Veröffentlichungen aus dem Übersee-Museum in Bremen. Reihe B, Volkerkunde 1(2):148-162.

[“The Spearthrower in America” In German.] Typological distributions with maps for N Am + Mesoam, and for S. America. [Interesting but ignores differences in date of the many forms]

**Squirra, Francois** **o**

2012 Momentum vs Kinetic Energy for Dummies: How a Traditional Bow Kills. *Bulletin of Primitive Technology* 43:32-34.

Ashby’s work: kinetic energy is not the proper measure of killing power because it is  $\frac{1}{2}$  mass times velocity squared, but decreases fast, especially on impact, because as velocity is increased, resistance increases exponentially, i.e. if velocity doubles, resistance quadruples. [But so does kinetic energy!]. Momentum is more important effect on penetration, mass times velocity.

**Stamer, Greg** **x**

2004 The “Finer Points” of Harpoon Throwing: For Accuracy and Distance. *The Masik: Quarterly Newsletter of Qajaq USA* 2(3):5-8. Electronic document, URL: [http://www.qajaqusa.org/newsletter/Masik\\_Fall2004\\_10043.pdf](http://www.qajaqusa.org/newsletter/Masik_Fall2004_10043.pdf)

Elaborate harpoon technology and use described. Throwing for distance and accuracy included in current Greenland National Kayaking Championship events; harpoon must weigh at least 1 kg (2.2 lbs). Sealing “knob” (on end) harpoons hook to thrower with pegs on side of shaft (“side-thrown”); lighter “winged” harpoons (with bone wings on end) have socket on end (“end-thrown”). (See Baker 2004 for harpoon making.)

Throwing harpoon from kayak: lean back then forward, with little body twist [though the photo shows some]. Ca. 18 m is max throw for a strong man. Usually throw in an arc to hit seal from above. Correcting throws to R or L done by altering depth of socket (end-thrown) or angle of peg (side-thrown). Birket-Smith says knob harpoon originally thrown without board in 18<sup>th</sup> C. “you should not allow your throwing hand to drop on the followthrough. Rather, Maligiaq uses a short, powerful throw, without much wrist break and he stops his hand abruptly at the end of the throw. The end of his throwing stick remains pointed upward at the end of the throw rather than becoming horizontal.” [NOTE that even without much follow through, and with a heavy, rigid dart, the atlatl works as a lever, flipping up. His photos show this too.] Competition throws either as lob, or “line drive” at closer targets.

Target is a floating 2m diam circle with 4 concentric rings 25 cm apart, distance at least 10 m for men, 5 m for women + children.

**Standen, Vivien G.**

x

2003 Bienes Funerarios del Cementerio Chinchorro Morro 1: Descripción, Analisis e Interpretación. Funerary Goods from Chinchorro Morro 1 Cemetery: Description, Analysis, and Interpretation. *Revista de Antropología Chilena* 35(2):175-207.

[In Spanish with English abstract + captions.] 134 individual natural and artificial mummies with 301 funerary goods, dating 5400-3700 BP. Hunting gear (assoc with men) more common than fishing + gathering gear (assoc with women). Includes 5 estolica (atlatls) and 6 darts. [from illustrations, atlatls include simple stick form with single “security cord” loop one side and attached bone hook or integral carved hook, and a flatter grooved form (fragmentary). Darts are of wood, with harpoon points. One atlatl, bone hook, with adult male, dates on body 5160 bp. Two others assoc with women.

**Stander, P., X. Ghau, D. Tsisaba, and X. Txoma**

x

1996 A New Method of Darting: Stepping Back in Time. *African Journal of Ecology* 34:48-53.

Darting techniques for tranquilizing animals now mostly rifles powered by CO2 or .22 blanks, using syringes. Ju/'Hoan Bushmen use light bow, unfletched poison arrows, small and compact for hunting in dense vegetation cover. Bow 1 m L, weighs <200 gm, “twine constructed from back muscles of large antelope” [he must mean backstrap sinew for bow string]. Arrow hollow grass shoot, 400 mm long, 3.3 grams, detachable arrowhead shaft 150 mm long covered with resin on which poison paste is placed, from larva of a beetle. [I omit Latin names]. Hunters can hit target over 50 m. Arrowhead replaced with dart syringe.

Five Ju/'Hoan hunters shot 5 darts each at targets 5-30 m at 5 m intervals, measured distance from centre. Radius of 25 cm consistently hit up to 30 m. Mean accuracy decreased from 5 cm radius at 5 m to 23 cm radius at 20 m. Normal hunting range 20-30, subjects felt uncomfortable shooting at less than 20 m. Then darted 6 lions and 17 leopards [but most were previously drugged or immobilized, though some were stalked on foot]. Good technique: cheap equip, involves locals using traditional skill in sustainable wildlife management.

**Stanford, Dennis**

1979 Bison Kill by Ice Age Hunters. *National Geographic* 155(1):114-121.

Multiple exposure photo shows Stanford throwing. [Appears to be a distance throw, starts with atlatl and dart down by hip, dart leaves at high angle. He uses full overhead motion with torso rotation and wrist flick. Other photos show an Arctic-like atlatl and long foreshafted dart.]

**Stanford, Dennis**

x

1996 Foreshaft Sockets as Possible Clovis Hafting Devices. *Current Research in the Pleistocene* 13:44-46.

A socketed harpoon head could hold an Anzick Clovis point and fit on the end of one of the bone rods from Anzick, which would then be foreshaft. Richmond, Indiana bog surface find dates  $7,990 \pm 120$  BP, so not Clovis, but maybe similar.

**Stanford, Dennis, and Bruce Bradley** o

2002 Ocean Trails and Prairie Paths? Thoughts about Clovis Origins. In *The First Americans: Pleistocene Colonization of the New World*. N. Jablonski, ed., pp. 255-271. California Academy of Sciences, San Francisco.

Supposed similarities between Clovis and Solutrean, including blade technology, overshot biface thinning, etc. [None of these are illustrated, perhaps because they would be even less convincing.]

**Starr, Frederick** x

1898 Some North American Spear-Throwers. *Archives Internationales d'Ethnographie* 11:233-235, plate XV.

Utah "spear-thrower" from "cave-house ruin" given him by Charles Lang. [Basketmaker form], 613 mm L, leather finger loops, heart-shaped groove, integral "peg," slightly curved, small white quartz "charm" attached. Lake Patzcuaro, W of Mexico City, Tarascan Indian towns, some hunt ducks with "tsu-pa-kwu" spear-throwers, 2 m long cane spears with iron points. Thrower has round hand grasp with wide portion perforated with 2 holes for 1<sup>st</sup> + 2<sup>nd</sup> fingers, deep groove, peg for butt of spear, underside keeled with hook to retrieve floating spears. Light fine-grained wood, 550 mm L (short specimen) to 740 mm. Peg often broken out and repaired. [poor illustrations of all 3 specimens, and canoe on Lake P.] George Hyde says spear-throwers in use elsewhere in Mexico, Tenanpulco on Apulco R., Tecohitla and Nauhtla Rivers.

**Starr, Frederick** x

1901 Notes Upon the Ethnography of Southern Mexico. *Proceedings of the Davenport Academy of Sciences* 8: 102-198.

Expeditions of 1898, 1899, and 1900. Describes several tribal groups, including the Tarascans in the state of Michoacan, around Lake Patzcuaro, p111: "In hunting ducks, a spear-throwing stick is used, which is called tsu-pa-kwu. This is simple, about 2 feet long, with two holes for the fingers, a groove in which the spear shaft lies and a peg against which the butt rests; there is also a hook below the end for dragging floating spears to the canoe. The spears are made of long canes with two or three divergent iron points firmly bound in." Small photo of atlatl.

**Steckel, Nathan, and Chris Vincent**

o

2006 The Physics of the Atlatl: Flex: Irrelevant...or not. *The Atlatl* 19(3):5-6.

Flexible atlatl with a “half throw” stopping at 2:00 with no follow thru allows atlatl spring to propel dart. 44 throws each way show 6.3% more distance and similar but slightly better accuracy than full throw with follow through. [No details on equipment. Small sample, but difference in distance is statistically significant by t-test; difference in accuracy is not. Plausible, although accuracy measured only as distance from straight line, so not useful. This is not the right way to use a normal atlatl, but might be relevant for some long flexy ones as in Australia].

**Stirling, Matthew W.**

o x

1960 The Use of the Atlatl on Lake Patzcuaro, Michoacan. *Bureau of American Ethnology Bulletin* 173:265-268. Smithsonian Institution, Washington D.C. (also excerpted with good illustrations in *The Cast* Fall/Winter 2000;13-15)

1944 expedition, photos in article (also color motion-picture made).

Tarascan word: "phatamu".

Atlatl survived in "most civilized regions" = Peru, MesoAmerica, because hunting less important, didn't need bow. Also maybe superior in warfare.

Like Eskimo, Tarascans use to hunt aquatic birds, throwing multipronged spear into rising flock.

Reed spear shaft, 9' long, steel prong tip.

Atlatl 24" long, wood, rigid, grooved with integral spur, hook on back for retrieving birds, two finger holes.

**Stockel, H. Henrietta**

1995 *The Lightning Stick: Arrows, Wounds, and Indian Legends*. University of Nevada Press, Reno.

Arrows and symbolism. [Collects some old, hard to find ethnographic accounts of archery, and medical accounts of wounds. Unfortunately, she doesn't have any understanding of how bows are made and used, and her atlatl knowledge is even worse. Page 41: “The atlatl dart – the forerunner of the arrow, according to Peckham - fit snugly, attached to a foreshaft, into a spear's mainshaft. Often these dart throwers were as much as fourteen feet long, especially in the SW, where Spanish influence was strong.” Page 16: “The Comanches and Pawnees carried lances that resembled the atlatls of old – tips of swords inserted into wooden handles.”]

**Stodiek, Ulrich**

x

1992 A propos de l'emmanchement des propulseurs au Paléolithique Supérieur. In *Le Peuplement Magdalénien: Paleogeographie Physique et Humaine*. J-P. Rigaud, H. Laville, B. Vandermeersch eds., pp 317-331. Comité des Travaux

Historiques et Scientifiques, Paris.

[‘Concerning the hafting of spearthrowers in the Upper Paleolithic’].

Paleolithic spearthrowers are not complete, the antler hook ends were made to haft in wooden handles, in several ways. Some finely carved.

Dates from late Solutrean to Magdalenian V, most Magdalenian IV.

Eight complete specimens: 10-30 cm long, too short compared to ethnographic. Round perforated examples could haft in socket but too much work, more likely in groove, lashed on through holes.

Some short specimens merely beveled, glued and lashed to beveled wood.

[Good photos of how he did it]. Trials show durability.

### **Stodiek, Ulrich**

o

1993 *Zur Technologie der jungpalaolithischen Speerschleuder: Eine Studie auf der Basis archaologischer, ethnologischer, und experimenteller Erkenntnisse.*

(The Technology of the Upper Paleolithic Spearthrower: A Study Based on Archaeological, Ethnological, and Experimental Data). Verlag Archaeologica Venatoria: Tübingen.

[A magnificent book, lots of information and illustrations of all kinds of atlatls, including famous Upper Paleolithic ones, and details of Stodiek’s reconstructions and experiments. From my point of view, too bad it’s in German, and now out of print. Someone should publish a full translation. See Street 1994 for information from his translation of the summary.]

### **Stodiek, Ulrich**

x

2000 Preliminary Results of an Experimental Investigation of Magdalenian Antler Points. In *La chasse dans la Préhistoire/ Hunting in Prehistory*, Anthropologie et Préhistoire 111. C. Bellier, P. Cattelain, and M. Otte eds., pp. 70-78. Société Royale Belge d’Anthropologie et Préhistoire, Bruxelles.

from work for 1993: antler pts all that remain of darts assoc with Upper Paleolithic atlatls. Double + single beveled points show diameter around 10 mm, = shaft size, which works with shafts 1.3-2.2 m long. Tested using crossbow device, 30 m/sec velocity, at 15 m range, equivalent to velocity attained with spearthrower. Used gutted fallow deer carcass, 45 kg. Points attached with only resin/wax glue failed or split shaft, but lashing of sinew made the hafting strong enough. Body cavity penetration when no bone struck averaged 20 cm, and with flint side-blades 5-10 cm more. Bone hits often damaged both point + shaft. Glued-in flint inserts detached when struck bone.

### **Stodiek, Ulrich, and Harm Paulsen**

1996 *“Mit dem Pfeil, dem Bogen”*: *Technik des steinzeitlichen Jagd*. Isensee Verlag, Oldenburg.

[“With Arrow and Bow: Stoneage Hunting Technology” In German.] Sections on spear throwers (Speerschleudern) with color pictures of reconstructions of Upper Paleolithic examples, and European competitions.

**Stolpe, Hjalmar**

x

1890 Ueber Altmexikanische und Südamerikanische Wurf Bretter. *Internationales Archiv für Ethnographie* 3:234-238.

[“On Ancient Mexican and South American Dartboards”. In German.] Engravings of British Museum Aztec atlatl, a couple S. Am. forms.

**Storey, William K.**

2004 Guns, Race, and Skill in Nineteenth-Century Southern Africa. *Technology and Culture* 45(4):687-711.

Friendly groups portrayed as unskilled and harmless, foes as skilled and dangerous - so if accounts are biased, how do you assess technological skill? [And that of course affects assessment of the technology itself too.] “Practice” (how guns were used in storing, carrying, displaying as well as fighting and hunting) was ideological too - as seen in discourse and efforts to control spread of guns. Use involves “mimeomorphic” skills (loading, firing etc) that are routine, and “polymorphic” skills (shooting at game) that respond to circumstances. Mimeographic skills for using flintlocks replaced by better technology, so shooters could hone polymorphic skills, but manufacture required more skill. Burchell 1812 predicted guns would drive out game, forcing people into agriculture.

Boer smiths adapted heavy caliber flintlock guns to African game. Muzzle loaders, reliable and not needing special ammo, remained in use into late 19C. Martini-Henry finally outmoded locally adapted muzzleloaders. Breechloaders and reduction of game led to deterioration of skill in Boers.

Under British, Africans were portrayed as technologically incapable at same time as dangers of them owning guns were a worry. Gun ownership related to citizenship - conservatives wished to deny to Africans, making Boer states more comfortable with confederation with British colony. Liberals downplayed African skill (and thus danger); conservatives who claimed Africans were incompetent nevertheless portrayed them as skillful and thus too dangerous with firearms and tried to make them 2<sup>nd</sup> class citizens by disarming them.

**Street, Martin**

1994 Translation of the summary of the Doctorate thesis of Ulrich Stodieck, "Zur Technologie der jungpalaolithischen Speerschleuder." *The Atlatl* 7(4):1-5

Ethnographic survey, size ranges.

Australian info: successful hunting range 10-30 m.

Upper Paleolithic archaeological survey: 123 specimens of hook ends [which

include the famous animal carvings, and some pieces considered by others to be complete].

Two hook types: hook, and hook + groove.

Surviving pieces are too short to be complete, would be part of more complex tool.

Reconstructions and experiments performed: Needed fletching on pine shafts with antler points. Flexibility of spear affects system. Max distance with reconstructions 180.9 m. Bow vs atlatl experiments: arrow 40-50% more velocity, 1/17 the time to launch. Spear 60-70% more kinetic energy because heavier (90 gm).

Penetration of bison carcass poor with atlatl and antler point (10cm), better with lithic points. Bone points survive damage better than stone.

### **Strehlow, T. G. H.**

1964 The Art of Circle, Line, and Square. In *Australian Aboriginal Art*, edited by Ronald Berndt, pp. 44-59. The Macmillan Company, New York.

Illustrates and explains designs on a woomera type spearthrower as example of Western Australian art. "The Central Australian curved and circular figures were stylized representations of marks or tracks on the ground... painted or incised as individual figures... with empty spaces left between them. The Western Australian angular and straight-line figures, on the other hand were combined into patterns that covered practically every inch of the surface. They do not seem to represent marks or tracks on the ground, but to be heavily stylized drawing of the actual objects themselves." Two 1933 Pintubi spearthrowers represent storms with wind and floods. [Why those designs on spearthrowers? Not explained]

### **Strischek, Ray**

o

1995 Atlatl Elbow, or How to Kill Yourself Before You Kill Your Mammoth. *The Atlatl* 8(3): 2-3

Theories of atlatl weight use discussed, favors weights to reduce side-to-side wobble of atlatl during throw.

Got real sore from using heavy weights, recommends no more than 2-3 oz.

### **Strischek, Ray**

1996 Atlatl Weight Function. *Ohio Archaeologist* 46(1):32-39.

[Useful article], considers many variables in accuracy and distance: theories of atlatl weight functions, body motion and casting styles, atlatl grip styles, problems affecting throws.

Experiments with lots of variables [not very systematically], concludes: Heavy weights no good, they slow throw, damage arm. Moderate weights increase accuracy by helping prevent spur end of atlatl from being pushed to side as dart flexes. On light flexible atlatls, small weight may increase flex of atlatl and stored

energy, and tunes atlatl flex to that of dart.

**Striscech, Ray**

**xo**

1997 Dart Construction and Design. *The Atlatl* 10(2):7-8; 10(3):3-4, 10(4):8-10.

Recommends only slight flex to store energy, too much destroys accuracy, especially at distances where harder throw needed.

Uses bamboo or cane approximately 6 foot long.

Can shorten or stiffen to reduce flex, want weight a bit forward of center.

Uniform diameter milled lumber darts with even flex not as good as weight-forward darts with larger forward diameter.

**Striscech, Ray**

**o**

1998 Aluminum Darts. *The Dart* 3(2):2-3.

Add dowl inside tip end - stiffens and weights so control flex.

**Striscech, Ray**

**o**

1998 Striscech's Atlatl. *The Dart* 3(2):3-4.

Describes + pictures his odd atlatl with dart rest and finger pegs. [Not like anything ethnographic or prehistoric, but works well.]

**Striscech, Ray**

**xo**

1999 Atlatl Spurs. *The Atlatl* 12(1):8-12.

1999 Atlatl Spurs. *Bulletin of Primitive Technology* 18:70-73.

Recommends spurs for different purposes. Spurs at angle (30 degrees) to shaft provide initial lift to point of dart, as does curved-down end of atlatl. Horizontal spurs don't. Curved up atlatl end drives dart point down. End of dart "rides on" spur most of throw, need flat surface on spur to prevent slipping off to side or snagging of end of dart.

**Striscech, Ray**

1999 Atlatl Darts. Unpublished manuscript.

Basic dart principles and manufacture of cane, wood, and aluminum shafts.

**Striscech, Ray**

**o**

1999 Ray Striscech's Tips for Making A Good Dart for the WAA ISAC Contests. *The Dart* 4(1): 5-7.

Emphasis on importance of balance point being forward of center.

**Striscech, Ray**

**o**

2000 Atlatl and Dart Do It Tips for the New Season. *The Dart* March 2000: 9-12.  
 2000 Atlatl and Dart Tips for the New Season. *The Atlatl* 13(3):3-5.

Useful basic instruction/tips on equipment and use.

**Strischek, Ray** o

2000 Ray Strischek's Atlatl. *The Dart* July 2000:17-18.

Why Ray uses a flexible, weighted atlatl with an ergonomic peg grip.

**Strischek, Ray** o

2001 The Pull, Push/Lever, Wrist Flick Action of the Atlatl in Motion. *The Dart* November 2001: 26.

Describes motion with schematic drawings: First, horizontal pulling of the dart, then hand pushes forward and levers atlatl spur up, followed by flick of wrist which accounts for 50% of force, after atlatl passes the vertical position. Spur contact only at beginning [but then how does atlatl apply force to spear, especially in wrist flick part of throw? Needs closer look at slow motion films].

**Strischek, Ray** o

2002 How to Use the Atlatl and Dart. *The Dart* August 2002: 20-21.

“Pull, push/lever, flick.” Don't bend over. Keep elbow above shoulder.

