To haft and to hold: Evidence for the hafting of Clovis fluted points

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Abstract:
Clovis fluted points vary considerably in technology and morphology, but also share a set of attributes, the most diagnostic of which are the flute scars, the remnants of the flake removals from the basal region that travelled up towards the tip. Fluting on Clovis and Clovis-like points generally extends no further than a third of the way up the face of the point. Finished points are usually ground smooth along the base and lower edges, suggesting facilitation of the hafting (attachment) to a wooden shaft or handle by way of an ivory or bone socket. The points may have been hafted directly to a mainshaft and used as a thrusting spear during close encounter attacks, or in the hand as knife or butchery tool. Alternatively, an intermediary shaft, or foreshaft may have been used to secure the point. The suggestion of foreshafts being used by Clovis hunters received support after the discovery of bone rods in association with mammoth remains and Clovis points at the type site at Blackwater Draw, New Mexico in 1936. Several other Clovis-aged sites across North America have yielded ivory and beveled rods that have also been associated with foreshafts and the hafting of Clovis points. Scratches that are present on a couple of Clovis points made on varieties of obsidian, have been identified as being “hafting abrasion” evidence, this roughening of the surface would have helped in securing the point into the shaft or socket. In one example from the Hoyt site in Oregon, remains of a “pitch” or hafting adhesive was discovered in the abrasions in the fluted area of the point.

Keywords: Paleoindian; Clovis; fluted points; hafting; osseous tools

1. Introduction
Clovis fluted points (see Howard 1990) are found across all of contiguous North America and are now generally accepted as dating to ca. 11,500 14C years BP (e.g., Waters & Stafford 2007, but see Haynes et al. 2007). Two primary technologies dominated Clovis stone tool flaking, bifacial and blade (Collins 1999a). Bifacial flaking was used to produce the large flake blanks or preforms on which fluted points were produced, and it is these points that will be the main focus of this paper. The other technology produced long regular pieces, known as blades, which were shaped into various tool forms such as scrapers, burins, gravers and other small unifacial tools. There is a considerable variation within Clovis-aged fluted points (see Buchanan et al. 2014; Miller et al. 2013), and research into the causes of the variation and the
morphological forms play an important role in contemporary studies in early Paleoindian archaeology (e.g., Amick 2017; Buchanan & Hamilton 2009; Prascianus 2011). Understanding variability in Clovis point shape and size not only assists in establishing material culture that is vital for archaeological studies (see Buchanan et al. 2014; Miller et al. 2013), but can also reveal Clovis landscapes, hunting practices and social behaviour (see Buchanan et al. 2011; Morrow & Morrow 1999). One particular suggestion for Clovis point variability concerns how they were affected by the hafting process (Buchanan et al. 2012). Hafting Clovis points could influence the size and shape of the basal section, whilst not affecting the blade section (Judge 1973; Keeley 1982; Musil 1988), the basal area being the most diagnostic section of the point. A recent study of Clovis and Clovis-like points carried out on basal morphology and basal concavity morphometrics, supported this hypothesis (Slade 2018). It was during research on certain Clovis fluted point specimens for that study, that evidence for hafting was recognised on certain specimens and led to a presentation at the conference that in turn led to the inclusion of this paper in this volume (Slade 2016). This paper will look at the material evidence for Clovis hafting that is available; this includes examples of Clovis fluted points that display evidence of hafting and bone and ivory artefacts associated with the hafting process, the various sites and locations where this evidence is present, and as part of the current study, whether there is a suggestion that hafting does affect the point's morphology.