**Strischek, Ray** o

2004 Atlatls. *The Dart* May 2004: 1-8.

Wrist flick gives greater force for penetration and distance from animals. Defines atlatl parts. Three grips: Hammer, Basketmaker II, and Single Hole. Changing from hammer to BM grip helped his atlatl elbow. Male, Female, and Neutral Hooks. Weight theories: increase velocity/distance (variable test results); tuning flex or oscillations (maybe gives greater efficiency, but accuracy is more important); centrifugal force (counters forces of flexing dart playing on atlatl spur, for smoother throw and accuracy – his favor); counter balance (motionless hold while stalking); fetish. Probably some of all or many of above. Recommends no more than 70 grams or stress elbow. Dart rest – eliminates confusing extra actions of fingers in throw. Known from Peru and New Guinea. His atlatl flexes slightly, and he uses cane darts 8 ft long and 4-6 oz [124-186 gm].

**Strischek, Ray** o

2004 Darts: How They Work, How to Make Them. *The Dart* August 2004: 13-22.

Dart flexes to “get out of the way of the oncoming atlatl” and springs off. Simple

wag and bend tests to get consistent flex. Flex should be in rear 2/3s. Balance point should be 6-10 inches in front of center. Bamboo and cane are naturally like this, wood can be tapered. Bamboo straightens well, saplings difficult.

**Strischek, Ray**

**xo**

2004 How to Cast a Dart with an Atlatl. *The Dart* December 2004: 7-18; *The Dart* August 2009:9-19.

also posted on Community Zero Atlatl web page 5/2004 URL:

<http://www.communityzero.com/atlatl>

and on Thudscave web page URL: <http://www.thudscave.com/npaa/others/rs-dartcast.htm>

Uses “end over end” [means overhand] rather than side-arm motion, right handed. Elbow level with shoulder, don’t bend over, keep aiming until dart separates from atlatl. Build momentum slowly, don’t overpower your throw. Limit movement as much as possible – Europeans tend to lean back but don’t step forward, Americans tend to take a step with left foot.

**Strischek, Ray**

**o**

2005 It’s Like Fly Casting, Man! *The Dart* August 2005: 7-8, 13.

Compares to motion described in J. A. Henshall, *Book of the Black Bass*, Bass Angler’s Sportsman Society, 1881. Similarity in gradual acceleration, final throwing motion with arm up and fully extended, but differs in stance and other things.

**Strischek, Ray**

**o**

2005 Article Review: Experiments in the Function and Performance of the Weighted Atlatl (Raymond 1985). *The Dart* August 2005: 11-12.

Raymond concluded slight advantage in distance with weights (negligible), but important conclusion is weight increases angular momentum which contributes stability to the throw, improving accuracy. Why Ray uses weighted atlatl.

**Strischek, Ray**

**o**

2006 Aiming the Dart. *The Dart* March 2006: 7-9.

Align visually on target, develop consistent motion and especially force of throw.

**Strischek, Ray**

**o**

2006 Atlatl and Dart ‘Parameters’ as it Relates to Equipment and Throwing Technique. *The Dart* December 2006: 19-22.

Too many unaccounted variables in experimentation, it’s only personal experience, so experimenters should describe details of relevant parameters and



Good tips, what RS thinks may cause a miss in 10 shots. 1. Dropping elbow. 2. Bad spur design. 3. Unstable grip, distinguish three basic types: hammer, basketmaker, and single finger hole. 4. Centrifugal stability – wobble at spur end; a weight helps prevent. 5. Hesitation at start of throw. 6. Aiming – keep aimed through throw. 7. Use a good dart – prefers dart a foot longer than you are tall, balanced 8-10” forward of center, 4-6 oz, 3 x 8” feathers. 8. Clutching – death grip on atlatl = loss of throwing power. 9. Saddle finger – on atlatl without rest, holding dart inconsistently with finger over it. 10. Diagonal thrust – inconsistent side-arming or letting dart wander to side during motion.

**Strong, Emory**

**x**

1966 The McClure Atlatls. *Screenings* 15(5):1-4.

[Rather incoherent descriptions]. Two atlatls from packrat nest in looted cave, Columbia River area. Wood, integral mixed hook, 15 inches long, flat blade shape, attached double finger loops of antler or horn, stone weight 40.2 gm set in socket. Second similar, larger, >21 inches, missing both ends, socket but missing stone.

**Sudar, Anna**

**o**

2010 Flint Ridge Knap-in Shows Off Tools, Techniques Used by Ancients. [original source info missing] reprinted in *The Dart* September 2010:17.18.

Flint Ridge knap-in, Strischek organizing atlatls.

**Sullivan, S.**

**x**

1965 Certain Aspects of the Material Culture of the Aborigines of the Richmond and Tweed River Valleys. *Armidale and District Historical Society Journal and Proceedings* 8:4-17.

N New South Wales, Australia. Destruction of native culture since 1840s contact. By 1890s “young men do not climb or use spear or boomerang as their fathers did. Drink and gambling are their curses...” Rainforest environment, plentiful food. Hunting with net, club, spear, boomerang, paddi-melon (throwing stick). P 11: lack of woomera and barbed spear made fishing and hunting kangaroo more difficult, but perhaps not needed because food not hard to get. Simple wooden spear only. Ground edge axe, flint knife. Flint knife hafted with bark used for fighting, smaller ones for scarification. Lots of fishing, but no womera or specialized fishing spear.

**Swanton, John R.**

**x**

1938 Historic Use of the Spear-Thrower in Southeastern North America. *American Antiquity* 3(4): 356-358.

Spanish text and translation from Garcilaso de la Vega account of de Soto

expedition of 1543 to Florida in area of later Chitimacha, mouth of Mississippi River.

*Tiradera* “(javelin)” or better, *bohordo* [currently a light javelin thrown by competitors on horseback] “a fathom long” made of “firm rush”, shot with *amianto* “wooden stock” “like in Peru,” 2 tercias long. Three-barbed dart went through thigh of Spaniard, shoots with “extreme force” to “pass through man in mail coat.” “Spaniards in Peru feared this weapon more than any other the Indians had.” [Probably source of myth of armor-piercing atlatl darts].

**Swope, Bob**

o

2010 *Learning More About Youth Hunting and Hunter Safety: Handbook/Guide for Everyone*. Jacobob Press, St. Louis.

Includes section on atlatls, pp. 193-205. Introduction + definitions, [generally ok and illustrated]. Three style grips: knuckle, finger hole, and wrapping style. [Odd distinction, first is for hammer grip, a distinction used later]. Hunting points of stone, bone, and modern broadheads. Grip styles figure shows hammer, split finger and others, split finger and single hole allow easier rotation of wrist in throw. Safety tips: 100 m behind target [excessive], handling safer than for firearms, carry darts point down, pull with one hand on target etc, similar target basics as for other projectile weapons. Casting motion described, uses my photo sequence. Optional features include dart rests (modern), and weights (help balance atlatl at rest, help smoother cast).

**Taçon, Paul, and Christopher Chippindale**

o

1994 Australia’s Ancient Warriors: Changing Depictions of Fighting in the Rock Art of Arnhem Land, N. T. *Cambridge Archaeological Journal* 4(2): 211-248.

Theories of warfare reviewed, bias toward view of rarity in pre-agricultural societies. Australia. Three phases over 10,000 yr record. World’s oldest depictions of fighting in Dynamic Figures period ca 10,000 BP, boomerangs and spears used but not atlatl. Middle period Simple Figures show “hooked stick” which may be spearthrower. Late Energetic Figures often have spearthrowers in combat. [Authors were not interested in atlatls, and photos are small and poor, so can’t make out any details.] Comments by others mostly note the difficulty of interpreting – is depicted fighting real, common, ritual, mythical, metaphorical?

**Tait, Lawson**

1874 Feathering in Flint Weapons. *Nature* July 30:245.

Notices twist/bevel on points = “feathered”. “...if the weapon was propelled with any great rapidity, its revolution would be a matter of necessity and would result in a greater steadiness in its line of trajectory.” Experiment: made plaster cast, cut sections to show symmetry of “spiral.” Flint tends to fracture with “spiral” anyway, but often deliberate.

**Talwani, Sanjay**

x

2011 Spear-Hunting Bill Flying Toward Passage. *Billings Gazette* online, January 11, 2011, accessed 1/14/2011. URL:

[http://billingsgazette.com/news/state-and-regional/montana/article\\_978788a6-0dcb-52de-886d-af36ed7df0f1.html](http://billingsgazette.com/news/state-and-regional/montana/article_978788a6-0dcb-52de-886d-af36ed7df0f1.html)

Expect approval of Senate Fish and Game Committee bill to allow big game hunting with hand thrown spear, also allows atlatl “a spear thrown with a separate device to increase power.”

**Tankersley, Kenneth B.**

x

1994 Clovis Mastic and its Hafting Implications. *Journal of Archaeological Science* 21:117-124.

Amber used as hafting mastic, recognized on obsidian Clovis point, surface find, Hoyt Site, Oregon. Use of amber may be another trait shared by Clovis and Upper Paleolithic of Europe.

Insoluble in organic solvents except xylene, microscopically similar to amber. Longitudinal scratches in flute - to improve grip of mastic and bone foreshaft, especially useful on slippery obsidian.

Amber is not as sticky as resin, but will melt, and can be found where there are no living conifers.

[But that shouldn't have been a problem. Much more likely this is resin that became “amber” in the 12,000 years since its use. See also Beck 1996: amber does not melt, won't work as adhesive. Helwig (see Helwig et al 2008) told me she was also skeptical, didn't think T's tests sufficient to establish material, but didn't think resin would become amber in that time either.]

**Tankersley, Kenneth B.**

x

1996 Archaeological Paradigms, Provincialism, and Semantics: A Reply to Beck's Comments. *Journal of Archaeological Science* 23: 455-458.

Beck is too provincial and restrictive in his definitions of amber. “Amber is a tree resin that has lost some of its volatiles.” Fossil resins [no age info given] from Plains area do indeed melt. [Tankersley still misses the point – he has never established whether the adhesive used on the Clovis point was fresh or “fossilized” (ie “amber” in his very broad definition) at the time of use. Occam's Razor suggests fresh resin: more common, widely used, easy to use.]

**Tankersley, Kenneth B.**

o

2002 *In Search of Ice Age Americans*. Gibbs Smith, Publisher, Salt Lake City.

Personal account of some Clovis research (Crook County and other caches, Sunrise Ochre Mine) with background on Clovis. [Generally nice popular

archaeology, well illustrated, but with way too many sloppy errors, misstatements, and too much fawning over collector/looter Forest Fenn.]

Atlats (p.80): "Atlatl darts can be launched from either the side of the body or over the shoulder. An atlatl dart is an accurate and deadly weapon when launched with a snap of the wrist from the side, but only at a distance of seven to eight feet. While an over-the-shoulder throw significantly increases the dart's range, it loses accuracy, speed, and penetration power. Also, long distance throws require more release time and space. However the dart was thrown, hunting with the atlatl would have been done in open environments." [Almost all of that is wrong or misleading – why didn't he learn to use one, or consult someone who has?]

**Tate, Bill**

1987 *Survival with the Atlatl*. Aurora: Tate Enterprises.

Short general "how to" and description of manufacture.

**Tate, Bill**

1990 Atlatl Weights. *The Atlatl* 3(2): 3-6.

Long flattened weights from Colorado.

**Tate, Bill**

1995 Evidence for Atlats at Rancho La Brea. *The Atlatl* 8(4): 1-3.

1 bunt, 3 fire hardened wooden points, references, [dark] photos.  
C14 = 4450±200 B.P.

**Tate, Bill**

1995 Long Distance Record Shattered. *The Atlatl* 8(3):1-2

July 1995, Dave Engvall 848'6 5/8" (258.64 m).

**Tate, Bill**

1996 The World Atlatl Association's International Standard Accuracy Contest. *The Atlatl* 9(3): 1-3.

First description and announcement of ISAC results

**Tate, Bill**

1997 Jeffers Petroglyphs, Bingham Lake, Minnesota. *The Atlatl* 10(2):1-2.

Clear atlatl depictions with large rectangular weights - could be catlinite, large for weights, could be flat surface (bark, feathers) to slow cast - need tests. [Look like Indian Knoll style drilled weights to me, depicted exaggeratedly large.]

**Tate, Bill**

1997 Spear Hunting Legal in Alabama. *The Atlatl* 10(4):3-4

How Alabama got legal spear and atlatl hunting for deer and boar.

**Tate, Bill**

1998 First Contact. *The Atlatl* 11(4):1-4.

Eight Americans visited European atlatl events July 1998 (R.Richard, C.Brown, J.Ray, B. Tate, M. Tate, P. Pine, L.Pine).

**Tate, Bill**

2000 Y2K Elections. *The Atlatl* 13(2):5-6.

Biographical info on J. Ray, R. Strischek, R. Mertz, M. Takoch, D. Pritchard, A. Lukes, C. Judson, S. Brown.

**Tate, Bill**

2002 One of WAA's Founders Dies. *The Atlatl* 15(4):3

Charles Lilly of CO helped found WAA, organize Valley of Fire event, starting 1989.

**Tate, Bill, and Marcia Tate**

o

2007 WAA Charter Member Dies. *The Atlatl* 20 (2):5.

Obituary for Hallie Cash.

**Tate, Bill**

o

2007 WAA 20<sup>th</sup> Anniversary. *The Atlatl* 20(4):2.

Origins in Rod Laird's Jr High school classes in Saratoga Wyoming organized World Atlatl Open, CO Archaeological Society inspired to organize WAA in 1987, Tate Pres, Leni Clubb VP, Charlie Lilly Sec-Treas.

**Taylor, Herbert C. and Warren Caldwell**

1954 Carved Atlatl from Northwest Coast. *American Antiquity* 19(3): 279-280.

Dredged from mouth Skagit River, WA. Looks old, but not like NW art, resembles MesoAmerican, probably not fake, maybe lost, drifted in? Further tests proposed.

[Were there any? Poor photo and minimal description shows what looks like one-piece wood atlatl with finger holes like Mexican, carving just forward of grip on bottom looks like dragon or feathered serpent holding mask.]

[Fladmark et al. (1987), Bruchert (1999), Borden (1969) accept as NW; Fladmark

dated 1700±100 B.P. and has best picture and description, also good picture in Ames and Maschner 1999:236.]

**Terpstra, Kelly** **x**

2011 Lucas Yates: Excelling at a Unique Sport. *Ottumwa Courier*, Saturday March 26, 2011, p. 16.

9 yr old, grandson of Roger + Mary Granneman, Ottumwa, Iowa. [Adequate journalistic explanation of basics.]

**Thieme, Hartmut** **x**

1997 Lower Palaeolithic Hunting Spears from Germany. *Nature* 385: 807-810.

[see Dennell 1997] Stratigraphy and geology of Schoningen open pit coal mine sites. Lake shore deposits from Reinsdorf Interglacial have flints + fauna assoc w 3 pieces fir wood, 17-32 cm L, 3-4 cm W, with “diagonal groove cut into one end” 4-9 mm W, 10-47 mm L [depth not given] possibly “for holding flint tools or flakes...the oldest composite tools yet discovered.” [No photo, description inexcusably vague, don’t sound like tool haftings to me.]

Another channel, in organic mud under peat, temperate boreal pollen, horse bone + other faunal w butcher marks, flint flakes, points, and scrapers, “possible hearth” reddened sediment. Wooden tools (spruce): bipoined “thrusting spear or throwing stick”, 3 spears, all sim, max weight and T at front, taper to tail like javelin “projectile weapons rather than thrusting spears”. Est age 400 kya.

[Enlargements show nicely shaped sharp tips, but other photos are too small to see anything else.]

**Thieme, Hartmut** **x Burling**

2005 The Lower Paleolithic Art of Hunting : The Case of Schoningen 13 II-4, Lower Saxony, Germany. In *The Hominid Individual in Context : Archaeological Investigations of Lower and Middle Paleolithic Landscapes, Locales, and Artefacts*. Clive Gamble and Martin Porr (eds.), pp. 115-132. Routledge, London.

Buried lakeside site with organic mud and peaty layers. Dates ca 400,000. Interp as hunting site with >20 horses, 8 wooden spears, stone tools other organics. Spears are fir + pine saplings, trimmed, point at base of tree, smoothed, 1.8-2.5 m long, weight 1/3 from tip, so throwing weapon. Shorter piece sharp on both ends .78m interp as throwing stick for bird hunting. Also burnt worked wood interp as spit, several hearths. Possible cleft haftings for stone tools [not detailed, no photo] from diff layer.

Implications : Complex hunting of herd of fast large mammals = complex society, communication. Specialized hunting technology, complex tools, variation = fit to individuals. But abandoned them, maybe symbolic reason ? Control of fire, processing of lots of meat implies drying/smoking = storage. Hides = clothing, shelters. All abilities usually assigned only to more modern humans.

**Thomas, David Hurst**

1978 Arrowheads and Atlatl Darts: How the Stones Got the Shaft. *American Antiquity* 43(3): 461-472.

Looks at American Mus Nat Hist specimens of hafted points to determine relationship between shaft and hafting area of point, uses discriminant analysis to derive formula to separate atlatl darts from arrow points. 118 ethnographic arrows, 14 Pueblo Bonito arrows, but atlatl dart foreshaft sample very small (10, of which 9 SW, 1 CA) His equations classify the specimens about 86% correctly (7 of 10 for darts, 115 of 132 for arrows). Single variables show statistically significant differences between mean darts and arrows in most dimensions of point size and foreshaft diameter. [Problems : small sample, specimens from all over, so may not apply well to any one prehistoric site. Also, arrows all late, may not reflect transitional types well.]

**Thomas, Elizabeth Marshall**

o

1980 *Reindeer Moon*. Boston: Houghton Mifflin Company.

[Novel. Perhaps the best novel of prehistory. Upper Paleolithic hunters from the point of view of a young woman. Thomas knows what hunter-gatherers think about (she worked with San), and her writing is creative and beautiful. She is weakest in technological details (no atlatls although there should be, flintknapping not well described), and strongest in details of animal life and behavior, another of her areas of expertise. This is a realistic Pleistocene world, where the dangers are not dramatic encounters with big beasts or human enemies, but the harsh realities of hunger, cold, childbirth, infection. The dramas are also small and personal, as families argue, marriages are made and broken, and lineages maneuver for access to game and shelter - the kinds of social issues that all human life focuses on.]

**Thomas, Elizabeth Marshall**

o

2006 *The Old Way: A Story of the First People*. Farrar, Straus, and Giroux, New York.

Reminiscences of her experiences among the San Bushmen of the Kalahari, starting with family expeditions in 1930s. The theme of the book, "the old way" is how humans evolved as hunters. P 105: "When Paleolithic people painted on the walls of their caves, they didn't paint grubs or baby birds, and they didn't paint nuts, roots, or berries. No, they painted large mammals, mostly ungulates, many with projectiles sticking out of them. They were big-game hunters, just like the Bushmen. They were artists who knew about hunting. They were hunters who knew about art." Some of her ideas are far fetched or inaccurate, but there are some fascinating insights and observations. P 34 - a flight distance of 100' is enough to protect antelope from lion or Bushman arrow. Chapter on arrow poison

- stories about how careful the San are with poison and arrows.

**Thompson, Marc**

**o**

2006 Pre-Columbian Venus: Celestial Twin and Icon of Duality. In *Religion in the Prehispanic Southwest*, edited by C. VanPool, T. VanPool, and D. Phillips, pp. 165-183. Altamira Press, Lanham MD.

Venus, morning/evening = twin, duality, also assoc with warfare, feathered/horned serpent imagery in Maya and Teotihuacan. Some of this symbology shared into American SW, especially star icons [although no good ethnographic case is made]. In Mexico, assoc with atlatl : finger loops = eyes of xiuhcoatl fire serpent or Tlaloc, serpent atlatl held by dieties, atlatl intro to Maya with Teotihuacan architecture and Venus war.

**Thorpe, I. J. N.**

**x**

2003 Anthropology, Archaeology, and the Origin of Warfare. *World Archaeology* 35(1) :145-165.

Summarizes theoretical stances, cites many early archaeological examples including some Upper Paleolithic that may be arrow, or dart wounds. Violence really becomes common in Mesolithic.

**Tindale, Norman B.**

**x**

1928 Natives of Groote Eylandt and of the West Coast of the Gulf of Carpentaria. *Records of the South Australian Museum* 3: 61-134.

Observations 1921-22. GE + 3 small isles, ca. 1000 sq miles, occup by Ingura tribe, est around 300 pop in several local groups. P. 67 children and toys, "young boys are encouraged to play at spear-fighting using diminutive throwing sticks and lengths of cane-grass...often assisted and encouraged by young and middle-aged men." Initiation 10-13, circumsized with stone head temporarily detached from a spear. P. 76 avenging death by spearing trial, e.g. 36 spears thrown at man by 6 kin of dead, distance 30 yds, no hits. P. 80 wallaby hunted with special spear, "Having approached to within 10 yards or less, the spear is hurled and seldom misses its mark." P.92 weapons: varieties of spears – fish, dugong, hunting, fighting, all for spear thrower except dugong. Superior workmanship, split out of log, shaped with knives, scrapers, and rubbing stones. Some spears acquired by trade. Fish spears: hardwood shaft 9-11' long, 2-3 barbed wood prongs lashed on, 22 oz [very heavy!] and sink in water, but floating light wood used in deep water. Dugong harpoons: not for spear thrower, up to 16' long, 5 lbs. Hunting spear: 8' long, hardwood, one piece, sharpened and fire hardened tip, no barbs, ca 9 oz. "young men often practice using low cycad palms as targets." Fighting spears: 4 types – one pc hardwood, hafted with barbed wood head, bamboo hafted, and stone headed, last 2 imported. On island 20-30 spear makers, each with own style spear

and ornamentation. Made in sets of 3-12 similar. "Tests made by setting up a target (a drawing of a wallaby on bark, about 4 ft in height) showed that the effective range of the spears was 30 yds. At 35 yds only one man hit the target at a height of more than a few inches above the ground, whereas at the former distance, few failed to score a body hit." Several left handed throwers [including photo, but too small to see any details]. Manufacture detailed: split from stringy-bark log, barbs cut with stone knives on first visit, mostly metal on later, decorated with paint, or separate head spliced on with bloodwood resin. Average L = 9', wt = 15 oz. Different styles of barbs. "Older men constantly employed in making spears and produce great numbers." Traded on mainland for emu plumes, ochre, stone tools; >300 sprs in possession of party of 30 men. Lighter bamboo shafted spears obtained from Balamumu on mainland, who are feared raiders, spears have longer range and break on contact so can't be returned, but heavy wooden preferred for fighting in brush. Raiding party of 26 had each 15-40 spears. All stone tools obtained by trade, stone tipped spears prized but not as well made by source.

Throwing sticks: 3 types. 1) yumangala – flat, softwood, rect in section, wood peg attached on flat side with string and bloodwood gum in notch, handle indicated by notches or raised band of wood is often painted white while shaft is red ochred. Or may be all red, or with white and yellow patterns. [this is the familiar form]. 2) yukarupu – round in section, hardwood, sim to those of tribes S of Roper River, but decorated w bunch of fiber instead of hair, most common form on island. 3) mamuntunga – peculiar to the island, like yukarupu, but expanded lanceolate flattened handle, usually decorated with paint but sometimes just incised. [this is probably what I have as the odd form, but mine is quite short and stout by comparison to those illustrated. I have never seen the long elaborate forms pictured]. "In use the yumangala and mamuntunga are held above the junction of the handle with the shaft, and thus the handle is purely conventional. In the yukarupu the grip is close to the end." [ a high grip would reduce the enormous length of those I have seen]. P. 134 figure and description of grip of mamuntungu: spear is held between the first finger and thumb, and the throwing-stick between the first and second fingers, above the flat handle, which is held edge-up [with hook to side too then].

**Titmus, Gene L. and James C. Woods**

**x**

1986 An Experimental Study of Projectile Point Fracture Patterns. *Journal of California and Great Basin Anthropology* 8(1): 37-49.

[Note individual variation: L vs R patterns]

Use vs manufacture breakage of Elko corner-notched forms. Manufacture: perverse [and bending] breaks, mostly barb or stem in notching. Effects of hafting. [Not enough statistical treatment.] Surprisingly long survival of some points in use, but 70% damaged by 1 throw, average 2.1 throws. Bending fracture most common, especially at neck, espec in yielding material. Crushing - mostly distal and marginal [includes impact flutes] and hard materials. Shearing

[burination] espec on barbs and in somewhat yielding material eg wood.

**Tokioka, Kenjiro**

x

1992 Rock Art of Escalante Canyon: Quantitative Analysis of Rock Art Elements of Glen Canyon. unpublished MA thesis, Department of Anthropology, Northern Arizona University.

Element inventory statistics show two cultural traditions: Fremont in the Escalante drainage, and Anasazi elsewhere. Fremont sim to Barrier Canyon Style L. Archaic, while Anasazi sim to Glen Canyon Linear Style. Anthropomorphs most distinctive. Glen Canyon area, middle of S border of UT, 99 sites used, mostly recorded during dam project [appendix shows all images, but records were probably not very well done].

Atlatls [looped sticks - he does not apparently distinguish between atlatls and darts] co-occur statistically with A-3 anthros (spread arms + legs, some lizard men [ambiguous + variable date likely]), dotted lines, bird tracks, ladder-like crosshatching, and a bit further statistically, with A-2 anthros (broad shouldered to square with headdresses and large hands [typically BM]), and hand prints. A-1 hump backed anthros [often flute players] and some geometrics form another cluster; all kinds of sheep and some anthros (stick figures) another. In multidimensional scaling groups p88, p83 he says also A-10 anthros (triangular wide bodies, horns, Schafsmas's S. San Rafael Style, Fremont) also assoc with atlatls, and atlatls also assoc strongly with sheep as hunting scenes. [All these clusters and groups are hard to interpret because mixed dates of elements, and for that matter, many elements have long or ambiguous use-lives. He doesn't associate his 18 atlatl images with either Fremont or Anasazi, but all but one are S of L. Colo. R. in Anasazi territory, and most are E, close to our Cedar Mesa area. There are notably few atlatl/dart depictions, few darted sheep, and no scenes of warfare compared to SE Utah.]

**Tolley, Arthur Robert, and Jack Barnes**

1979 Reinventing the Atlatl. *Journal of the Steward Anthropological Society* 10(2): 161-180.

Experiments with lots of variables [controlled and un]: fletched and unfletched darts, lengths 127-232 cm, compound elderberry shaft with hardwood foreshaft, lead points, 10 atlatls of different lengths, some modeled after several ethnographic and archaeological examples, stone weights 27-94 grams, mostly at balance point of atlatl. [All atlatls apparently not flexible.]

Lots of practice over 5 months, 10-60 meters.

High speed filming of throwing action, drawing presented.

Gauge for relative force [not calibrated].

Results: Dart construction more important in distance than length or form of atlatl. Any atlatl >30 cm worked, but not well if <2/3 dart length. Accurate, with practice, to 30 m. Dart flex important [but why is not discussed]. Dart released

when atlatl is vertical, contra Howard 1974. Velocity ca 40 m/sec. Weights do not affect distance, or improve control or balance, and don't add either to mass of spear or to its velocity, so they do not add force.

**Torres, John A.**

s

2000 Changing Lithic Technology During the Basketmaker-Pueblo Transition. In *Foundations of Anasazi Culture: The Basketmaker-Pueblo Transition*. Paul F. Reed, ed., pp. 221-229. University of Utah Press, Salt Lake City.

Cove-Redrock Valley (near Prayer Rock) data to show distinctive Anasazi technology recognizable by BM-P transition, highly evolved and adapted to specific needs. BM II-III becoming sedentary agric. AZ-I-26-34 typical of hunt-gath technol at  $585 \pm 190$  BC: dart pts, bifacial cores for flake production, formal curated tools most common tools, exotic raw materials, = mobility. By later BM times, similar in dart pts, flake tools, some bifacial cores, but tool production trajectory diff - relates to sedentism. Mobility = bifacial cores of high quality curated material, which are too costly as become sedentary, shift to local prospecting embedded in other activity, and "expedient" reduction of cobble cores. Mean flake tool length constant thru time, but mass decreases [seems odd since biface core flakes ought to be thinner than ordinary flakes, but explains as follows:]. From BM III, multidirectional cores decrease, cores become more patterned and unidirectional = efficiency in reduction and make better expedient tools. [Still doesn't explain why trend begins in Archaic.] BM dart pts Elko + similar types, differ only in that II made from BTF and III made from cobble core flakes. Rapid transition to bow with arrow pts appearing 500-600 AD in BM III, made on core flakes, Rosegate + similar types, small forms of earlier types. Replaced by smaller side-notched pts by early P I, because smaller pts have longer range for big game.

**Torres, Luis M.**

x

1931 Hallazgo de Ganchos de Propulsor en un Cementerio Indigena de la Cuenca del Rio Lujan. *Notas Preliminares del Museo de La Plata* 1:101-105.

[In Spanish. "Find of Atlatl Hook in an Indian Cemetery in the R.L. Basin."] Excavations by Lothrop, find in Museo de La Plata. Peruvian types expected to be the "baton with 2 hooks [distal hook and proximal handle ornament]. Often hooks in form of bird. This is old form, later (ethnographic) forms have notch or ring at handle. This specimen of hook is bone, 5x3 cm [handle hook, crudely birdshaped but not effigy], first for Argentina.

**Townsend, Joan**

x

1983 Firearms Against Native Arms: A Study in Comparative Efficiencies with an Alaskan Example. *Arctic Anthropology* 20(2):1-33.

Technological “superiority” is usually not good explanation for conquest; until after ca. 1850 firearms were comparatively inefficient. Russian contact with Aleuts, Koniags, and Tlingits of S AK as example. Smoothbore flintlock musket of 18 to early 19<sup>th</sup> C was apex of development to that time. Arrow wound more survivable than bullet wound, but guns slow and innaccurate. [Lots of documentation, but perhaps overly pessimistic both in complaints of the time and how bad muskets seem to modern shooters - after all, they killed thousands of people in hundreds of battles over a couple centuries. See Harding, David F. 1999 *Smallarms of the East India Company 1600-1856, Volume III: Ammunition and Performance*. Foresight Books, London for a better assessment. In particular, muskets fired at close range at individuals (as in most combat with natives) are pretty effective].

Native arms: “In Florida, the Spanish discovered that their breastplates, which would stop musket balls, could be penetrated by Indian arrows.” [Undocumented misinformation.] N. Eskimo bow and arrow, plus comparative info: wounding or killing power at 75-100 yards, accurate up to 67 yards. Aleut dart and throwing board: Darts 4-5 feet long with stone or bone points thrown >45 yards with great accuracy. Russian accounts stress accuracy and force; poison also used on darts; Nelson 1899 and other ethnog as added support, also Hill’s (1948) experimental info. Details of the Russian fur trade and subjugation of Alaska 1741-1810. Guns rare, expensive, low quality, provided little if any advantages; casualties often equal on both sides.

**Townsend, Richard F.**

s

2004 *American Landscapes, Seen and Unseen*. In *Hero, Hawk, and Open Hand: American Indian Art of the Ancient Midwest and South*. R. F. Townsend and R. V. Sharp eds, pp. 15-35. Art Institute of Chicago/Yale University Press, New Haven and London.

Exhibition book, lovely photos, in this chapter bannerstones, but little real info on atlats.

**Tucker, Gordon C. Jr.**

x

1980 *Quantitative Affirmation of Intuitive Typology*. *Tebiwa Miscellaneous Papers in Regional Anthropology* No. 22

Quantitative typology of projectile points - size and hafting changes important in the transition from dart to arrow point in the Great Basin.

**Tuggle, H. David, and J. Jefferson Reid**

o

2001 *Conflict and Defense in the Grasshopper Region of East-Central Arizona*. In *Deadly Landscapes: Case Studies in Prehistoric Southwestern Warfare*. Glen E. Rice and Steven A. LeBlanc, eds., pp. 85-107. University of Utah Press, Salt Lake City.



**Turnbow, Chris and Ronald Fields**

o

2004 Ancient Spearthrowers from the Museum of Indian Arts and Culture, Laboratory of Anthropology. *The Atlatl* 17 (3): 14-15.

Claims 61 SW specimens known, only 2 direct C14 dates. Three in mus Santa Fe, Mera excavs 1930s. Little Pine Cave #1, #2, and Rock Fall Cave. [No pictures] but apparently BM types. LPC 1 is whole, 50.3 cm long, but all lack loops. All have some resin and red pigment on them. AMS dates LPC cal 790-410 BC, RFC cal 1140-920 BC. Replication and trials mentioned but not described.

**Turpin, Solveig A.**

x

1984 Prehistory in the Lower Pecos: An Overview. *Texas Archeological Survey Research Report* 90. University of Texas, Austin.

fig 7 includes illegible photo of apparent distal end of “probable atlatl” from unnamed dry shelter. Atlatls Archaic age, not replaced by bow until Late Prehistoric after 600 A.D.

**Turpin, Solveig A.**

o

2005 Location, Location, Location: The Lewis Canyon Petroglyphs. *Plains Anthropologist* 50 (195): 307-328.

Texas, Pecos R. area, petros on flat limestone bedrock covered by sediment. Excavation revealed natural bedrock pond = reason for use of site. Glyphs recorded in 1930s are geometrics w animal tracks, projectile pts, and anthropomorphs. Buried glyphs are older: nested sinuous lines, atlatls w exaggerated weights, tracks, spirals, small anthros = “Serpentine Style,” relates to Archaic “Red Linear” pictographs. [Atlatls figured are quite stylized, bar with bilobed or round very large weight and hook on end. Assoc w anthropomorphs].

**Uceda, Santiago**

o

2008 The Priests of the Bicephalus Arc: Tombs and Effigies Found in Huaca de la Luna and their Relation to Moche Rituals. In *The Art and Archaeology of the Moche: An Ancient Andean Society of the Peruvian North Coast*. Steve Bourget and Kimberly L. Jones, eds., pp. 153-178. University of Texas Press, Austin.

Coca-taking scenes relate to warfare. p 158 seated warrior with captive holds shield in one hand, “javelin” in other [it’s NOT, nor is it dart, it’s an atlatl]. Equipment seen in coca-taking scenes found in burials at HdLL.

**Uhle, Max**

x

1887 Ueber die Wurfhölzer der Indianer Amerikas. *Mitteilungen der Anthropologischen Gesellschaft in Wien* 17(7):109-114. Vienna.

On the Dartboards of Indian America. In German. S.American and Mexican info. Engravings of S. Am. forms, possible grips (including Panama form with turned down volute like Cushing's), Mex codex, Aztec atlatl Bliss Collection in National Mus of Washington [Smithsonian?].

**Uhle, M.** **x**

1888 Pfeilschleuderhaken? *Internationales Archiv fur Ethnographie* 1(1):209-211.

Arrowthrowerhooks? In German. Birdstones and other birdlike forms.

**Uhle, Max** **x**

1907 La Estolica en Peru. *Revista Historica* 2:118-128.

[In Spanish.] Describes several types, including Chimu and Moche, engravings of 3 stick-form Moche atlatls, without hook or handle attachments, and a group from Lima Valley that have a single center hole and an upright attached hook of Peruvian type. Also of several ethnographic S. American single-hole types.

**Uhle, Max** **o**

1909 Peruvian Throwing Sticks. *American Anthropologist*, n.s. 11:624-627. (Reprinted in *The Cast Spring* 2001:14-16.

Eighteen atlatls from Chavina, costal burial site, "early Inca/Nazca" [now called Chavin]. All similar, 44-53 cm, ornamented carved hooks of copper, bone, wood. At handle end, larger "hook" [= grip, deflection wing, dart rest?? - illustration too dark to tell], generally points back toward distal end hook.

**Uhle, Max** **x**

1922 *Fundamentos Etnicos y Arqueologia de Arica y Tacna, 2<sup>nd</sup> ed.* Universidad Central, Quito, Ecuador.

[In Spanish, a few pages Xerox only, Tiahuanaco area.] Plate shows wooden atlatl from Arica, first centuries AD, apparently inlaid or painted, with single side loop on flattish shaft, apparently groove and integral hook, [but copy is poor.]

**Umberger, Emily** **x**

2007 The Metaphorical Underpinnings of Aztec History: The Case of the 1473 Civil War. *Ancient Mesoamerica* 18:11-29.

[MS version: 2004 The Metaphorical Underpinnings of Aztec History: The Case of the 1473 Civil War. In *Expression, Ideology, and Precolumbian Art History: Essays in Honor of Terence Grieder*. J. Farmer and A. Rodman eds.]

Aztec mythological history was rewritten under Spanish to eliminate metaphorical

and religious elements, survivals of which indicate pre-Conquest symbolic thought in staging of wars. Tenochtitlan fought a war against its neighbor Tlatelolco in 1473. Typically, victor was identified with Huitzilopochtli, and loser with his sister Coyolxauhqui. According to Spanish historian Duran's account, war followed ritual insults, including hunting ducks with atlatls to symbolize hunting the enemy. Cremated remains, probably of Tlatelolco leaders, with duck necklace, buried after their sacrifice near Coyolxauhqui stone (an insulting and threatening pre-war sculpture) at base of Templo Mayor in Tenochtitlan.

**Underwood, Leon**

**x**

1965 Le Baton de Commandement. *Man* 65(143):140-143.

[Odd article, not very useful. Begins with irrelevant and muddled rant on failure of science to recognize art and the subjective.] By labeling baton de commandement a "magic" object, its function was ignored. Not magic, not shaft straightener. Early cave art (Altamira) static, while later (Lascaux) dynamic, reflecting new weapon: baton as spear thrower. Holes comparable to grips on Eskimo versions, but Eskimo are wood, cruder, throw larger spear. [Illustrations show his reconstructions and possible grips. They probably would work at least some, but he added hooks for which there is no evidence, especially given that we do have clear and quite different Upper Paleolithic atlatls. It is not clear that he really experimented effectively or knows much about atlatls.]

**University of Colorado**

**x**

2010 CU Researcher Finds 10,000 Year Old Hunting Weapon in Melting Ice Patch. Office of News Services, University of Colorado, Boulder, June 29, 2010. Electronic Document, accessed 7/3/10, URL: <http://www.colorado.edu/news/r/6f01e0cf192c909927c88da29caafdd8.html> Reprinted *The Atlatl* 23(4):19.

In Rockies near Yellowstone, Craig Lee archaeologist. Birch sapling with notch for point. Atlatls described, artifact called dart, but is probably a long foreshaft, ca 3 feet. Photos show that it was minimally worked, still has twig nodes unsmoothed, now broken in several places. Incorporates National Geographic video with similar info, better pic of atlatls + action scene, but with oddly extraneous stuff too, like unidentified ice finds and shot of Skara Brae to illustrate "hearths". Gives dates 10,300-10,400 years ago, presumably from C14. See Scott 2010.

**Urcid, Javier**

**x**

2006 Antigüedad y distribución de la danza de los Voladores: Águilas que descienden, corazones que ascienden. *Arqueología Mexicana* 14(81):70-74.

[In Spanish.] "Antiquity and distribution of the Voladores" (costumed dancers swinging on ropes from high pole). Back at least to 600 BC, still performed by

various Mexican groups. Philosophical principle of 4-part space and time. A recent article says late spread, 2 flyers, but better archaeological evidence and ethnographic context shows variation on common ideas, and original 4 flyer form. Early W. Mexico ceramic models and sites with quadripartite round platforms. Pole represents axis mundi between heaven and earth. Performance associated with tombs and sacred occasions. Codex Tepeucila 1540 Cuicatlan shows dance with 4 on pole, associated with images of war and human sacrifice - tied to a scaffold and struck with atlatl + darts or bow + arrow to produce abundant bleeding, then heart cut out. Teotihuacan 6<sup>th</sup> C AD figure of man bound and pierced by darts means voladores ritual probably practiced too. Graffiti at Tikal pre 9<sup>th</sup> C AD shows flyers in bird costume with ropes and possible atlatls, victim on scaffold pierced by long dart. Mixtec codex shows scaffold sacrifice and skeletal deity with atlatl.