2. Osseous rods as Clovis foreshafts

The exact way in which Clovis points were employed has been the subject of much discussion almost since the first discoveries were made at Blackwater Draw, Locality No. 1. in a gravel pit in New Mexico, back in the 1930s (Hester 1972) and Clovis was recognised (e.g., Frison 1991a). The points may have been hafted directly to a wooden main-shaft and used as thrusting weapons at close quarters. Alternatively, an intermediate shaft, or foreshaft may have been used to secure the point, whilst the opposite end would have either been spliced onto or inserted into the main-shaft (e.g., Lahren & Bonnichsen 1974; Stanford 1996), and used as a projectile weapon, such as an atlatl, allowing attack from a safe distance. Both of these methods were possibly available to the Clovis hunters and used in a hunting situation (Frison 1991a). Another theory was put forward based on the assumption that bi-beveled rods were indeed foreshafts (Pearson 1999, but see Lyman & O'Brien 1999). It proposed combining two bi-beveled rods on their ventral sides to form a clothes peg-like foreshaft, allowing two 'v' shaped openings permitting the insertion of a Clovis point and a main shaft. With a Clovis point securely attached to the composite foreshaft, it becomes an efficient hand-held thrusting weapon or spear-like cutting tool. The strength of this proposal is that it links each characteristic of the bi-beveled rods to a specific purpose and to function as a whole. The other two ideas rely on pieces or sections of the composite tool, that do not appear in the archaeological record (i.e., wooden or bone splints, antler bits, foreshaft sockets. etc.). However, an antler artefact from an Indiana peat bog was sent to the Smithsonian Institution for identification (Stanford 1996: 45) and was recognised as being a possible foreshaft socket, and would fit perfectly on a single-beveled osseous rod, such as the examples from the Anzick site in Montana (Wilke et al. 1991). Although the AMS date taken from a portion of extracted collagen postdates Clovis, the hafting technology of which it may be part of may well resemble that employed during Clovis times (Stanford 1996: 46).

The discovery in 1936 at the Blackwater Draw site of two cylindrical bone rods in direct association with mammoth bones and fluted points, strengthened the suggestion of a foreshaft and evidence of hafting ( Cotter 1937). Cotter proposed that that the rods, with either one or both ends beveled, served as the foreshafts on Clovis spears. The suggestion was further
advanced through the discovery of more examples at a site near Wilsal, Montana in 1968, now known as the Anzick site (Taylor 1969), and the reconstruction models proposed by Lahren & Bonnichsen (1974). Known examples of these osseous rods, and their possible foreshaft association, come from other Clovis-aged locations across North America; most notably the Sheaman, in Wyoming (Frison 1982), East Wenatchee, in Washington (Gramly 1993), and Aucilla River sites in Florida (Dunbar & Webb 1996), and from various site types which include caches, campsites and kill sites (Table 1). These tools are the most common non-lithic artefacts found in the Clovis archaeological record, but vary in size and shape. Some rods are beveled at only one end, some at both, while others are beveled at one end and the other pointed (Figure 1). Some specimens are very long and thin, others are shorter and fatter (see Lyman et al. 1998). Since the discoveries of the osseous rods, the idea of them as foreshafts has never seriously been challenged. However, some researchers have questioned their description, and suggested that the rods were commonly and erroneously referred to as “foreshafts” (e.g., Hemmings 2004).

Several alternative ideas of their function have been put forward (see Boldurian & Cotter 1999; Bradley 1995; Pearson 1999). It was suggested that they were used as projectile points (e.g., Frison & Stanford 1982; Jenks & Simpson 1941), as tip breaks on some of the examples have been found in kill sites, in direct association with mammoth bones, and also in campsites (Bradley 1995). Wilke et al. (1991) put forth the idea that the bone rods from Anzick, Montana, were handles for pressure flakers, while Taylor (1969) originally suggested the Anzick specimens were fleshing tools. Another idea was that they were used as pry bars: a bone crowbar used in mega fauna butchery (e.g., Saunders & Daeschler 1994). Another theory, developed from the East Wenatchee specimens, was that they served as shoes for the underside of sled runners (Gramly 1993), and Bradley (1995) suggested that the rods from East Wenatchee may have been ceremonial staffs and held some spiritual significance. These latter two suggestions are not supported by many Paleoindian specialists, and so the most widely accepted hypothesis is that of Cotter's in 1937 (Lyman et al. 1998; Pearson 1999; Stanford 1991).

An interesting find, and currently the only one of its kind from a Clovis context, is a bone tool discovered at the Murray Springs site in Arizona (Haynes & Hemmings 1968). The shape and structure of the tool appears to be well suited for the purpose of straightening wooden shafts. Experimentation with casts of the bone tool indicate that it would be highly effective for straightening shafts (Haynes & Hemmings 1968: 187).