Dumbarton Oaks atlatl, finely carved, probably Mixtec 14-16 C. At distal end, warrior with eagle helmet and atlatl + darts in celestial plane (descending from sun), then 4 sets of warriors alternating with captives and at bottom (proximal) a figure representing terrestrial plane. Link to voladores by bird + atlatl, with war + captives for sacrifice, top figure would be the one on top of pole, with 4 flyers. Top figure honors sun, another with rain god mask = prayer for rain. Quadripartite figures.

**Urcid, Javier** x

2007 Effigy Vessel. Unpublished ms.

Middle Formative vessel of unknown provenience, Maya or N. Mexico Colima? Man carrying deer, a motif with lots of parallels. Wide pre-columbian use of deer hunt as symbolic warfare and capture of deer/captives for sacrifice. Sacrifice by atlatl and dart in some instances.

**Urcid, Javier** x

2010 Dart Thrower. In *Ancient Mexican Art at Dumbarton Oaks: Central Highlands, Southwestern Highlands, Gulf Lowlands*. Susan Toby Evans, ed., pp. 210-220. Dumbarton Oaks Research Library and Collection, Washington D.C.

[Most useful discussion of iconography on Mexican atlatls] Analyzing complete carved atlatl, (no finger loops) bought from Brummer 1947, probably Mixtec 1200-1520. L = 60.3 cm, W = 3.8 cm distal tapering to 2.7 proximal. No evidence of wear or finger loop attachment. Dark hardwood. Both sides carved, read top to bottom (distal to prox). Along groove on upper side, 4 darts, with eagle, serpent, and rosette décor, fletching, stone point depicted. Underside has 10 figures, top one descending personage armed with 2-loop atlatl, shield, darts, with eagle headdress and serpent at face, solar band identifies him as impersonator of Sun God. Figures below mostly carry atlatl, or spear, and shield with darts, 4 face R and appear to be vanquished, 4 face left (victors in aggressive postures), including one warrior with female dress. They wear masks or head dresses identifying them

as impersonators of rain and other gods. Lower figures assoc w serpents. Bottom figure is Rain God impersonator with curled lip “buccal mask” and protruding fang. Eagle mask of descending figure relates the scene to “voladores” sacrifice.

Other atlatl examples similar iconography referring to voladores sacrifice, including British Museum atlatl with descending impersonator of Mixcoatl-Camaxtli with cloud serpent = rain, carrying dart, hoof earring = deer substituted for human sacrifice to sun. Atlatls part of insignia of many deities. Specimens assumed to be ritual use only, but functional size, and decorated atlatls are depicted in use. Could have been used in sacrifice, owned by high elite.

## V

o

1891 Recent Literature. *American Naturalist* 25: 260-273.

Short review of E. Seler, *Alt-mexicanische die Wurf Bretter* (1890) “a sliding apparatus from which darts and javelins were hurled” ... “ from the amiento, by the later addition of the bow, the crossbow has evolved.”

## Valla, F.R.

x

1987 Les Natoufiens connaissaient –ils l’arc? In *Le Main et l’Outil: Manches et Emmanchements Préhistoriques*. D. Stordeur ed., pp 165-174. Lyon: Maison de l’Orient.

[In French] Did the Natufians know the bow? Mid East Epipaleolithic/Mesolithic 10,500-8300 B.C. Older research skeptical, more recent receptive, oldest bow and arrow specimens Stellmoor, Germany, 8500 B.C. No proof possible for Natufian, but small flint armatures (lunate microliths), light bone points with and without flint edges, and grooved stone possible shaft straighteners are all what one might expect with bow and arrow.

## Van Arsdale, Scotty

1999 Rookie Ramblings. *Indian Artifact Magazine* 18(1):10, 72.

Experiences at atlatl competitions 1998.

## Van Arsdale, Scot

2000 First Modern Day Atlatl Accident Reported. *Indian Artifact Magazine* 19(3):22

Stupid 12 year old, only slight injury.

## Van Arsdale, Scott

o

2007 Discovery Channel Show. *The Atlatl* 20(4):11-12.

SVA, B Perkins, M Waters, M Bracken, D Leeth, and B Berg participate in “Weapons Master” production, throw at Spanish armor. [Results not stated; in

film you see it is a plate breastplate, and is not penetrated. The Spanish accounts probably refer to chain mail or leather, or quilted cotton - see Swanton 1938]

**Van Buren, G. E.**

**x**

1974 *Arrowheads and Projectile Points with a Classification Guide for Lithic Artifacts*. Arrowhead Publishing Co, Garden Grove, CA.

[Most of the book is devoted to an eccentric and not very useful splitter typology scheme based on 35 attributes, with point names unused by anyone else and quite unnecessary.] Discusses design influences on points, including bows: N. Am. relatively weak, would use light arrows, thus average arrowhead should be 4 gm, although up to 17 gm possible. Various possible point hafting techniques.

Atlatls: darts depicted on pre-hispanic art (Nuttall) suggest lengths 26-50 inches [Too short. As he notes, art is not necessarily realistic.] Wormington says Basketmaker darts 5.5-6.5 feet. He measured 3 darts 'of unknown origin,' all with stone pts: 24, 27, 45 inches. Cites Brown on atlatl inaccuracy. [Mentions a lot of suspicious darts – his 3 – where from? – and darts “from Turkey, Iran, Israel, Syria and N. India” – what’s with these? Atlatls were not used in these areas after Upper Paleolithic. Also San Diego Museum of Man collections darts ‘tipped by either flint or steel pts’ – historic US atlatl darts? I don’t think he knows what he’s talking about.] Experiments with different shaft lengths: 1 ft to 8 ft, made of different light materials. Used 2 atlatls modeled [sort of] after Mexican forms [both are short and stumpy – 24” L, but only 15” hole-tip]. “Each throw was designed to test maximum range and accuracy of a shaft of specific length, with proj pts of gradually increasing weight to determine point of diminishing return.” Also observed effect on flight of center of gravity changing with point size. No fletching used. Over 3000 throws of the 8 dart sizes using over 300 proj pts, at least 3 throws for each dart averaged. 1 ft and 2 ft darts didn’t work well, 3 ft poor, others ok, but 8 ft too long to balance well on atlatl. Max distance achieved was 138’ with 5 ft dart with light pt. [He talks a lot about stability problems with most of the darts, and the distances are poor. He also cites Howard, so I guess he is not throwing with good form, and has too short an atlatl besides.] Four, 5, 6, 7 ft darts thrown for accuracy at a stake, landed “within the circle” “accurate enough for use as weapon.” [But circle size not given, so can’t judge.] Longer shafts and longer points tended to break more points. Projectile point weight had only minor effect on flight. Test points “copied only the outline” of various types and had “thick lateral ridge sometime exceeding 1/2 inch in thickness,” and “little attention was paid to thinning of the base or stem.” [In other words, these were not good replicas of any prehistoric points.] Also tried penetration tests with stone points on hay bales. [This was an ambitious experiment – in fact, he experimented with too many variables to properly control any of them. He gives lots of detail, but it shows serious inadequacies in his equipment.]

**VanderHoek, Richard**

1998 In Search of the Optimal Dart. *The Atlatl* 11(2):3-6.

Some personal thoughts. Darts need forward center of gravity, center of pressure behind that (either adding fletching to rear or weight to front), and appropriate spine flexing. Stiff tip, flexible tail recommended. Need a standard measurement for spine. Proposes pressure on tail needed to bend dart, measured by standing vertically on postal scale. Suggests questionnaire to collect info.

### **VanderHoek, Richard**

1998 *The Atlatl and Dart*. Unpublished MA thesis, Anthropology Dept, University of Illinois at Urbana-Champaign.

[A very good study, well written, the most thorough work in English. He covers the available literature in detail, and also relies on his own experiments and experience of Madden, Strischek, and Chauvaux.]

Begins with ethnographic information on Arctic and Australian atlatls with good references, distribution of types, reports of use. Chapter 4 is History of Experimentation, good summaries. Chapter 5: The Motion. Differences are between short range accuracy throw and longer throw for distance.

Short throw with light dart needs just arm and shoulder, cites Raymond film showing dart + atlatl tip move in straight line throwing at 20 m target, with slight raise of atlatl tip as atlatl handle rotated downward. Atlatl moves 90 degrees to the ground [he means straight over].

Heavy dart, longer distance needs torso rotation + weight shift, resembles baseball throw, atlatl moves 45-60 degrees [meaning sidearm motion as shown in his ethnographic photo]. Notes some Eskimo underhand/sidearm throw to skim water for birds (Nelson 1899). [But it's still a bad way to throw.] Dart moves in straight line (Stanford 1979 photos), except Engvall's distance throw with sidenock dart.

Overhand throw reduces side to side dispersion of dart, while crossbody throw tends to disperse upper R to lower L. Sidearm darts strike in horizontal line across target [optimistically!].

Describes accuracy throw: atlatl and dart held horizontal at shoulder height, hand behind body, feet 30 degrees to target, L foot advanced. Atlatl drawn back, then propelled by torso rotation and weight shift to leading foot. Enough weight shift to forward leg to lower body slightly, allowing atlatl to rotate forward but maintain flat trajectory with spur end. [This is actually very bad form, and his major practical and theoretical flaw – a full overhead motion of the atlatl is much more effective, and not just for distance.] Start smooth, end with wrist snap. [Which implies proper form, not some version of Howard's extended force model, so he is a bit confused.]

Three handle styles: stick (Aust, N. Guinea, N. + S. Am., Up. Pal. Euro.), central hole (Arctic, N. Pacific, Carribean, Amazon), double hole (N. Am., MesoAm.) – affect wrist. Stick uses hammer grip, dart held by thumb + index or middle finger. Central hole is for index finger, thumb and opposing fingers around grip also hold dart. Two holes for index and middle finger – as some Basketmaker

style. New Guinea and S. American also developed side piece to help hold dart by thumb pressure.

Chapter 6: The Atlatl. Longer atlatl lengthens throwing lever of hand and forearm for more energy to spear. Optimal relation of atlatl length to spear length is around 1:3. Rotation of the atlatl moves the dart base out of line of the dart's trajectory, and amplitude of oscillation should match time taken by atlatl rotation. So longer atlatl requires more dart flex. [I don't think the oscillation timing is important here, but greater length aids flex, so longer atlatl will be best with longer dart.]

Atlatl weights. Other theories cited, then flex of atlatl and tuning to dart flex. Actually it most likely dampens sideways movement of atlatl shaft for increase smoothness and accuracy of throw. [Right] Atlatl flex is not important – ethnographic and experiments show. [Right again]

Chapter 7: The Dart Many variables affect performance: material, length, diameter, weight, taper, center of balance, center of pressure, mass distribution, locations of greatest stiffness and flex, spine weight, point weight and length, foreshaft, fletching type and location. Dart more critical than atlatl. Flex: spine should match thrust. [In summarizing experiments, he seems to accept idea that flexing dart acts as spring to increase dart velocity, which is wrong, but here he correctly discusses flex for accuracy.] Compare to bow: string pushes arrow toward center of bow, must flex around bow – archer's paradox. Dart bent by atlatl rotation, in same plane as atlatl, spine should curve up or down in same plane too. Longer darts may be more accurate. Easier to aim, easier judgment of spine. Arrow balance point usually 25-35% from tip, Australian spears more often 40-48% (Cundy 1989). Center of pressure [not well defined] should be behind center of gravity. Fletching moves c of p back, but not all darts need fletching. Spine is important but hard to measure, and wide range appears to work. Location of flex is important – tail should flex more than tip. Modern parallel sided same-diameter shafts have poor center of gravity and bend uniformly along length. Tapered shaft is better. But oscillations can be simple or complex with two different nodes, which is why a spliced dart of two same diameter segments still works – splice isolates tail flex. Front third of dart should be stiff – if it oscillates, not accurate.

Chapter 8: Accuracy, Power, Speed. Accuracy is better practical measure of effectiveness than range. Cites ethnographic accounts ranging from 20 to 60 yards. WAA ISAC developed 1996.

Distance records. Ethnographic accounts and modern experiments variable, from 40-130 m. Wayne Brian record 1993 modern gear 210.31 m, 1994 primitive gear 177.17 m. David Engvall 1995 258.64m with "Off-Axis-Forward-Nock spear. Arrow flights: Ishi 183 m, British longbow practice at 200 m.

Penetration – affected by point as well as force of throw and weight of dart. Lists some experiments.

Speed: probably aim and throw almost as fast as bow and arrow. [I doubt it, much more complex motion] Velocity: cites various dart records.

**Vanderhoek, Richard, Charles E. Holmes, J. David McMahan, Brian Wygal,  
and Randolph M. Tedor** x

2006 Ice Patch Research and Monitoring in the Denali Highway Region, Central Alaska, 2003-2005. Ms. in prep for Alaska Journal of Anthropology.

Caribou favor ice patches for temperature relief and to avoid insects. Arrows and barbed antler arrow points 100-300 yrs old. Probable dart points and shaft fragment dated at 975-1175 AD. Hooked wooden stave dated 1437-1634 could be atlatl but dates later than Yukon evidence of transition around 700 AD, wear and ethnog suggests a stick for setting snares in ground squirrel holes. Summarizes Yukon dates: oldest unambiguous bow is fragment 644-876 cal AD, overlapping with a dart shaft dated 656-890 cal AD. One dart frag as old as 7194-7568 cal BC. One anomalous shaft (nocked but 100 cm long, with lanceolate stone pt) dates ca 1500 BC, suggests scaling down a dart to make an arrow, but other arrows all later. Shrinkage of wood may make difficult size distinction between arrow and dart shafts.

**VanPool, Todd L.** o

2006 The Survival of Archaic Technology in an Agricultural World: How the Atlatl and Dart Endured in the North American Southwest. *Kiva* 71(4):429-452.

SW atlatl background and refs. Most archs say bow intro SW ca AD 500, had replaced atlatl by 800. Bow advantages: lighter, faster, longer range, use in brush, don't have to stand, spook animals less. Atlatl advantages: heavy projectile = big wound, 1-hand use. But atlatl continued in many parts of Americas up to ethnohistoric times, so why not in SW? Similar reasons to retain: symbolic importance, 1-hand use + heavy dart good in warfare (lots of shield figures who couldn't use bow). Preservation may be why no atlatls from secure contexts after AD 700.

Examples: 1) Ventana Cave (his diss), long occupation, Archaic levels hunt more small game, later Hohokam larger. 9 Hohokam arrow shafts, no atlatl or darts, but using 3 gm limit, or Shott's formula, more than half of H period pts should be dart pts. [But a statistical trend based on pts from all over does not necessarily apply to interpreting a single assemblage.] Argues against mixing and curation. N. Sonora atlatl loops assoc w agric period relatives of Hohokam (Johnson1971).

2) Paquime, Chihuahau. Large center 1200-1400 AD, W Mexico and SW connections. 75/98 pts small triangular or stemmed arrow pts, but 13/21 larger pts class as dart pts using 3 gm or Shott. Five stone cruciforms that Johnson considers atlatl weights [but no stone/shell loops].

Why late atlatl with bows?: Ventana C became lg game hunt camp. Paquime maybe bison hunting, also ritual significance as in Mesoamerica.

[Possible, but unlikely. Some counterarguments: eg deer hunters in much of SW did fine with little bitty pts, no good info on whether atlatl advantages really outweigh bow for such hunt, lack of late arch specimens beyond points, and all of

the examples are based on ambiguous evidence of point sizes. See Whittaker 2007, 2012]

**Vaughan, Thomas, and Bill Holm**

1982 *Soft Gold: The Fur Trade and Cultural Exchange on the Northwest Coast of America*. Oregon Historical Society.

Artifacts from fur trade era (1700-1900) in Harvard Peabody Museum and elsewhere. Four Tlingit atlatls, wood, highly decorated, single central hole for forefinger, groove and “shelf” to engage butt of dart [this side not pictured, so can’t tell what it’s like.] “All highly decorated but uncomfortable to hold and use compared to the totally functional, no-frills throwing sticks of the Eskimo.” [Not a good description of many Eskimo atlatls, but probably right about non-functional nature of these – thick and short (finger hole is almost in middle) with lots of carving on handle]. Ornament comparable to that on shamans’ rattles, “not obviously related to hunting or the prey sought with atlatls, such as seals and sea otters.” Collected in the early 1800s.

**Vega, Margaret Brown, and Nathan Craig**

2009 New Experimental Data on the Distance of Sling Projectiles. *Journal of Archaeological Science* 36:1264-1268.

Central Andes, Peru, ethnographic slingers asked to throw for distance. Variable throwing style [no details], irregular river stones 4-9 x 2.5-4.5 cm comparable to archaeol specimens, local wool slings ca 1.8 m long. Recorded 142 casts, men, women, youths. Adult men do best, youth may not practice as much now, women up with men except for longest distances. Max distance 130 m, mean 65 m. Finney experiments (novice slinger) at UK Iron Age hill forts underestimate possible range. This data shows would clear defensive walls in Peru. “Strong tradition of slinging among Andean women... some reported having used slings in battle during recent land disputes”. Major use is in herding. [No info on accuracy].

**Verano, John W.**

s

2001 War and Death in Moche World: Osteological Evidence and Visual Discourse. In *Moche Art and Archaeology in Ancient Peru*, J. Pillsbury, ed., pp. 110-125. Yale University Press, New Haven.

Detailed fine-line designs on pottery show ritualized warfare with clubs leading to capture and sacrifice. “Although individuals occasionally carry longer-range arms such as spear-throwers and slings, these are rarely shown being used against an opponent. This is in clear distinction to Moche deer hunting scenes in which the spear-thrower is the principal weapon used.” (112) [reported injuries in article also are club, not projectile]

**Verano, John W.**

s

2001 The Physical Evidence of Human Sacrifice in Ancient Peru. In *Ritual Sacrifice in Ancient Peru*, edited by Elizabeth P. Benson and Anita G. Cook, pp. 165-184. Austin, University of Texas Press.

Inca et al female sacrifice by strangulation. Problems identifying sacrifices. Pacatnamu mutilated bodies (late) with earlier injury like parry fractures indicate sacrificed warriors. Bourget's Huaca de la Luna (Moche) repeated multiple victim sacrifices left exposed in plaza mud after rains all healthy young men, many with healing violent injury as well as perimortem trauma - throat slashing, skull bashing, decapitation + dismemberment, defleshing and possible cannibalism [but no projectile wounds].

**Verano, John W.**

o

2008 Communalism and Diversity in Moche Human Sacrifice. In *The Art and Archaeology of the Moche: An Ancient Andean Society of the Peruvian North Coast*. Steve Bourget and Kimberly L. Jones, eds., pp. 195-213. University of Texas Press, Austin.

Plazas 3a and 3c at Huaca de la Luna. Lots of skull fracturing and decapitation, mutilation. P 201-202: 2 sharpened bone frags "similar in size and shape to bone points found in Pacatnamu mass burial and may represent the tips of atlatl darts. In M iconography, atlatls are weapon of choice in deer hunting, but rarely shown being used against human targets in combat scenes." Darts with barbed pts shown as part of weapons bundles and isolated elements in combat scenes" One individual, and isolated sternum with square puncture wounds may be from dart. Photo of bone point [but it is just a sharpened splinter, not square, not at all like barbed pts depicted, which I expect were metal.]

**Verneau, R., and P. Rivet**

x

1912 Ethnographie Ancienne de L'Équateur. In *Arc de Meridien Equatorial* 6(1):193-205. Paris.

[In French. "Ancient Ethnography of Ecuador." selected pages only xeroxed]. p 194 Spear thrower hooks. Figure 48 of a fancy atlatl of Peruvian type but with only one hook, stone, google-eyed bird form, [not clear whether it is the grip or the hook]. Fig 49 another, this with both hooks, cast metal birds, from Sigsig.

**Viegas, Jennifer**

2000 Aboriginal Olympics: From Boomerangs to Woomeras. *Discovery Channel News* Sept 28, 2000. Accessed on web <http://www.discovery.com/news/features>

Aboriginal athletic "sports carnivals" include boomerang and woomera (or miru) competition. [Poorly described] but "spearthrowing skills are still highly valued in the aboriginal community." [No location given, but short film clip on web shows

men using woomera Central Australia type atlatl with long spear, details not clear. They hold it flat, not sideways, use straight overarm motion at stuffed cloth kangaroo target maybe 20-30 m away. Hard to see, but accuracy doesn't look impressive, and at least one spear can be seen bouncing off target.]

**Vignati, Milciades Alejo** x

1936 El Uso del Propulsor en el Noroeste Argentino. *Notas del Museo de La Plata* 1(3):349-358.

[In Spanish.] Burial finds contain double hook type atlatls. Hooks differ: *gancho-talon* [heel-hook] propels dart, has *diente* [tooth] in center so base can be solidly attached, while *gancho anterior* is at grip, tooth is at one end. Examples from Museo - including a *gancho-talon* of copper in form of bird head [crude], polished, rectangular x-section, weight 375 gm.

**Villa, Paola, Paolo Boscato, Filomena Ranaldo, and Annamaria Ronchitelli** x

2009 Stone tools for the hunt: points with impact scars from a Middle Paleolithic site in Southern Italy. *Journal of Archaeological Science* 36:850-859.

Neanderthals hunted everything from large dangerous game to small critters, sometimes specializing in a particular animal. Wooden spears even earlier. Form, damage, hafting residue, Umm el Tlel point in ass vertebra all show at least some Levallois points were used as spear points. In W Europe, less evidence because: conflation of convergent scrapers with points in Bordes typology and Dibble model of reduction, a few microwear studies showing woodwork and not point use for Mousterian points/convergent scrapers.

Six Mousterian points with impact damage from Oscurusciuto rock shelter [ca 50 kya or more], ungulate faunal remains. [All points are small (<60 mm L) and thick – clunky for hafting, but with bases usually thinned some. Comp to exper and arch impact fractures: burination, spin-off, and stepped scars diagnostic. Also tip crushing on 2 pts. Probably thrusting spears, experts show same kinds of damage as projectile. Low frequency of impact damage (6/59) similar to other sites. TCSA tip cross sectional area and tip penetrating angle falls in range of thrusting spears.

**von Winning, Hasso** x

1958 Notes on Mexican Spear-Throwers. *The Masterkey* 32(3):93-98.

Atlatl representations: Chichen Itza relief, codices, Teotihuacan sherds shown. Two atlatls found at Cuautla, Morelos (Leonard 1956), 3-5<sup>th</sup> C AD, Teotihuacan related. A Patzcuaro atlatl described and figured.

**Wagers, Charlie** x

1992 A Kentucky Atl-Atl. *Prehistoric America* 26 (2): 6.

Antler hook with “tube bannerstone” or handle of antler. Looted “many yrs ago” from shell mound, no context.

**Waggoner, Curtis**

**o**

2011 Subject: Organizing an Atlatl Wild Boar Hunt. *The Atlatl* 24(3):15-16.

Looking for participants in good deal on TX hunting ranch.

**Waguespack, Nicole**

**s**

2011 The Role of Skill in the Production of Folsom Projectile Points. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

“Manufacture of Folsom projectile points is notoriously difficult - high level of skill and risk of failure. Among foragers, craft specialization tends to emphasize the productive abilities of specific individuals and groups operating under specific technological constraints.” Sports model – when game is easy, all play, when tough, only play best players. Likewise, in Folsom sites, when raw material is scarce, only best knappers make points, when plentiful, more knappers.

**Waguespack, Nicole M., Todd Surovell, Allen Denoyer, Alice Dallow, Adam Savage, Jamie Hyneman, and Dan Tapster**

**o**

2009 Making a Point: Wood- versus Stone-Tipped Projectiles. *Antiquity* 83(321): 786-800.

Stone points widely used - must be advantageous. But also costly - cites experiments showing high breakage rates in use. Wooden tipped arrows very common ethnographically, even for large game or war, so must be effective.

Experiment - 6 wood tip, 6 stone tip modern cedar arrows (the stone tipped arrows would have been a bit heavier, but statistical tests say no correlation between mass and penetration) fired from fixed modern “compound” [pulley] bow at ballistic gel target with/without hide cover, to test penetration and accuracy, at distance of 16.75 m. Stone penetrated 9-10% better, but all penetrated more than 200 mm. Accuracy virtually identical. So is slight stone tip penetration advantage significant? Ethnograph shows most assoc with large game, so maybe. And also better medium for symbolic/identity signalling.

**Walker, Edwin F.**

**x**

1943 A Real Mexican Atlatl. *The Masterkey* 17(3):91-94.

SW Museum acquired Tarascan atlatl from Lake Patzcuaro through D.B. Cordry ethnographer. “Duck hunt is rapidly dying out..” With 10 foot cane spear w 3 iron barbs. “Doubles” the distance of hand throw with same spear, because of added leverage. Silent, one-handed, penetration of dense duck feathers. Atlatl 22 5/8” long 3/4” T. Weights or boatstones might impart greater force. Here small

projection at distal end is weight, gives balance [he means the spear recovery hook that these atlatls all have.]

**Walker, Phillip L.**

x

2001 A Bioarchaeological Perspective on the History of Violence. *Annual Review of Anthropology* 30: 573-596.

Countering the view that prehistoric and non-western societies lacked significant violence requires bioarch evidence: "several flint arrow points embedded in a person's spine are not symbolic constructs." Technical and definitional problems of recognizing and interpreting skeletal injury. Modern trauma data for interp and demographic modeling. Modern assault as examples of culturally conditioned patterns – eg facial damage relates to rise of boxing sport, Brits favor broken drinking glasses, etc. Only 16% of US assault injury results in bone damage. Early cannibalism evidence. Atlatl injury – Kennewick, up to 20% of some TN Archaic pops have embedded pts. Bow might have created short-term disequilibrium and added warfare.

**Walker, Robert, Kim Hill, Hillard Kaplan, and Garnett McMillan**

x

2002 Age-dependency in Hunting Ability among the Ache of Eastern Paraguay. *Journal of Human Evolution* 42:639-657.

Ethnographic hunting abilities peak in 30s and 40s - peak performance occurs after physical peak. Arrow shooting contests - 25 cm target in tree 8.8 m distant for youth + women, 14.3 for men. Hits 2/344 women, 0/70 youth, 81/1934 for men. A few men up to 12% accuracy, improving up to age 40 then leveling off. Similar for hunting success - From age at highest strength (24) to age at peak return rate (40), return rate doubles.. Teenage boys hunt easy animals, are given bows, but only late 20s become full independent hunters, hunt monkeys (most difficult). Hunting accidents and lost arrows common, espec for young hunters. Skill more important than strength in success. Journals kept for 11 men age 14-37 (reservation born, with little experience) for 13.5 months, showed little improvement. Takes ca 30 yrs for hunters to reach their prime, from 12-15 to 35-40. Selective forces thus favor long development in humans.

**Walsh, G. L. and M. J. Morwood**

x

1999 Spear and Spearthrower Evolution in the Kimberley Region, N. W. Australia: Evidence from Rock Art. *Archaeology in Oceania* 34: 45-58.

Rock art can provide technol sequence at better chronol resolution than arch. Oldest arch spears in Aust from Wyrie Swamp, S Aust, 'simple short spr + barbed javelin frag' dated 10,200 – 8,990 BP.' (Luebbers 1975). Kimberly rock art spans 40,000 yrs, lots human figures, visual specificity, four periods. 1) Irregular Infill Animal Period: rare, simple line spears, impaled women. 2) Bradshaw Period: Lots humans, mostly male, boomerangs common, sprs rare, no throwers early.

Later more common, multi-barbed, thrower appears at end, shown as short hooked line assoc w barbed spr. 3) Clothes Peg Figure Period: Static style humans impaled by multi-barb sprs and hit by boomerangs. Throwers get longer, add spatulate handle still found on Kimberly spr throwers. [Shown as strt line with prominent hook and blob on end.] Long spr some shown hooked on thrower. Sprs shown w red barbed head, white shaft = composite spear. 4) Clawed Hand Period: Add “spade handle” thrower [shown as looped end] and stone spr pts. Arch evid shows stone pts intro 5-3000 BP. Transition in Holocene to Wandjina Period.

Ethnog: Used until 1980s, long ‘nungaroo’ for war, short form ‘yungari’ for hunt, all N. Australia type, 70-150 cm long. Sprs composite, reed/bamboo shaft, hardwood foreshaft, stone, glass or metal point, also wooden barbed heads. Late glass pts considered “one shot” and more for fighting. Metal “shovel-nosed” pts made from shovels or other scrap replaced stone around 1930s as response to killing horse + cow. By 1970s few knew how to knap glass.

Earliest paintings Kimberly and Arnhem Land show hand sprs and bmrngs. Light wt composite sprs seem to follow appearance of thrower, stn pts even later. Bradshaw dates suggest predate Last Glacial Maximum, [ca 16- 20,000 BP] so spr thrower unexpectedly early [but implies that this dating uncertain and controversial]. Arnhem Land has more diverse thrower paintings.

### **Wang, Regina**

**x**

2010 Atlatl Makes Debut for Missouri Deer Season. *Columbia Missourian* Sept 28, 2010. Electronic version, accessed Sept 28, 2010, URL:

<http://www.columbiamissourian.com/stories/2010/09/28/atlatl-fall-season-hunting-legal-missouri/print/>

Good photo and focus on Justin Garnett, quotes also R Mertz, J Whittaker, R Madden, and Tom Draper of MO Conservation Dept: Atlatl legalized for trial deer hunt season during rifle season - but could expand if there is demand. PA, WI, and NY tried to legalize, failed; AL legal since 1996.

### **Wang, Regina**

**x**

2010 The Atlatl’s First Season in Missouri Comes to a Close. *Columbia Missourian* December 17, 2010. Electronic version, accessed February 7, 2011,

URL: <http://www.columbiamissourian.com/stories/2010/12/17/hunting-deer-atlatl-many-say-it-was-learning-experience/>

No one got one. Problems with gun season. Eric Smith, J Garnett, R Madden quoted. Comments: one negative - not accurate, will wound. Responses from JG and D Pettigrew.

### **Warner, W. Lloyd**

**s, L**

1958 *A Black Civilization: A Study of an Australian Tribe, revised ed.* Harper and Row Publishers, New York.

Fieldwork 1926-29, orig pub 1934. Murngin group of tribes, pop ca 3000, NE

Australia, Arnhem Land, the peninsula NW of Groote Eylandt. Women produce most of food, but men hunt, which is more prized. [Vague mentions of spears apparently mostly used with thrower] for hunting emu and kangaroo, fishing, and harpooning turtles. Apparently lots variation in spears. P. 139-140: "A spear-thrower (mangel) is made by 1) cutting down with a stone axe a branch or small tree, 2) splitting it with a stone axe and scraping it with a bivalve shell, 3) carving it into correct shape, and hafting with 4) fiber, 5) string, and 6) resin. 1) The mere act of cutting the tree down with a stone axe connects the spear-thrower with an elaborate stone technique and system of trade. 2) Scraping with the bivalve shell connects the mangel with the sexual division of labor, for women gather the shells, this not being considered man's work. 3) Hafting it with resin takes in the whole process of preparing the sap of a tree and forming it into cement. 5) Hafting with fiber string brings in the process of using a digging stick to pull up the roots, breaking and cutting them up, soaking them in water and drying by a fire before a woman twists them into string. The spear-thrower presupposes a spear. If a stone spear is used once, then the spear-thrower connects with the stone technique, the fiber string making, with the use of fire to straighten a shaft, etc." [His point being interconnection of all technology – the spear thrower and manner of use are never described]. 142: Spear thrower used as wedge to strip bark from tree. Ironwood tree root sap used to haft wooden spear points and atlatl hooks, beeswax to haft stone spear points. Warfare important, reduces young men and allows polygyny. Ests 200 deaths last 20 yrs. 152: When a man is killed, his soul approaches the killer and can be heard because the shaft of the spear which hangs from the stone head within him drags on the ground. The killer ritually allows the soul to enter him and gains strength from it. 156: Several levels of formal violence, using spear-thrower, stone headed spr, club, stone knife, stone axe. No shields, ward off spears with thrower. Poor quality plates show elab wooden spr heads, 6 spr throwers. Four are typical Groote E types (mangels) other 2 are narrower, one with tasseled handle.

**Watkins, Joe**

x

2000 Tribalizing Public Archaeology. Paper presented at the 99<sup>th</sup> Annual Meeting, American Anthropological Association, San Francisco. Session on Public Archaeology: International Perspectives, Debate, and Critique.

URL <http://www.p-j.net/pjeppson/AAA2000/Papers/Watkins.htm> accessed 9/13/2006

Uses Kwaday Dan Sinchi find as example of good relations between "respectful" archaeologists and tribes who want scientific info. [But like many of these sunny views of why tribes should control archaeology, this example is not honest: little info was actually produced or released, see Beattie et al. 2000, Richards et al. 2007, and the find was ritually destroyed by the tribes].

**Watt, Steve**

1994 Southeastern Rivercane Arrow Notes. *Bulletin of Primitive Technology*.

7(1):59-61

Cane arrow shaft making.

**Weathermon, Rick L.**

**elec**

2011 *Late Archaic Hunter-Gatherer Perishable Technologies in the Black Hills: An Investigation of the Crystal Cave Location and Its Culturally Modified Wood*. PhD diss. Dept of Anthropology, University of Wyoming.

[Overall, very useful, lots of data on dart shafts, evidence of manufacture techniques and repairs, but practical knowledge of atlatls is limited, and he failed to find WAA and much other recent info.]

Background: interested in hunting tool forms and chronology, usually obtained from stone points, but traps and shafts preserved here - analysis of Crystal Cave (South Dakota), and roughly contemporary Spring Creek + Daugherty Caves (Wyoming) Frison material, some comparative Great Basin material. NW Plains/Black Hills Late Archaic 3500-1500 BP (uncal) probably several cultural groups. P 27 bison kill sites with atlatl dart pts, Pelican Lake (corner notched) and Besant (low shallow side-notches) styles. At CC, called PLake, but preforms are basal-notched, then lateral retouch reduces sides until they appear corner-notched. [This doesn't work. From photos, I don't see why the b-notched are called preforms. The notch angle is different, and can't be changed by further working.]

Research oriented to: cultural affiliation, resource orientation toward B Hills or from outside. So from wood artifacts: ID/sources, harvest age and seasonality, wood use and technology. Atlatl darts - technology, manuf or maintenance in cave, metric attributes to assess effectiveness.

Avocationalists Nonast and Miller did salvage of looted areas in 1960s. Excav 2003-2005, single component L Archaic, organic remains + diagnostic points. Very detailed chapters on geology + sediment info, climate + climatic history, biogeography and woody plants, packrat middens and mountain sheep habitat, wood structure and identification, silviculture and plant manipulation.

P 162 - 102 wooden artifacts, 43 ID to at least genus, mostly willow and wild cherry. Chap 5, Prehist Woodworking: from all sites, 208 dart frags (189 Plains, 19 Gt Basin) 5 fire drill tips, 47 split+notched sticks (deadfall parts), 100 misc worked wood pcs. Woodworking techniques listed + IDd. Green wood easier to work but harder to control shaping. Ochre helps prevent degradation through exposure (203). Standardized methods used in CC replicated by experiment. Saw + snap as dominant technique.

P 194-219: atlatl darts, 59 mainshaft frags from CC, DC, and SCC. Proximal mainshaft frags - 41 from Plains, 5 from Gt B. Some statistical diffs in measures between Plains and Gt Basin: GB has wider proximal shaft, wider + deeper sockets. Prox (socket) diameter 5-10 mm [pretty small]. Prox shafts planed to remove bark and reduce diameter, sometimes sinew wrapped, some burnished + with ochre. 59% intentionally cut off, others burned or broken. Rim of socket

shows use-wear, often all around, indicating dart not used in consistent orientation [that's hard to imagine, given biased flex of all darts - his good photos do show diffs in wear, but high wear all around may actually be intentional finish]. 8 prox shafts from CC, 4 were willow.

Distal mainshafts with deep drilled socket (14 Plains, 5 Gt B), no metrical diffs, 10-18 mm diam. A number intentionally cut off, probably shaft rejuvenation after damage to socket. At CC, 6 distal shafts, hazel and *Phragmites*.

Three mainshaft repairs or joints, (CC2, SPC1) with bi-pointed wooden insert into opposed sockets. One CC specimen *Phragmites* + chokecherry + willow, with resin mastic in socket.

Shaft frags up to 510 mm, regular taper. Shorter pieces less regular, probably from repeated maintenance. Assuming constant taper, shaft was 135-155 cm long, estimated weights 47-76 grams.

Foreshafts - 134 frags, 6 complete, 3 w stone points. 96 prox frags, tapered by whittling, scraping or abrasion. 40% taper down from socket to point. No statistical diffs between Plains and Gt B. Some show heavy impact battering [really heavy in some cases - multiple uses against hard target, presumably indicates practice throwing since they are too damaged for hunting use. He suggests use of shaft + battered fore as walking stick - NOT a good or likely use for an atlatl dart. They are splintered into a broom, also not walking stick wear, maybe even hammered into something - fig 5.21]. 10 of 19 from CC tested for wood ID: 1 serviceberry, 9 *Prunus*, probably chokecherry. 36 "distal spatulate" foreshafts - narrowed, then left wider at distal to hold stone point. These only from Plains CC, SCC, DC, not from Gt B. Opposed cut to remove tenon to form slot for point, often burnished, with ochre. Often sinew wrapped [or to hold point] and split from impact driving back point. From CC, 4 examples, one willow, one *Prunus*. Three complete from Spring Creek Cave - two with stone pts - longest is 149 mm long with 32 mm long stone point [illustrations also in Frison]. Others 78, 57 mm long. Estimated lengths for others 220-336 mm, weight if *Prunus* ca 12 grams, add stone point av. 6.5 grams + sinew = ca 18-19 gm at 300 mm long.

Figures - 5.12: distal mainshafts - DC rasped and sinew wrapped, CC sinew wrapped, but splintered with foreshaft fragment jammed in so tightly that the mainshaft was cut off in order to renew it. Measurement details given in tables.

Conclusions (296 - ). Discusses theoretical concepts, maintainability vs reliability. "The compound dart, with its detachable foreshaft, isolates breakage into several different segments that can be replaced or refurbished individually, without taking the entire dart out of the system (312)." So atlatl works as both maintainable, for encounter hunting, unpredictable, and reliable, with redundant replaceable parts possible for mass specialized hunting. Seasonality of wood and size suggests non-growth season, possible manipulation of trees, and evidence of maintenance in sites like CC.

Reworking of stone points: "If the atlatl and compound darts are considered a balanced system, changes to one part of the system would require changes in others. This is especially true of the darts. If all of the darts were

matched to a particular atlatl (see Frison 2004:209-214) and were originally within a set of required parameters, even small changes in length and/or weight would affect the performance of that dart when compared to the unchanged darts. Darts comprised of two or more segments, as in a mainshaft and a separate foreshaft, together with the projectile points, would likely have required interchangeability between all the different components.” [This overestimates the effects of dart component variability - a fairly wide range gives similar results.] No evidence of fletching from these sites; balance point of 32-48% from proximal end reported by Hughes and Cundy likely needed. Using previous estimates of weight + length, model dart would be 174 cm, weight 65.6 gm, balance would be 46% from prox end. If rework broken pt + foreshaft by 15.5 cm and -8 grams, shifts balance, need to remove 7 cm of prox mainshaft to return to same balance. [Series of interesting calculations, and a good argument for looking at repair and discarded parts. The other thing affected by changing length is the flex.] Reworking a point is one way to maximize weight change without losing length.