3. The fluted point evidence

Several of the osseous rods display evidence of criss-crossed grooves or cross-hatching on the beveled ends (Haynes 1982: 390). Roughening the surface like this would increase friction with the adjoining, opposing bevel that would strengthen and make the tool more effective as the binding would have something to grip onto, and if covered with a resin-like pitch acting as an adhesive, the cross-hatching on the beveled ends of the rods would aid the securing of the flat fluted area of the point to the foreshaft (Lahren & Bonnichsen 1974: 149). At least one of the rods from the Anzick site have remains of a black substance present in the cross-hatching on the beveled ends; this material is believed to be an adhesive pitch (Wilke et al. 1991: 258). On one of the rods, cat #88.08.10 (Wilke et al. 1991: 260), incised lines occur at right angles on the back of the beveled surface, that suggests the incisions were made to prevent slippage of the binding, and on another, cat #88.68.13 (Wilke et al. 1991: 261), the short diagonal cuts to the side of the bevel could have functioned as slots where traces of a pitch were found, used as a binding agent (Lahren & Bonnichsen 1974). For the purpose of this paper the use of the term “pitch”, used as a synonym to describe a tree resin and other
materials that could have been used as an adhesive in the hafting process (see Frison 1989: 770; 1991a: 107), will now be just referred to as an adhesive.

Figure 1. One of the Clovis osseous rods from the East Wennatchee cache that might be a foreshaft which Clovis fluted points were hafted to (after Gramly 1993). Metrics of the rod: length: 26.3 cm; width: 2.4 cm; thickness: 1.8 cm; weight: 75.1 g.
Table 1. Clovis or Clovis-era sites where bone or ivory rods have been found (after Haynes 2002).

| Location and site type | Description and quantity                                                                 | Associations                                             | Primary source                                           |
|------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------|
| Anzick, Montana cache  | 11 bone rods (2 complete, 4 beveled ends, 5 midsections, some display a resin or mastic substance) | 8 fluted points, 85 other lithics                         | Lahren & Bonnichsen 1974; Jones & Bonnichsen 1994        |
| Aucilla River sites, Florida campsite or kill | 33 ivory rods                                                                             | possible fluted points and other lithics                  | Dunbar & Webb 1996                                      |
| Blackwater Draw, Locality No. 1, New Mexico kill camp | 4 bone rods (1 complete, 3 fragmentary)                                                   | fluted points, other lithics, and faunal remains          | Cotter 1937; Boldurian & Cotter 1999                    |
| Broken Mammoth, Alaska campsite and kill | 1 ivory rod                                                                              | lithics (mammoth possibly much older than the lithics)   | Yesner 1994                                              |
| Drake, Colorado cache  | 1 ivory rod (possibly)                                                                   | 13 fluted points                                          | Stanford & Jodry 1988                                    |
| East Wenatchee, Washington cache | 13 bone rods (a possible 14th found in fragments in a separate carnivore scatter). 2 of the rods are decorated | 14 fluted points, 15 bifaces                             | Gramly 1991; 1993                                        |
| Gault, Texas campsite | 1 bone tool (possible bone rod)                                                           | fluted points, other lithics, and faunal remains          | Waters et al. 2011                                       |
| Goose Lake, California campsite | 6 bone rods                                                                              |                                                          | Riddell 1973                                             |
| Klamath Lake, Oregon campsite | 2 bone rods                                                                              |                                                          | Cressman 1941; 1956                                      |
| Murray Springs, Arizona campsite | 1 bone rod, shaft wrench (unlike any other specimen), used to straighten foreshafts     | fluted points, other lithics, and faunal remains          | Haynes & Hemmings 1968                                   |
| Grenfel, Saskatchewan, Canada isolate | 1 bone rod                                                                              | no known associations                                    | Wilmeth 1968                                             |
| Sheaman, Wyoming campsite | 1 ivory rod                                                                              | 1 fluted point, other lithics                             | Frison 1982; Sellet 2015                                 |
| Sheridan Cave, Ohio campsite | 1 bone rod                                                                               | non-fluted point, other lithics                           | Tankersley 1997                                          |
| Wizards Beach, Pyramid Lake, Nevada campsite | 1 ivory artefact (possibly a point and not a rod) and barbed, 11 bone or antler pieces |                                                          | Rendall 1966                                             |
Traces of an adhesive to bind fluted points to the beveled osseous rods interpreted as foreshaft components, were discovered in scratches on the channel-flake scars of an obsidian Clovis point recovered from the Hoyt site in Oregon. This Clovis point (Figure 2) was the first suggestion of original hafting adhesive preserved on the surface of a point (Rondeau 2009a; 2009b; Tankersley 1994). The Hoyt site is part of a large Clovis workshop which may be part of the same campsite complex that includes the Dietz site (Fagan 1986), which also has specimens of Clovis points that exhibit similar scratches to the fluting area (Rondeau 2008) and had possible evidence of hafting adhesive present. The Hoyt Clovis point was found by an amateur archaeologist, Mr. J. Dyck, who made the point available for study. It is made on an opaque black obsidian, both faces of the point have scratches on the fluted surface. During analysis of the point traces of the resinous material were found, believed to be an amber-like tree resin that was a binding adhesive. (Tankersley 1994, but see Beck 1996; Tankersley 1996). The texture and position of the substance suggested it was a hafting adhesive, an amber-like substance had also been previously reported from the later Paleoindian Folsom site Lindenmeier (Wilmsen & Robert 1978), but should also be disregarded as resembling amber (Beck 1996). The outline of the scratches on the point morphologically and metrically correspond to the dimensions of the beveled ends of the Clovis osseous rods, thus supporting the foreshaft hypothesis further and the possible evidence for hafting (Tankersley 1994: 123).