Spring Creek C atlatl ca 48.3 cm L, wt ca. 16 gm. Atlatl and dart should be matched, consistent proportions of specimens suggest 1:3 to 1:4 length and weight. “Ratio of the reconstructed dart to the reconstructed atlatl from Spring Creek is 1:3.98.” Recovered darts often reworked, lower ratios may be for discarded reworked darts, or darts to use with shorter atlatls that were not found.

Three hook types: male (above ungrooved board), female (groove with level hook), mixed (groove with hook above it). Male just wears interior of socket, others edges, as in these darts; SCC atlatl is “female.” [Misused terminology, and it’s not that simple.]

(307) Experimental info: arrow flight comparable, but not “archer’s paradox” - arrow flexes side to side, dart up and down. Experimental dart speeds range from 19 to 20 meters per second (Van Buren 1974, Raymond 1986) to 65 meters per second (Hutchings and Bruchert 1997). Hand thrown spears and javelins have recorded speeds 13.7 and 25.5 mps (Hughes 1998:352), so atlatl must do significantly better to be efficient. Velocity affects impact energy: Hutchings + Bruchert 222 gram dart thrown 43.2 mps = 152.75 foot pounds of kinetic energy - heavy atlatl dart delivers more force than even modern bow. [But I doubt the velocity claimed by H+B]. Model Plains atlatl and dart (65.6 gram dart), 25 meters per second, = 15.12 foot pounds of energy. Same dart 50 meters per second = 60.48 foot pounds. Speed doubled, impact energy increased four fold. Weight of the dart doubled to 131.2 grams, speed held at 25 mps, the impact energy = 30.24, doubled. Increasing the speed of the projectile is more efficient increasing energy than increasing the weight of the projectile and maintaining or losing velocity. Bow has set velocity, but atlatl thrower can vary power of throw [only some - I don’t think he has much practical experience.]

Expense of manuf and frequent breakage make atlatl inefficient for small game. Atlatl delivers within modern recommended foot pounds for even large game (311). Atlatl + dart may encode social, ethnic identity info.

Experiment (313) springy dart on floor jumped sideways, fixed and flexed atlatl propelled 50 gram arrow 5.5 m, so atlatl flex could add force. Flex of dart or atlatl may reduce likelihood of breakage.

Manufacture of Plains darts: no mastic to haft point, sinew only. Point neck width greater than spatulate foreshaft width. Spatulate foreshaft head gives added support, point notches are weak point. Foreshaft unlikely to detach when hitting target, requires force. Wound depth needed for different animals calculated. Higher mass and thicker stone point make atlatl more likely to penetrate ribs than arrow. Stone point cuts larger wound than wood. [He makes elaborate calculations, which might be useful for comparison of projectiles. But you can't tell whether he has any actual hunting or experimental experience.] Caves lack the discarded tenons indicating foreshaft notching, probably more used for maintenance and repair (330).

Faunal remains in CC include bison, mt sheep, deer, duck, small mammals.

### **Webb, Alf**

1999 Prehistoric Archery – Some Considerations. *Experiment in Archaeology* No. 1: 6-9. Newsletter for Experimental Archaeology, Lydney, Gloucestershire, UK.

Mesolithic bows of two types: stick bow, bends in complete arc, breaks at grip; handle reinforced bow, bends in restricted arc, breaks at end of limbs. Both found archaeologically in Mesolithic. Tend to have archaeological finds of heavy bows from wet lowlands sites, light arrows from upland sites – they should not go together.

### **Webb, Alf**

1999 The Design, Dimensions, and Weight of Spear-Throwers and Spears. *Experiment in Archaeology* No. 1: 30-32. Newsletter for Experimental Archaeology, Lydney, Gloucestershire, UK.

Experimented with French Paleolithic and Inuit forms. Double the throwing distance of hand throw. Suggests 3:1 ratio of spear length to atlatl length. [He had information from Musee de Malgre Tout 1994, nothing new].

### **Webb, S. David**

x

1996 Museum Receives Ancient Spearthrowers. Aucilla River Times 9(1). Aucilla River Prehistory Project, accessed 10/12/06, URL: [http://www.flmnh.ufl.edu/natsci/vertpaleo/aucilla9\\_1/spearthrowers.htm](http://www.flmnh.ufl.edu/natsci/vertpaleo/aucilla9_1/spearthrowers.htm).

Two antler hooks from Santa Fe river donated by amateurs. White-tail deer, possibly Paleoindian, submitted for C14 dates. Photo of one, drawing of Key Marco atlatl, and of atlatl in use [dart not flexing].

**Webb, Stephen**

s

1995 *Palaeopathology of Aboriginal Australians: Health and Disease Across a Hunter-Gatherer Continent*. Cambridge University Press, Cambridge.

Willandra Lakes hominids: WLH3 in dune sands, 28-32,000 years old, extended burial with ochre, M, >50 yr old. Very severe osteoarthritic involvement of all bones of R elbow - major loss of function. P 47: "Regular and continuous loading of the elbow joint associated with spear thrower activity produces a distinctive set of degenerative features which together have been termed "atlatl elbow" (Angel 1966:3). These include erosion of the capitulum which, together with the head of the radius, undergoes a double stress action when the spear thrower is used. It is precisely these parts of the bone that have been affected in WLH3, together with the head of the ulna which bears the most stress during rotation. Moreover, the large exostosis formed at the origin of the pronator teres could indicate that large mechanical forces were applied during rotation of the lower arm. It has been suggested that certain types of degenerative features around the shoulder joint help define osteoarthritis caused by using a spear thrower (Angel 1966; Ortner 1968)."

But shoulder is missing in WLH3 [and apparently L arm?]. Other causes possible, this one is uncommonly extreme. Possible evidence of infection. [Right, no reason to blame this on atlatl].

P 165 survey of osteoarthritis: "basic pattern among Abo groups ... affected males more than females, elbows more than knees... The most affected parts are left knee and right elbow, the latter not surprising given predominance of right handedness." [In other words, altho atlatl used all over, he doesn't blame it for common R elbow problems - which makes sense given all the other activities that might affect them].

**Webb, W. S., and W. G. Haag**

x

1939 *The Chiggerville Site: Site 1, Ohio County, Kentucky*. University of Kentucky Reports in Anthropology Vol 4, No. 1. University of Kentucky, Lexington.

Green River shell mound, WPA project, inspired by Webb's interest in Moore's Indian Knoll finds, especially "peculiar hooks made out of deer antler" etc [which are mentioned as problem in very first paragraph.] Of 114 burials, only 1 with stone bar atlatl weight, 1 with shell weight, and 1 with antler hook + bannerstone. Skeletons (Skarland) poorly preserved, hard to sex. [No info on injuries.]

Pp. 50-59 "The Problem of the Atlatl." Moore finds interpreted as netting gear, but M argues against atlatl theory, and assumption that hooks and bannerstones are related. Willoughby (in Moore) suggests atlatl, Pepper hair ornaments. In both Moore's work and C-ville, assoc with all age + sex classes, = wide use? SW info since 1915 provides better atlatl info. [This, and his work in Alabama mounds, seems to be what convinced Webb, but it is not clear why atlatls became such a focus for him.]

1. Hooks = end of atlatl, wide use pre-bow and pre-pottery. 2. relative rarity = most atlatls made of wood as in SW. 3. Many as in SW had stone weights of bar or bannerstone form. This theory accounts for 1. co-occurrence of hooks + bannerstones, 2. asphaltum in sockets, 3. variety of form (because utilitarian), 4. agrees with SW weighted atlatls before bows 5. wide occurrence of hooks 6. winged bannerstones not work as net sizers 7. many hooks not suitable as net weavers, 8 cultural similarity of SE sites, 9. don't need one-piece atlatl for strength and some hooks both asphalt and lashing for strength [but he hasn't actually tried them] 10. composite shell forms explained 11. new common trait between SW + SE, 13. explains fragments as accidents in midden or sacrifice in burials 13. explains repairs, 14. explains large size of points - better for darts than arrows. Photo of hypothetical reconstructions [so he at least made useable equipment.]

**Webb, William S.**

o

1946 Indian Knoll, Site Oh 2, Ohio County, Kentucky. *University of Kentucky Reports in Anthropology and Archaeology* Vol. IV, No. 3, part 1:115-365. Reprinted 2006 as *Atlatls and Bannerstones: Excavations at Indian Knoll*, by Gustav's Library Reprints, Davenport, IA.

Classic report of Archaic shell mound. Webb excavated partly to deal with problem of atlatl parts.

Many burials (male, female, and children) with atlatls or parts.

Compound atlatl: antler handle + hook, stone or shell weight on wooden shaft.

Found in alignment in burials, some intentionally broken before deposition.

Bodies with points in them common.

[Many photos of both the artifacts, and of burials with atlatl parts in situ.

However, although some show hook and handle or hook and weight in alignment, most were displaced by decay of body, or were broken and placed side-by-side in grave. None of the photos is clear enough to provide the completely convincing clincher evidence of a complete atlatl with all parts in position, so skeptics can still argue that bannerstones might not be atlatl weights.]

**Webb, William S.**

x

1950 The Read Shell Midden: Site 10, Butler County, Kentucky. *University of Kentucky Reports in Anthropology* 7(5):358-401.

Shell mound on Green River. Plowed, planted, exploited by local morons for shell for chickens [!]. 247 burials recorded. B66, young adult M with 3 conch gorgets, broken atlatl weight, flint + bone artifacts. B 94 y adult M with shell necklace, antler hook + stone weight in alignment under L leg. Several others with atlatl weight or wt and hook, one with wt, hk, and handle, several burials with points in body or points in grave. Weights mostly prismatic stone, some shale bar.

The Atlatl Complex = antler hook, antler handle, perforated prismatic stones + flat stone bars, in 13 graves. Sometimes in alignment, sometimes broken

before burial, under or over body, different places, usually not all parts - e.g. 5 wts without other parts here. Three geniculate (L-shaped, knee-shaped) bannerstones, not in graves, but broken. Most grave bs are intentionally broken, but there are also repaired examples. Points are large stemmed or corner notched forms with convex edges.

Atlatl Mechanics - like bat and ball, atlatl changes momentum of projectile. Weight moves center of percussion (most efficient place to strike or propel from) closer to hook. If shaft is elastic, it stores energy to be transferred to the projectile. On Basketmaker atlatl, hook is not at extreme end. Archaic antler hooks are, so they need even larger weight, close as possible to the hook. In some late forms, the hook is formed on the stone weight; the geniculate form allows part of the weight to extend under the hook. Their elliptical perforation prevents rotation on shaft. [None of this is correct; his reconstruction with the weight out by the hook is enormously inefficient - neither the weight nor the flex transfers force to the dart].

**Webb, William S.**

o

1957 The Development of the Spearthrower. *University of Kentucky Occasional Papers in Anthropology* No. 2. Reprinted 1981, Program for Cultural Resource Assessment, Department of Anthropology, University of Kentucky.

Reviews world atlatl types: most forms rigid, they increase length of arm.

Paleolithic "weighted" forms (large carving with hook) are as inflexible as straight "unweighted" ones, so no advantage.

Atlatl's importance in Archaic explains why is treated ceremonially in burials, but weights are not "bannerstones". "Enormous" numbers of fakes made 1890-1930 and on.

Changes from 4000-1500 BC led to greater efficiency.

Archaic and Basketmaker atlatls are "elastic devices for transferring momentum to projectile". P27: "the action of an elastic atlatl in casting a spear, and the action of a bat striking a ball are dynamically equivalent operations. ... During most 2 of the sweeping forward action of the arm, the spear is gaining momentum, but at the same time the shaft of the atlatl is being heavily flexed transversely, i.e., at right angles to the length of the shaft and is thus acquiring potential energy. ... When the arm has completed its swing, the hand holds firmly the grip of the atlatl shaft and at once the atlatl shaft begins its recovery, thus giving an added impulse to the projectile, quite comparable to the action of a bat on a ball. As has been shown, this additional impulse is most efficiently transmitted, that is, gives the projectiles the largest increment of velocity, when the projectile is seated at the 'center of percussion of the atlatl.' This is another way of saying that atlatl weights of convenient size should be so attached to the shaft as to bring the center of percussion of the atlatl as near to the spur of the hook as possible."

Atlatl physics compared to pendulum or bat and ball - weight brings "center of percussion" (mass for most effective transfer of energy) as close to hook as possible. [Webb seems to consider length or flex of spear irrelevant. No mention

anywhere of him experimenting with actual atlatls, and the weight as he reconstructs it at end of atlatl near hook is very inefficient – his center of percussion idea makes no sense – an atlatl is not a club, and more weight on the end does not transfer force to the dart. He feels a rigid atlatl works only by lengthening the lever arm, but a flexible one is better –allows “transfer of momentum” an idea that leads him to put the weight at the end, when really the atlatl increases velocity, which is different.]

Associations in Archaic graves indicate atlatl shaft some 25", with hook and handle >30", weights indicate flexible atlatl.

Antler handles flare for good grip necessary as transfers force to spear.

Earliest shell midden levels have only bone points, assume all-wood atlatl.

Basketmaker atlatl weight 56 grams near middle, loops for grip.

Archaic: Bar weights earliest, most through time, often in graves with no other atlatl parts (= wooden atlatl). Four examples L = 9-13 cm, Wt = 65-87 gm.

Later add antler hook, several types and attachments, some too long for efficiency - remove hook too far from center of percussion.

Then drilled prismatic weights to go with short antler hook. Temporal order: straight sided, constricted centers, expanded centers, shell section weights, butterfly winged forms.

Indian Knoll area center of development, site dates C14 5300±300 B.P.

Later hooks - short conical antler segments with spur on rim, also "geniculate" weights, and prismoidal weight with hook cut in stone - all to get weight + center of percussion as close to hook as possible [My own experiment with Indian Knoll type atlatl with stone weight convinced me that weight near hook was not good - it made motion far too slow. But others, like Richard Lyons, like the weight out there.]

Prismoidal weights usually 7-8 cm long, 50-85 grams. [Seems too light for size of weights.]

Depth distributions of atlatl parts to indicate chronology at Indian Knoll and Annis Shell Midden sites [but stratigraphy too crude to trust this info].

Complains that "bannerstone" idea from collectors interested in objects, not knowledge, complains about looting and faking back to 1930s and earlier.

Grave associations, parts drilled similarly and in alignment prove weight theory [but he doesn't illustrate any or compare hole diameters of any sets].

### **Webster, David**

**x**

2000 The Not So Peaceful Civilization: A Review of Maya War. *Journal of World Prehistory* 14(1):65-119.

[Long but unusually readable review]; history of thought, social, political, economic conditions, documentary evidence, fortifications, strategy + tactics.

Change thru time, not all should be assumed to follow model of Contact documents. Bow, cotton armor, possibly sling are Post-Classic innovations. Atlatl may be from highland Mexico in 4<sup>th</sup> C AD. (Schele + Friedel 1990).

Archaeological finds of Classic weaponry rare [and little info here]. Both ritual

and materialistic interpretations of war apply.

**Webster, Gary S.**

1980 Recent Data Bearing on the Question of the Origins of the Bow and Arrow in the Great Basin. *American Antiquity* 45(1):63-66.

Conventional date for Fremont introduction of bow and arrow is 1500 BP. Dry Creek Rockshelter stratigraphic info shows Rose Spring/Eastgate [assumed to be] arrowpoints as early as 3300 BP, mixed with atlatl points (Elko, Pinto etc), so bow early, did not immediately supplant atlatl. [Point sizes should be considered only weak evidence, these are probably small variants in a group of related types].

**Weder, Dennis G.**

s

1980 Lithic Artifacts and Debitage. In *Cowboy Cave*, Jesse D. Jennings ed., pp. 39-48. University of Utah Anthropological Papers 104.

Sequence of Archaic point forms, distinguish larger old dart points (Gypsum, Elko, N. Side-Notch forms) from late arrow points (Rose Springs, Desert Side-notched, Cottonwood Triangular). Arrow pts incompletely flaked, made on small flakes. Dart pts more intensive flaking, visible use-wear, which implies dart points were more formal tool also used as knife, but with more pressure flaking and equal likelihood of wear to knives as well. p 44: "...the dart pts, with and without wear polish, continued to be used even after the arrow pts appeared in the arch record at CC."

**Wendorf, Fred**

s, B

1968 A Nubian Final Paleolithic Graveyard near Jebel Sahaba, Sudan. In *The Prehistory of Nubia*, edited by Fred Wendorf, volume 2, pp. 954-995. Southern Methodist University Press, Dallas.

58 burials, est dates 12,000-10,000 B.C. Many (40%) have stone weapon point fragments embedded in bone or in chest, back, arm, and head regions. These are usually truncated or backed flakes and microliths. Usual type system not useful as many different "types" formed parts of points or barbs. Violence affected males, females, children, often with multiple wounds. Several multiple burials, cut marks on other bodies also suggest. [No evidence or argument about whether bow or atlatl in use. These would be light compound points, suitable for either. At this early date, could be either.] Anderson, J.E. "Late Paleolithic Skeletal Remains from Nubia" pp. 996-1040 in same volume adds that several skeletons have parry fractures of lower arm.

**Wenke, Robert J. and Deborah I. Olszewski**

o

2007 *Patterns in Prehistory: Humankind's First Three Million Years*, 5<sup>th</sup> ed., Oxford University Press, New York.

[Good general archaeology + human evolution text.] P. 176 fig 4.29 “The atlatl or spearthrower was important new technology in the Upper Paleolithic. John Whittaker demonstrates how an atlatl is used.”

**Wenmohs, Roy** o  
2007 First Official ISAC in Texas. *The Atlatl* 20(3):10.

Gradual spread of WAA and ISAC.  
“organizers disqualified themselves for disruptive behaviour.” [Swearing. A high ethical standard!]

**Wenmohs, Roy** x  
2010 Birth of the Texas Atlatl Association. *Texas Atlatl* 1(1):1.

New group, logo of Pecos R Style petro superposed on TX outline. Bylaws. Feral hogs are legal atlatl game in TX.

**Wescott, David**  
1992 Crashing the Unreachable 500 Foot Barrier. *Bulletin of Primitive Technology* 1(4):76.

Distance records by Wayne Brian: 616'11.5" on record, personal best 664'. Whippy flyrod atlatl, "tuned" with weight, unfletched 50" aluminum dart.

**Wescott, David** o  
1994 An Introduction to the Atlatl. In *Woodsmoke: Collected Writings on Ancient Living Skills*, edited by Richard Jamison and Linda Jamison, pp. 176-189. Menasha Ridge Press, Birmingham, AL.

[OK intro, but too many errors]. He has an interesting concept of different kinds of atlatl systems: “throwing board” = rigid, heavy harpoons; “spear thrower” = some flex, long heavy spears [but atlatls probably don’t go back to Neanderthal times]; “flexible system” = SW, flexy light atlatls and darts with weights and other tuning; “casting stick” = baton de commandment and other thong-using throwers and very flexy atlatls [not the same]. [His explanations borrow too much from Perkins’ incorrect ideas of flex and “tuning” and his diagram of throwing shows the atlatlist leaning forward and an unflexed dart.]

**West, A. L.** x  
1978 Aboriginal Material Culture: No. 2 On Spearthrowers and Paddle Steamers. *The Victorian Naturalist* 95:88-91.

Variable forms; in Victoria and nearby S Australia and New South Wales a slender form with hook carved out of the wood. [figure shows single piece thrower with rod-like handle expanding to narrow flat blade which tapers distally

to large raised integral hook] Specimen acquired 1891, Casuarina wood, 143 gm, 66.3 cm L, 4.3 max W, 1.3 thick. Decorated with incised designs of steamers. Wood + steamers suggest manufacture by Murray R tribes in NW Victoria. Unusual decoration probably from Euro influences.

**West, Constance F.**

**s**

1996 Trail Creek Caves, Seward Peninsula. In *American Beginnings: The Prehistory and Paleoecology of Beringia*. Frederick. H. West ed., pp. 482-484. University of Chicago Press, Chicago.

Alaska. Slotted bone arrow points, assoc w faunal bone dated  $9070 \pm 250$  BP. [drawing shows ca 10-20 cm long, pretty thin, beveled base on one. Would be very early date for bow, could work on atlatl tho small]

**West, Robert C.**

**x**

1948 *Cultural Geography of the Modern Tarascan Area*. Smithsonian Institution Institute of Social Anthropology Publication No. 7. United States Government Printing Office, Washington DC.

[Another old ethnographic survey, see Foster 1948]. Pp. 51-52 Hunting: "Today only duck hunting on Lake Patzcuaro has economic importance," limited to fishermen, 9 varieties of duck. Customarily starts Dia de las Muertos fiestas Oct 31 and Nov 1, when as many as 100 ducks killed by a single hunter. Continues to March when ducks leave. "The p'atamu, or spear propelled with the throwing stick, tsipaki, is still employed by many hunters." Spear has 3 pts, called fisga or k'encheta (figure). Also flintlocks and modern shotguns. Island of Janitzio has most fishers.

**Wheat, Joe Ben**

**o**

1967 A Paleo-Indian Bison Kill. In *New World Archaeology: Readings from Scientific American*. E.B.Zubrow et al. eds. pp.213-221. San Francisco: WH Freeman and Co. (*Scientific American* January 1967).

[Classic Paleoindian kill site.] Olsen-Chubbuck site, almost 200 bison killed, drive into arroyo, some completely butchered, others partly, a few at bottom untouched. Systematic butchering, leaving piles of sorted parts. Calculations of meat quantity - some 60,000 lbs meat, could support 150 people for ca 1 month, depending on assumptions. Cody Complex [Plano] points: Scottsbluff, 1 Eden, Milnesands - demonstrate contemporaneous cultural variation as one type grades into another.

**Wheat, Joe Ben**

**o**

1972 *The Olsen-Chubbuck Site: A Paleo-Indian Bison Kill*. *Memoirs of the Society for American Archaeology* 26. *American Antiquity* 37(1): part 2.

[The detailed professional publication of this site.] Here the points are called

Firstview (new type) and San Jon after extensive review of “Yuma” aka Cody aka Plano point typology. [His earlier designations are more consistent with modern usage.] [He speaks of “spears” but not of atlatls, not clear how he thinks points were used, but in my opinion, they were certainly on atlatl darts.]

**Wheat, Joe Ben** **x**

1977 Technology, Typology, and Use Patterns at the Jurgens Site. *The Museum Journal* 17:126-139.

Colorado, Paleoindian Agate Basin and Kersey Complex cultures [No C14 dates cited]. Bison butchering and other animals, base camp, chipping floors. Lithic analysis emphasis.

Kersey points [= Scottsbluff/Eden related]. Finished pt use-life often included break + resharpen. Use-wear shows secondary butchering use, so probably mounted in short foreshafts on atlatl darts.

Two kinds atlatl hooks recovered [illustrated but not described]: 1. cut antler - hollow cylinder with nub for hook on perimeter [like some SE forms], and 2. curved piece of bison molar core, which could be lashed on shaft with curved tip up for hook. [Both plausible, but no details given to confirm.]

**Wheat, Joe Ben** **B sic**

1979 The Jurgens Site. *Plains Anthropologist* 24 (84 part 2, Memoir 15):1-153.

As for 1977, but better illustrations, including reconstructed hafting of atlatl hooks, and descriptions. Four specimens of bison molar core form, flattened on bottom, grooved for lash to haft, with naturally conical root converted by grinding + polish into hook. C14 date 9070 + 90 B.C. [sic, uncalibrated, does he mean BP?] on combined charcoal frags, agrees with geological estimates of 9000 BP.

**White, Laura Smith** **x**

1989 Atlatl Spurs of California: Their Cultural and Technical Implications. Unpublished MA Thesis, San Diego State University Dept of Anthropology.

Probable antiquity > 8000 in Gt Basin. At least 11 atlatls from GB sites outside CA, but only 2 in CA. 1. Potter Creek Cave in Shasta Co - finger notches, u-shaped dorsal groove, missing spur. Assoc wooden dart shaft C14 AD 50. 2. Yol-13 near Verona, Yolo/Sutter Cos. - 2 finger hole type resembling Tarascan form [no fig] assoc C14 AD 1135-670. Ethnog atlatls in CA: short problematic form from Vancouver exped, 2 Chumash specimens also not native. Dart frags from several sites: Newberry Cave over 1000 wood + cane frags w C14 dates 1110-1600BC to 2120-2480 BC. Boat-shaped stone weights in CA + NV. Large pts = darts, Fenenga suggests > 3.5 grams. Coso Range petroglyphs, over 14000 drawings recorded, some 350 representing atlatls as vertical line with hook at one end, often transecting circle (= possible weight). Figs from Grant, also of Valley of Fire panel, NV.

Spurs [attached hooks] are best evidence of atlatl use in most of CA. Early spur finds considered possible arrowpoints for stunning birds, fetishes etc. Associations with weights (interp as fishline sinkers) at Mayer collection sites, Tulare Co.

1969 R+M recognized function, proposed typol based on specimens from collections: Type I: Snake Head. Central CA Early Horizon, Martin Complex, and Lovelock affinities, made of stone, oldest type based on spur assoc with deposit dates 6250 BC. Engaging head angles upward, with flat or notched stem for attachment.

Type II: Acorn. Mostly of bone or antler, a few shell or stone, Central CA Middle Horizon. Type III: large aberrant snake head form or ambiguous

Located 269 specimens in collections. 22 bone examples have traces of asphaltum, 8 decorated with punctate designs, and 4 of these have red ochre. Unsystematic and unprofessional collection doubtless biases sample; no wooden specimens survive, nor atlatls with integral spurs.

Variation reflects different ways of attaching spur to atlatl and elevating the “engaging head” of spur. New Typology of 4 types: 1. Snakeheads. Stem to lash to atlatl. Unkeeled stone only, keeled, stone and bone. Keel (on stem) fits into groove when lashed to atlatl. Some stems drilled, grooved, or curved up. 2. Acorn - thick acorn shaped head, stone or bone, short or long stem. Offset Stem, Central Stem, Grooved. All apparently hafted by setting end of stem into socket on thickened atlatl end (plus lashings). 3. Bossed - like acorn head but stem has raised boss or collar for lashing, sometimes with grooves. 4. Harpoon Thrower Spurs - like acorn head, but very large, ave 10 cm L, all of whale tooth ivory, often flat decorated stem, low head of spur suggests used on grooved atlatl. [Hafted this way, such a large spur would have a very long distal end of atlatl distal to the spur.]

Date info poor, from 29 sites yielding 55 spurs, but not directly on spurs. Reviews all evidence. Type 1 Snakeheads probably earliest type in CA, up to 8000 BP, but acorns also about that old. Acorns most frequent type between 2000 BC and first millennium AD, Snakeheads may have ended 2000 BP but Acorns persisted in Late Prehistoric after 1000 AD. [I don't think the dating info provided supports ANY useful chronological distinctions.]

Distributions also reviewed. Most spurs from central CA and S coast. Biases result from location of past archaeol work. Coast + island use may relate to bird hunting, while absence in N Coast and Desert may relate to low intensity of arch work and salmon subsistence, desert could have used wooden integral spurred atlatls. Type 4 known only from Chumash area, possibly associated with sea mammal hunting.

Lack of spurs after 1000 AD, sudden abundance of stone arrowpoints, prob indicates replacement of atlatl, but evidence not sufficient, possible late survival not documented.

(Dordogne). In *French Paleolithic Collections in the Logan Museum of Anthropology*, edited by Randall White and L. B. Breitborde, pp. 259-276. *Logan Museum Bulletin* (new series) 1 (2).

Small hook frag bought 1926 by Pond from Hauser, so prov unproven. *Faun aux oiseau* form. Antler palm, doubts bird intended. [Also not enough left to tell what if any animal depicted]. Hook polished, wear suggest L handed user [how can you possibly tell?]. Overall polish from binding or use, breaks prob from use.

### **White, Randall**

o

2006 The Women of Brassempouy: A Century of Research and Interpretation. *Journal of Archaeological Method and Theory* 13(4):251-304.

Excavation history - some criminally bad even for 19<sup>th</sup> C, but Piette and others with attention to stratigraphy. Cave produced lots of ivory, much worked, some oddly “melted” by humid conditions. Piette focused on female figurines, worried by resemblance to Egyptian art, and interpreted them in light of contemporary fixation on racial categories: steatopygous women related to African origin of Paleolithic ancestors, and especially French fascination with the “Hottentot Venus” Sartje Baartman who was exhibited in Europe and dissected by Cuvier 1816. So the figurines became evidence of two races in Paleolithic: a dominant slender hairless one (famous Dame a la Capuche head with hair or cowl) and conquered primitive steatopygous hairy race (some torso fragments, and La Femme au Renne from Laugerie-Basse), conforming to 19<sup>th</sup> C colonialist attitudes. Early use of “venus” label referred more to race and Baartman than to later “Venus” fertility interpretations of Up Pal figurines. [At least one piece of ivory, not discussed in detail, a “bouchon a outré” could be a spearthrower hook.]

### **Whitehead, Ralph H.**

1936 The Birdstone and its Probable Use. *American Antiquity* 2(2): 134-136.

Miscellaneous theories noted: womans headgear, shaman's gear, hunt fetish.

Common in lake states, near water, so how about canoe prow ornament?

Iroquois/Algonkian? - not in earlier moundbuilder graves.

[W.Ritchie in letter next issue correctly dismisses Iroquois idea, says birdstones are earlier.]

### **Whittaker, John**

o

1994 *Flintknapping: Making and Understanding Stone Tools*. University of Texas Press: Austin.

Figure 3.18 mediocre illustration of a generic atlatl, dart, and thrower.

### **Whittaker, John**

1997 Translation of a Late Basketmaker Rock Art Panel. *The Atlatl* 10(2):5.

Illustrated humorous poem.

**Whittaker, John**

1998 The Meanings of Atlatls? Robert Hall's Archaeology of the Soul. *The Atlatl* 11(2):2-3.

Hall (1997) in one chapter argues that atlatls are symbolically connected to courting flutes and calumet pipes, but bases his arguments on vague, ambiguous, and widely separated examples of symbols used by a variety of cultures.

**Whittaker, John**

1999 Why the World Needs WAA. *The Atlatl* 12(4):13.

Errors in a book by Stockel (1995).

**Whittaker, John**

2002 Coaching the Atlatl. Posted on Grinnell College Faculty Webpages at <http://web.grinnell.edu/anthropology/Faculty/faculty.html>

Photo essay and discussion of the throwing motion, good form

**Whittaker, John**

2003 Atlatl Elbow: Anatomy and Archaeology. *The Atlatl* 16(1):16-18.

Describes shoulder and elbow anatomy and injury from atlatl use, and archaeological attempts to interpret skeletal pathology as resulting from atlatl use.

**Whittaker, John**

2003 Mid Paleolithic Crisis. *The Atlatl* 16(2): 9.

Humorous doggerel.

**Whittaker, John**

2004 When Atlatls Are Designed by Computer Companies. *The Atlatl* 17(1): 17-18.

Humor.

**Whittaker, John**

o

2004 A Peruvian Atlatl. *Bulletin of Primitive Technology* 27: 55-57.

Peruvian specimen in U. Penn museum described, replicated.

**Whittaker, John**

o

2005 Review of Survival by Hunting: Prehistoric Human Predators and Animal Prey by George Frison. *The Atlatl* 18(2):11-12.

**Whittaker, John** x

2005 How to Throw with an Atlatl. World Atlatl Association webpage. URL: [http://www.worldatlatl.org/WhatisAtlatl\\_HowtoThrow.html](http://www.worldatlatl.org/WhatisAtlatl_HowtoThrow.html) and printed 2009 *The Dart* August 2009:20-22.

**Whittaker, John** o

2006 Atlatl Use on Moche Pottery of Ancient Peru. *The Atlatl* 19(3):1-3.

**Whittaker, John** o

2007 Late Survival of Atlatls in the American Southwest? *The Atlatl* 20(1):10-12.

Criticizes Vanpool (2006).

**Whittaker, John** o

2007 Clovis Atlatls? Hemmings' Evidence from Florida Rivers. *The Atlatl* 20(3):14.

Atlatl hooks made on proboscidian ivory and a *Paleolama* phalanx (photos) associated with Clovis technology. Clovis seen as a unique adaptation with broad spectrum resource use but focused on big-game with specialized technology.

**Whittaker, John** o

2008 Review: Poison Arrows: North American Indian Hunting and Warfare, by David E. Jones. (2007, University of Texas Press, Austin. ISBN 978-0-292-71428. \$29.95.) *The Atlatl* 21(1):13

**Whittaker, John** o

2008 Atlatl Artifacts at Indian Knoll. *The Atlatl* 21(2):1-3.

Reviewing reprints of publications by Moore and Webb, photos of antler hook and handle with bannerstones in burial contexts not completely conclusive of atlatl explanation, although that is still the best.

**Whittaker, John** o

2008 Ten-Minute Atlatls. *The Atlatl* 21(4):13.

simple atlatl design

**Whittaker, John** x

2009 The Aztecs and the Atlatl. Aztecs at Mexicolore webpage, URL: <http://www.mexicolore.co.uk/index.php?one=azt&two=aaa&id=432&typ=reg>



there are still alternative theories about spearthrower mechanical principles. Howard proposed that atlatls work by extending the time force can be applied to a spear. Others suggest that the flex of the atlatl or the dart, or both, stores energy to spring the projectile away. Both of these theories can be demonstrated to be wrong by a variety of evidence, including slow motion images. Those who believe that spearthrowers work by spring power often see them as ancestral to bows. Because they work by different principles, this is highly unlikely. Understanding how a spearthrower works is important in examining its capabilities and place in the evolution of technology, and both practical experimentation and theoretical understanding are necessary.”

**Whittaker, John C.**

2012 Experiment Meets Recreation: Throwing Spears with the Public. *SAA Archaeological Record* in press.

**Whittaker, John C.**

2012 Ambiguous Endurance: Late Atlatls in the American Southwest? *Kiva*, in press.

**Whittaker, John, Byl Bryce, and Chuck LaRue** ○

2008 Atlatl Hunting with the Basketmakers. *The Atlatl* 21(4):4-6, and posted URL: [http://www.worldatlatl.org/art/Album/Southwestern\\_RockArt.htm](http://www.worldatlatl.org/art/Album/Southwestern_RockArt.htm)

SE Utah rock art depictions of atlatl gear, hunting, and warfare.

**Whittaker, John, Phil Geib, Byl Bryce, and Chuck LaRue**

2009 Sand Dune Cave Atlatl. Electronic document, URL: [http://www.worldatlatl.org/Articles/SandDuneCave/SandDuneCaveArticle\\_2010.pdf](http://www.worldatlatl.org/Articles/SandDuneCave/SandDuneCaveArticle_2010.pdf)

Context and photos of complete atlatl and dart foreshafts.

**Whittaker, John and Kathryn Kamp** ○

2005 ISAC Sport and Science. *The Atlatl* 18(2):1-4.

**Whittaker, John and Kathryn Kamp** ○

2006 Primitive Weapons and Modern Sport: Atlatl Capabilities, Learning, Gender, and Age. *Plains Anthropologist* 51(198):213-221.

13,500 ISAC scores over 8 years show growth of sport, suggest that modern atlatlists are now at level of skill equal to prehistoric and can thus be fair test of atlatl capabilities

**Whittaker, John and Kathryn Kamp** ○

2007 How Fast Does a Dart Go? *The Atlatl* 20(2):13-15.

With a radar gun, measured JW throws using Whittaker, Berg, and Perkins equipment. Velocities from 45 mph (20 m/sec) to 57 (25 m/sec) with Berg gear slowest. Comparisons to other experiments.

**Whittaker, John C., and Kathryn A. Kamp** ○

2011 Long and Short: Reconstructing Key Marco Atlatls. *The Atlatl* 24(1):21-22.

Atlatl works as lever, longer is more efficient, but that doesn't show which of two possible reconstructions is more correct.

**Whittaker, John and Andrew Maginniss** ○

2006 Atlatl Flex: Irrelevant. *The Atlatl* 19(2):1-3.

Physical modeling of flexing atlatl as a cantilever spring suggests could add ca 10% to velocity of dart, but strobe photos show atlatl is still flexed after dart leaves: there is not time for atlatl to rebound like spring, so atlatl flex does not add to dart velocity. Tests of 3 atlatls identical except for flexibility confirms: no difference in velocities of throws.

**Whittaker, John and Ron Mertz**

2002 Atlatls for Teaching and Sport. *Anthropology News* 43(4):26.

2002 Atlatls and Public Prehistory. *ACPAC Newsletter*. July 2002:1.

2003 Atlatls and Public Prehistory. Unauthorized reprint in *Ancient American* 7(48):18.

Atlatls are good for hands-on teaching of primitive technology, and interaction with an interested public.

**Whittaker, John C. and Ron Mertz**

2011 Introducing the Missouri Atlatl Association. *Missouri Wildlife* 72(3):10-11.

Explains atlatl and organization; accounts of MO first atlatl deer hunt season.

**Wilbur, C. Keith**

2001 *Indian Handicrafts*, revised edition. Globe Pequot Press, Guilford, CT.

[All sorts of crafts, emphasis on New England, simple cultural info but generally ok, dozens of drawings, attempts to show traditional techniques as well as how to make today. Some of the instructions are pretty good, others, despite lots of detail, are ... optimistic. For example the flintknapping info is rudimentary, not very accurate, and the drawings of pressure flaking are ludicrous.]

Book begins with atlatl – origin in Early Archaic 7000 BP, propels spear by centrifugal force, bannerstones “add heft for greater control and power”. Dr. Maurice Robbins at Bronson Museum claims 1973 find of point on foreshaft in

marsh, point in socket in split shaft (gives instructions). Making shaft – suggests steel nuts instead of foreshaft, uses notch that fits under hook [instead of socket – would this work well?]

**Wilhelm, Neil**

**o**

2009 The Fluid Art of Fletching with Pitch. *Primitive Archer* 17(3):18-23.

instructions for making birch pitch by “dry still” and fletching arrows with it

**Wilhelmsen, Kris H.**

**x**

2001 Building the Framework for an Evolutionary Explanation of Projectile Point Variation: An Example from the Central Mississippi River Valley. In *Posing Questions for a Scientific Archaeology*, edited by Terry L. Hunt, Carl P. Lipo, and Sarah L. Sterling, pp. 97-144. Bergin and Garvey, Westport.

Evolutionary principles to test expectations based on design and Newtonian physics. Otherwise, explain of proj pt form usually circular: “activities inferred from p pt form are also considered the causes of the form.” Functional attributes are selected if successful, but may be shared because of same ancestral origin or because of convergence, same selective forces in different locations. Stylistic attributes are neutral and change by drift – error in transmission. Engineering design analysis identifies functional traits. Similarity in style (non-functional traits) reflects common ancestry, so chronological point types should be defined by those.

Used 37 surface assemblages from MO + AR spanning 11,000 yrs. Considerations of surface assemblages and amateur collection [he’s very optimistic!]. Proj pt = “Pointed Lithic Biface” defined by engineered traits for piercing: sharp tip, less pointed other end, longitudinal axial symmetry. [Lots of big words for simple concepts in this.] e.g. “repeated appearance of serrated blades... may be tied to changes in biface technology... that periodically reduced projectile velocity” because serration improves penetration [questionable, physics explained later but hard to understand]. Physics concepts explained. Improve proj equilibrium by adding weight to front, or light surfaces like fletching to rear. Oblique fletching imparts rotation to reduce wobble. Faster proj stabilizes sooner. Blade surface area + x-section also influence flight – greater blade surface area moves center of pressure forward [acts like fletching at front], increasing instability. If longitudinal axis not symmetrical, unevenly pulls proj away from flight path because of differential air pressure on each blade surface.