Figure 2. One of the Clovis fluted points from the Hoyt site. This specimen was the first to display evidence of hafting adhesive in the scratches or striations on the fluted areas of both faces (image after Slade 2016). The scale bar is 2cm wide (in 1 cm segments).
The scratches on the fluted surface of Clovis points are found most commonly on specimens made from obsidian, and these seem to be limited to the far west (see Frison 1991a: 44; Harrington 1948; Wormington 1957: 61). Examples have been recorded in Oregon, California, Nevada, and Utah (Table 2). However, some obsidian Clovis points that display these flute scratches have been recorded further east (Table 2). One of the best examples being an obsidian point: specimen #107 (Frison & Bradley 1999: 19), from the Fenn cache, somewhere along the borders of Utah, Wyoming and Idaho (Figure 3), and it has been suggested that the purpose of the scratches on this point may have been to enhance the facilitation of the binding of a point to the foreshaft (Frison 1991b: 330). This Clovis point was also reported to have similar traces of a pitch in the striations in the fluted area, similar to those of the Hoyt specimen (Frison & Bradley 1999). Another Clovis fluted point with flute scratches was identified by this author in the Blackwater Draw, New Mexico assemblage (Figure 4) whilst carrying out my research on Clovis fluted point variability (Slade 2010, 2018). The point was discovered in the 1930s by George Roberts and donated to the Colorado Museum of Natural History (now the Denver Museum of Nature and Science) in 1936, although believed to come from the main Blackwater Draw Locality No. 1 site, it is possible that it was collected from one of the nearby blowouts at Blackwater Draw (Holen 2004). I was unable to examine the original, but I did have access to a very good quality epoxy resin cast replica, that had the flute scratches and abrasions present (Slade 2017). The cast was part of the Blackwater Draw Clovis fluted point assemblage, part of the C.V. Haynes Cast Collection, Arizona State Museum, Tucson. I believe that this is the first time the scratches and their association with the points hafting has been reported anywhere. The original specimen is made on an obsidian sourced in Utah but was found in New Mexico (Holen 2004), and it is thought that this is the first instance that the flute scratches on this specimen have been identified. Two other Clovis points that were recognised as having flute scratches and were until now unrecognised can be recorded (Table 2). Both specimens are in private collections but good quality casts have been made and were available to study (Slade 2017). The Utah Clovis fluted point was identified and studied by several Paleoindian specialists whilst in the Smithsonian Institution, but no mention was made of the flute scratches on both faces of the point. The large Clovis fluted point, or possibly a hafted knife, was found only 12 km from the East Wenatchee site in Washington, and was recorded in the publication, but again no mention of the flute scratches and the hafting association was made (Gramly 1993). To date there is only one recorded non-obsidian Clovis point that displays flute scratches (Rondeau & Temple 2010). The specimen is an isolated surface find from the Shell Rock Butte area of Malheur County. It is made on a semi-translucent mottled variety of agate (Rondeau 2009c).
Table 2. Occurrences of Clovis points that display scratches and or abrasions that may indicate evidence to facilitate hafting.

Notes:
1. This Clovis point was discovered in 1986, it is in a private collection and is to date unpublished elsewhere. The point was examined by several Paleoindian archaeologists at the Smithsonian Institution. There is a good quality cast of the point in the University of Southampton (Slade 2016).
2. This specimen was found in New Mexico, but the obsidian was sourced in Utah and the process of scratching the fluted area to facilitate the hafting is believed to have taken place at the source when the point was produced and there is no suggestion that this process took place at Blackwater Draw. * This is the first instance to the authors knowledge that the scratches on these specimens have been reported, and associated with the possible hafting to osseous foreshafts.

| Assemblage                      | Description                                                                 | Comment                                                                                                               | Primary source                        |
|--------------------------------|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| Hoyt, Lake County, Oregon      | Clovis fluted points made from various unnamed obsidians, campsite assemblage | Pronounced scratches in the fluted areas of one point, and traces of a hafting adhesive on another                  | Tankersley 1994; but see also Beck 1996; Tankersley 1996                      |
| Dietz site vicinity, Lake County, Oregon | Clovis fluted point and several basal sections made on a semi-translucent obsidian from Glass Butte Mountains, surface-collected campsite finds | Pronounced scratches in the fluted area on both faces of the points                                                   | Fagan 1986; Rondeau 2008              |
| Shell Rock Butte, Malheur County, Oregon | Clovis fluted basal section made on a semi-translucent banded agate, isolated surface find | Intentional scratches present in the fluted area on both faces                                                       | Rondeau 2009c; Rondeau & Temple 2010                                           |
| Copper Creek, Wallowa County, Oregon | Clovis fluted point made on Gregory Creek obsidian, isolated surface find  | Pronounced scratches in the fluted area on both faces                                                                   | Reid et al. 2008                     |
| Seneca, Douglas County, Oregon  | Clovis basal section made on Buck Mountain obsidian, surface-collected campsite find | Pronounced scratches in the fluted area on both faces                                                                   | Ozbun & Fagan 1996                  |
| Sheep Mountain, (35HA3667), Harney County, Oregon | Small Clovis fluted point made on Buck Springs obsidian, surface find | Flute scratches present on one face, may be evidence for hafting                                                        | O'Grady et al. 2009                  |
| Sage Hen Gap, Harney County, Oregon | Several Clovis basal sections made on local obsidian varieties, surface finds | Pronounced flute abrasions present on several of the specimens                                                           | Thomas et al. 2011                   |
| Borax Lake, Lake County, California | Several Clovis basal sections made on varieties of obsidian; including Borax Lake, campsite | Intentional scratches present in the fluted area on both faces of the points                                              | Harrington 1948; Wormington 1957     |

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| Assemblage | Description | Comment | Primary source |
|------------|-------------|---------|----------------|
| CA-SBR-5350, San Bernardino County, California | Fragmentary Clovis fluted point made on Coso Hot Springs obsidian, isolated find | Faint intentional scratches are present on both fluted areas of the point | Sutton & Wilke 1984 |
| Poker Brown, Pershing County, Nevada | Clovis basal section on an unnamed obsidian, no further information | Pronounced scratches in the fluted area on both faces | Rondeau 2006 |
| 42BE903, Blaine County, Utah | Clovis basal section made on an unnamed obsidian, surface find | Intentional scratches on both fluted faces | Copeland & Fike 1988 |
| Dugaway Proving Ground, Tooele County, Utah (Note 1) | A large Clovis fluted point made on an unidentified Utah obsidian, isolated surface find | Possibly intentional scratches on one fluted face | Slade 2017 |
| Blackwater Draw, New Mexico - (vicinity of) | Clovis fluted point made on Wild Horse Canyon obsidian from Utah (Note 2), isolated find | Intentional scratches on one fluted face of the point, and possible evidence on the other face* | Holen 2004 |
| Seagull Bay, Power County, Idaho | Clovis fluted point made on Big Southern Butte obsidian from Idaho - no further information | Intentional scratches on one fluted face | Hughes 2008 |
| Heil Pond, Owyhee County, Idaho | Clovis basal section and possibly fluted points surface-collected campsite | Intentional scratches on the fluted area | Reid et al. 2015 |
| Fenn Cache, Idaho, Utah, Wyoming border | Clovis fluted point made on an unnamed obsidian, cache assemblage | Pronounced scratches in the fluted area on both faces and traces of amber residue in the scratches | Frison & Bradley 1999 |
| Badger Mountain, Douglas County, Washington | Large Clovis fluted point, or fluted knife, made on a semi-translucent Rainbow Obsidian, that turns sea green in the light, isolated surface find | Scratches on the surface of the fluted areas on both faces may be evidence for the facilitation of hafting* | Gramly 1993 |
Figure 3. Clovis fluted point from the Fenn cache that has pronounced scratches in the fluted areas on both faces, and may display evidence of an amber mastic (image after Slade 2016). The scale bar is 2cm wide (in 1 cm segments).