Penetration is function of velocity, mass, tip sharpness, blade-edge design. Prehist projs velocity from 18-50 m/sec. Kinetic energy = mass times velocity squared over 2.  $T = mv^2/2$  so increasing velocity does more. Tip sharpness opens hole, perimeter or x-sect affects drag as point cuts and enters, experts say arrow 18-24 cm [we know they can do better than that!]. Shape of blade ensures entry of edge at an angle, improving cutting.

Impact fractures longitudinal on stable high velocity p pts which strike

straight on, but oblique or burination on slower because they're more likely to hit at angle [doubt you can tell, also shafts flex, affecting angle of impact].

Manufacturing cost as well as performance acts to select for or against functional traits. Here, performance assessed by 1. Effectiveness of penetration, measured by max pt perimeter, max shaft perim [from stem?], blade edge sharpness [angle], and serration. 2. "retrograde resistance" [jargon meaning ability of point to stay in wound, which increases damage] measured by angle of barbs, depth of barb, angle of stem edges. 3. Angle of impact assessed by tip fracture [not workable].

[Some of these discussions are useful, but all are couched in masses of wordy jargon, not all of the engineering assumptions are well-based in practical experiment, and after 40 tedious pages he has just set up the research, not produced any analysis of points.]

### **Wilkison, Kermit**

1993 Bannerstones: Two Cents More. *The Atlatl* 6(3): 4-6

Anecdotes, metal weights taped on for experiments, weights behind fletching work well.

### **Williams, A. R.**

**o**

2006 Mystery of the Tattooed Mummy. *National Geographic* 209 (6): 70-83. (June 2006).

Moche female mummy at El Brujo. [Disappointing article. A few nice photos, little useful info - fluff stuff. News reports mentioned atlatls with mummy as some of unusual male goods with important female, but no mention here.]

### **Wilson, Thomas**

**x**

1898 Class A, Beveled Edges. *The American Archaeologist* 2:141-143.

Beveled pts [like Thebes] - experiments to show they give rotary motion – put museum specimens on unfletched shafts and dropped from Smithsonian tower. Also tried mounted and moved through water and simple wind tunnel using a fan. All showed rotation. Considers them arrow points. Most beveled to produce counter-clockwise rotation. "Whatever may have been the intention of the maker of the arrow-heads... in their flight through the air the beveled edges produced a rotary motion." It would be easier to use twisted fletching, but of 1000 arrows in Smithsonian, not more than a dozen have such. Since you can turn arrowhead in making, bevels do not indicate handedness.

### **Wiltens, Jim**

**x**

1990 The Amazing Atlatl. *Black Belt* August 1990:66-69.

"One of Asia's oldest martial arts weapons...." Uses leverage, darts "resemble

arrows on steroids”, over 95 miles per hour, mammoth hunting, “one atlatl master demonstrated power of the weapon by throwing high-tech steel dart through a car door from 15 yards away.” Aztecs threw 100 yds, out of musket range. Darts could penetrate armor “pin conquistador inside his breastplate.” Replaced by bow. Dave Holladay holds distance record of 426’. BPS Engineering sells. [Quotes, hype, and story show info must be from Perkins. Photos of a guy in karate gear throwing.]

**Wincer, Simon, director**

o

1997 *Quigley Down Under*. Movie, VHS, DVD. MGM/Ua Studios.

Western set in Australia. Quigly (Tom Selleck) is a sharpshooter from the US, hired by evil rancher (Alan Rickman). The job turns out to be exterminating Aborigines, which Quigly refuses to do. The bad guys beat up Quigly and the mad woman he befriends (Laura San Giacomo) and leave them to die in the desert, where they are rescued by aborigines and recover to return and wipe out the baddies. Not a bad movie, although a silly fantasy atonement for American guilt over our treatment of the Indians. The aborigines are shown using Central Desert type woomera against the ranchers and teaching Quigly – short sequences and hard to examine for info, but looks like they know what they’re doing.

**Winters, Howard**

1968 Value Systems and Trade Cycles of the Late Archaic in the Midwest. In *New Perspectives in Archeology*. S. Binford and L. Binford, eds., pp. 175-222. Aldine, Chicago.

[An archaeological classic, early attempt to be explicit about how we can get social information from burials, but long and laborious.] Indian Knoll, Archaic site in KY, 2500-2000 BC (see Webb 1946, 1957) is one of main sites considered. Why are atlatls, which are predominantly associated with males, also in female graves at Indian Knoll? Probably not just ceremonial artifact – they show use-wear. Probably not “a platoon of Amazons.” Possibly “transfer of corporate estate” having nothing to do with sex of individual. “Or perhaps some women were hunters of one type of game or another.” “All that can be concluded is that the roles of females overlapped those of males in some way, leading to occasional association with them of a weapon one would expect a priori to be a symbol of male activities.” [See Doucette 2001]

**Witthoft, John**

x

1960 Review of *Birdstones of the North American Indians*, by Earl C. Townsend. *American Anthropologist* 62 (5): 915-916.

Praises - includes virtues of collector’s literature eg. discussion of fakes, and archaeological typology.

**Wolfe, Scott W., Joseph J. Crisco, Caley M. Orr, and Mary W. Marzke pdf**  
2006 The Dart-Throwing Motion of the Wrist: Is It Unique to Humans? *Journal of Hand Surgery* 31A:1429–1437.

Kinematic analysis has shown a near-stationary proximal carpal row during the dart-thrower's motion, which is believed to provide a stable platform for the generation of force and accuracy during certain power and precision grip activities. This is consistent with evidence in the human hand of adaptations that enabled effective manipulation of stones, cylindrical wood, and bone tools for throwing and clubbing. There are at least two possible explanations for the observed human proximal carpal row kinematics: 1. retained from previous common ancestor with great apes and previously adapted to some form of foraging or locomotor behavior involving the hands, but was recruited for tool use after we diverged from the apes, or 2. evolved after our divergence from apes, in synchrony with adaptations in the human hand to the manipulation of tools, and central to the development of the human's unique ability to aim and accelerate tools and weapons. Observations of wrist motion complex + difficult, many small bones act in columns or rows or both, in "dart-thrower's arc" motion common to almost all sports (throwing, hitting, etc) [many refs]. Understanding motion important for surgery and rehabilitation. "The common denominator in effectively using either the precision 3-jaw chuck baseball grip (when holding a stone) or the power squeeze grip (when grasping a hammer or a spear) is a smooth arc of motion from an extended wrist position that is combined with radial deviation to a flexed wrist position that is combined with ulnar deviation—the dart-thrower's motion." Evolutionary changes in hand include shorter fingers, improved power and precision grips, but fully modern "modified power grip" ("squeeze grip") as in hammer appears relatively late, and is only useful if also have smooth power swing "generated by a cocking phase of wrist extension and radial deviation, and a swing phase of ulnar deviation and flexion." The cocking of the wrist generates acceleration of tool and power [applies to atlatl throw too of course]. Early hominin wrists more similar to knuckle-walking apes than arboreal apes, so less mobile, more stable, and suggests later development of throwing adaptations as hands freed by bipedality. E.g. chimp can use simple power grip, but can't throw or hit effectively because short thumb not as good, and lack "cocking" ability of wrist.

**Woodbury, Richard B. and Ezra B. W. Zubrow** o  
1979 Agricultural Beginnings, 2000 B.C.-A.D. 500. In *Handbook of North American Indians, Volume 9, Southwest*, edited by Alfonso Ortiz, pp. 43-60. Smithsonian Institution, Washington D.C.

Discusses transition from atlatl to bow. Nice illustration of Basketmaker II atlatl from Broken Roof Cave, AZ. Assumes Clovis + Folsom use. Projectile point size not sure indicator of use. Bow and arrow evidence rare in SW pre 500 A.D., but 500-1500 yrs earlier in Gt Basin, where coexist for several 100 yrs, atlatl

abandoned about same time as bow reached SW. [Supposed evidence for this overlap + early GB bows not detailed.]

**Woodward, Arthur**

1937 Atlatl Dart Foreshafts from the La Brea Pits. *Bulletin of the California Academy of Sciences* 36(2):41-60.

Man now proven to have existed with Pleistocene mammals – how late did they survive? Pit 10 human skull and pit 61-67 artifacts – how old? Most artifacts of late types, except 4 foreshafts. One “bunt” with conical end to fit shaft, thick blunt point, 5 inches long. Three fragments of foreshafts for stone points, 3-6 inches, notch for point broken off, pointed proximal ends [photographs]. Compares others, with photos: 6 San Juan Co. Basketmaker with stone points, 4 more unfinished foreshafts – La Brea are heavier. No stratigraphy, but foreshafts suggest early atlatl using folk, other artifacts later.

Describes Santa Barbara (1792) atlatl – “odd, stubby, 6-inches long” with bone hook, compares to Tarascan type. No Spanish historical record of atlatl among CA Indians. Also a 1792 foreshaft, but appears to be harpoon, not for atlatl. Maybe “memory” or “vestigial remnant” of older atlatl use in California.

**Wray, Donald E.**

x

1945 The Historical Significance of the Murals in the Temple of the Warriors, Chichen Itza. *American Antiquity* 11(1): 25-27.

Murals record subjugation of Maya by Toltec, stereotyped outfit of Toltec warriors includes round shield, atlatl, and bundle of darts.

**Wright, W. Davis**

x

1923 *Canberra*. John Andrew and Co., Sydney. (Reprint 1977 Library of Australian History, Sydney.)

Old-timer reminisces. P 58 Natives carried their weapons until at least 1850, usually 2-6 spears, some barbed, thrown with “considerable force and accuracy” with “thrower”, nulla nulla club, shields, tomahawk of polished stone.

**Yaroshevich, Alla, Yossi Zaidner & Mina Weinstein-Evron**

s

2011 Evidence of Hunting Weapon Variability in the Early Middle Paleolithic of the Levant. A view from Misliya Cave, Mount Carmel. Paper presented at Multidisciplinary Scientific Approaches to the Study of Stone-Age Weaponry, Mainz, 19-22 September 2011.

Middle Paleolithic of Levant: Tabun sequence: Early MP unknown hominids using Levallois pts on blades. Mid MP ovoid points. Late MP Levallois pts. EMP of Misliya Cave, Mount Carmel, Israel, near Tabun, L pts, Mousterian points (elongated), and Hummal pts (retouched on large blade). Do different pts =

different weapons? Two lines of analysis: ballistically important morphometric attributes and analysis of projectile damage. Correlations between point type, morphometric characteristics and frequencies of fractures diagnostic of projectile impact (DPIF). Levallois points and elongated Mousterian points have tip cross sectional areas similar to efficient thrusting spears, highest frequencies of DPIF, about 20%. Difference between these two types in W, T, and angle of the distal tip may indicate that L and M points were designed to meet two different objectives of spearhead efficiency, namely, depth of penetration and durability. Another group of newly defined Misliya points and some Hummal points were statistically similar to ethnographic dart tips in terms of TCSA and perimeter. These types exhibited less than half the frequency of DPIF observed for L/M points. Ratio of Levallois/Mousterian versus Misliya/Hummal points correlates with ratio of large versus small size game hunted at the site – suggests point types represent different kinds of hunting weapons. Blade production, a characteristic feature of the Levantine EMP is closely associated with hunting weapon technology: elongated M points identified as spearheads, as well as Misliya and Hummal points interpreted as possible tips of composite projectiles, are produced predominantly on blades.

**Yohe, Robert M.**

x

1998 The Introduction of the Bow and Arrow and Lithic Resource Use at Rose Spring (CA-INY-372). *Journal of California and Great Basin Anthropology* 20(1): 26-52.

Bow and arrow uses smaller points than atlatl - what is impact on use of lithic resources? Bow arrival in Great Basin estimates from 4500 BP to 1300 BP, based on small points, and bow fragments (none directly dated [!!!]). Cites cave strata dates suggesting bow by 1800 BP, concurrent with small corner-notched points (Rose Spring/Eastgate, Rosegate types).

Rose Spring site 8 miles from obsidian sources, deep strata, C14 dates. Bimodal pt size distribution with stratigraphic separation supports RS/E pts as arrow vs Elko as dart. RS pts appear ca 1600 BP. Bifacial cores, biface thinning flakes as debitage and blanks, should become smaller with shift to smaller points. Biface thickness however shows only slight decrease until 600 BP, BTF size increases slightly at 1600 then slowly declines until very late in time = pre-bow reduction strategies continue, perhaps because continued use of large Humboldt Basal-notched forms = thrusting spear or knife. Or atlatl continued in use - small numbers of dart pts throughout sequence until AD 600. However, obsidian hydration values fairly constant, suggest mixing of early material to upper levels of site.

**Yost, James A., and Patricia M. Kelley**

s

1983 Shotguns, Blowguns, and Spears: The Analysis of Technological Efficiency. In *Adaptive Responses of Native Amazonians*, edited by Raymond Hames and William Vickers, pp. 189-224. Academic Press, New York.

Field work with Waorani, E Ecuador, manioc + plaintain growers. Most research says shotgun more efficient, but others disagree, note that large groups of animals can be killed with bow but scared off by gun. "Mentalist" explanations too: gun makes "beautiful noise" an artifact and power not in rest of native culture etc.

Small population, but warfare common, up to 58% of male deaths [!!!].

A weapon is not just technical capabilities, but associated behaviors.

Blowgun: Child training "for arms, lungs, cheeks, eyesight, hearing and endurance." By 5 target proficiency, by puberty lots animal behavior knowledge. Pet keeping as training. Blowgun 2.75 m long, 2.5-3.2 kg, need some strength to hold. More accurate toward vertical than toward horizontal. Palm leaf rib darts ca 40 cm long. Range, including monkey kills, 12-30 m, accuracy up to 41 m but less after 25 m (overhead targets, horizontal accuracy less). Poison for larger animals + low cost of darts means willingness to risk longer shots.

Spear: Only for larger terrestrial animals, peccary, tapir, deer. Spear 2.5 m long, 1.5 kg palmwood. Usually thrust, not thrown. Dogs help get game in range, but only acquired in last decade.

Shotgun: Expensive, becoming more common, but poor quality. Potential extended range not attempted; use at ranges of blowgun or spear depending on game.

Most game carried home, very little discarded, 70% of carcass is edible meat and organ. Recorded 867 hunts, 18,781 kg meat acquired, 3165 animals, 64% animals with blowgun, 3% spear, 33% gun but blowgun only 36% meat, spear 13%, gun 51% because blowgun only for small arboreal animals. Compared to bow hunters, use blowgun on small game much more than bow. Only 7.4% hunts unsuccessful, no shortage of meat protein.

### **Yu, Pei-Lin**

**x**

2006 From Atlatl to Bow and Arrow: Implicating Projectile Technology in Changing Systems of Hunter-Gatherer Mobility. In *Archaeology and Ethnoarchaeology of Mobility*, Frédéric Sellet, Russell Greaves, and Pei-Lin Yu eds., pp. 201-220. University Press of Florida, Gainesville.

Transition from large to small points indicates change from atlatl to bow, should be subject to adaptive pressures. Test with Coastal Spain (Solutrean-Magdalenian), Japan (late Paleolithic to Initial Jomon), N.Am. Great Basin (Archaic to Early Prehistoric). Attempts to generalize about lithic tool density, to claim that "post-transition" sites have greater density, more intense occupation, more diversity. [Overgeneralizations ignoring too many variables, data not given.] Cundy (1989), Cattelain (1997) ethnog + experimental data manipulated [simplistically] to argue that spearthrower delivers twice as much force on impact. Heavier projectile more effective on larger game [again some meaningless "data"]. Atlatl is "shock weapon" that rapidly debilitates prey, useful if chance of escape is high as in watery environment. Bow more versatile, lighter ammo, more shots etc., more accurate at smaller game, needs less space to use. Bow reflects

use in more vegetated areas; earlier transition in Japan and Spain relates to temperature and vegetation changes - little change in Gt B. Bow use also likely to reflect reduced mobility/smaller territory because allows more efficient hunting of broader resources. [His conclusions seem mostly reasonable - they are derived from poorly understood ethnographic and experimental work by others - but he then tries to rationalize them into gross overgeneralizations that ignore all sorts of interesting complexity. Not very useful.]

**Zarlenga, Dan**

s

2011 St Louis Conservation Connection: Deer Season Missouri. KPLR Television interview with Dan Zarlenga, online at [http://www.kplr11.com/news/noon\\_show/conservation-connection/](http://www.kplr11.com/news/noon_show/conservation-connection/) December 8, 2011.

First atlatl deer in MO since atlatl legalized for deer in rifle season. Interview with successful hunter Luke Boenker and Ron Mertz. LB said he had only been atlatling ca 4 months. Shot from tree stand, small buck. Looks like simple atlatl and synthetic darts.

**Zeanah, David W. and Robert G. Elston**

x

2001 Testing a Simple Hypothesis Concerning the Resilience of Dart Point Styles to Hafting Element Repair. *Journal of California and Great Basin Anthropology* 23(1):93-124.

Flenniken et al. "rejuvenation model" - experimental knappers show it is possible that prehist hunters reworked points into different forms, making them poor chronological markers. This is not supported by stratigraphy, obsidian hydration, etc. And since dart points were curated, often of non-local high-utility stone, the lack of archy evidence for bases changing form is odd. Examine N Nevada site assemblages. Each dominated by single point type, also contradicting model.

Consider points as part of more complex artifacts: interchangeable component parts - foreshaft with point to go on shafts, notched points expected to break to increase effectiveness by staying in wound, hunter carries several foreshafts and few main, can repair darts in field, point is less work than foreshaft + attaching also time-consuming [all of these have some supporting citations but are arguable assumptions]. Different haft styles not compatible. For all these reasons, often not economical to salvage a point. "Rehafting hypothesis": More likely worry about foreshaft, make multiple points to fit them, so consistent point forms. Refitting repaired points to existing foreshafts constrained modification. Thomas found little correlation between point and foreshaft dimensions, Shott's sample showed some. Using 46 hafted dart points from literature - point L, W strongly correlate with foreshaft diameter. Point-dominated site assemblages represent short term occup with few users, limited point variability. Longer term palimpsest assemblages much more variable.

"Rejuvenation model" is example of replicative experiment that showed

something could be done, not that it was, and fails because not supported by other tests. Rehafting model does not explain why one type was preferred to another, but economic constraints explain why they were stable within a time/culture. “Stylistic” differences may exist, but often can be explained by function and economics.

**Zeh, Erich**

o

2005 The Atlatl (At-latl): The Most Primitive Weapon. *Indian Artifact Magazine* 24 (2):28-29.

Brief atlatl history and basics, info on WAA. [OK, except for dart spring idea.]

**Zollikofer, C., M. Ponce de Leon, B. Vandermeersch, and F. Leveque**

2002 Evidence for interpersonal violence in the St. Cesaire Neanderthal. *Proceedings of the National Academy of Science* 99(9):6444-6448.

A French find of a Neanderthal partial skeleton, associated with Chatelperronian [early Upper Paleolithic] tools, thermoluminescence dated to ca. 36,000 B.P. Shows a healing cranial injury, consistent with an impact wound from a sharp instrument. Could be accidental, but on top of head, so unlikely. Most ethnographic violence takes place within the group. Most likely shows 1) conflict among Neanderthals 2) using tools (presumably hafted hunting spears, which we know they had) as weapons, and 3) care of severely injured members of the group. [I include this because although it is earlier than any known spear thrower finds, it is during the period of coexistence of Neanderthals and Early Modern Humans, and someone will surely use it to argue for conflict between them, even though we can never really know. Unfortunately written in unnecessary awful jargon.]