Figure 4. A Clovis fluted point from the Clovis type site at Blackwater Draw Locality No. 1, that displays the scratches in the fluted area which may facilitate hafting to a foreshaft (image after Slade 2016). The scale bar is 2cm wide (in 1 cm segments).
There are three lines of evidence supporting the Clovis point hafting model associated with flute scratches. First, the scratches on the fluted surface of the point form a rectangular pattern that is consistent with the patterns of the bevelled ends of the osseous rods in Clovis (Figure 1). Second, the width of the scratches on the fluted surface compare with the width of the bevelled ends of the rods. And thirdly, the direction of the scratches on the fluted surface of the points are at right angles to the marks on the rods, this is expected if two areas were bound together with an adhesive (Lahren & Bonnichsen 1974; Stanford 1996). Flute scratches have had surprisingly limited attention and the argument of them being associated with the facilitation of hafting remains largely speculative (Rondeau & Temple 2010). When the Borax Lake Clovis-like fluted points were first reported (Harrington 1948), the scratches were noticed, but not elaborated on further and were not associated with the hafting process at the time. It was a few years later that the first reference was made to the scratches on the Californian points (Figure 5) being possible hafting evidence (Wormington 1957: 61). Flute scratches and their purpose were not discussed again until the Dietz site in Oregon was reported (Fagan 1986: 4). Since then, there have several reported cases from further sites in Oregon, Utah, Idaho (Figure 6), California, and Nevada (Table 2). More research needs to be done on the nature and range of flute scratches, and to look at more Clovis and Clovis-like points that are made on obsidian in existing collections, and see if they display any evidence of flute scratches, and or traces of the adhesive pitch. It may also be possible to carry out a study on some non-obsidian Clovis fluted point assemblages to see if the scratches exist on more specimens other than the Shell Rock Butte, Oregon agate specimen (Rondeau 2009c; Rondeau & Temple 2010). It may be, however, that other materials used to produce Clovis points, such as chert and chalcedony produce roughened surfaces when knapped, and it was just not necessary to abrade the fluting areas of the point, as this provided sufficient friction for the hafting process (Tankersley 1994: 122).

Figure 5. One of several Clovis-like fluted basal sections from the Borax Lake site, that displays the scratches in the fluted area on both faces (image after Slade 2016). The scale bar is 2cm wide (in 1 cm segments).

4. Discussion and concluding remarks

As we have seen since their discovery, the cylindrical osseous tools have been termed as foreshafts (e.g., Cotter 1937; Dunbar 1991; Lahren & Bonnichsen 1974), points (Cotter 1954; Jenks & Simpson 1941), rods (Gramly 1993), pins (Dunbar et al. 1989) and wedges used for tightening up loose haft bindings (Lyman et al. 1998). The differences in the terminology reflects the issues that Paleoindian archaeologists have had in trying to interpret the functionality of these implements, and there is no reason to limit their function to just one of these possibilities. Although the true function of the bi-beveled rods remain a matter of some debate, researchers recognise the importance of these objects and that they are an important element of the Clovis toolkit (see Boldurian & Cotter 1999; Haynes 2002; Stanford 1991). Several of the osseous rods display evidence of criss-crossed grooves or cross-hatching, as roughening the surface would increase friction with the adjoining, opposing bevel that would
strengthen and make the tool more effective (Haynes 1982: 390). Other engravings found on some specimens are definite distinctive patterns, such as zigzag designs on both sides of an ivory rod from the Aucilla River, Florida (Haynes 1982: 390), and the zipper designs found on some of the East Wenatchee specimens (Gramly 1993).

![Image of Seagull Bay Clovis fluted point with scratches](image after Slade 2016). The scale bar is 2cm wide (in 1 cm segments).

Figure 6. The Seagull Bay Clovis fluted point that has pronounced scratches in the fluted area on one of its faces (image after Slade 2016). The scale bar is 2cm wide (in 1 cm segments).

Experimental analysis surrounding the feasibility of the hafting procedures has been carried out on Clovis fluted points and beveled rods through replication projects (e.g., Lahren & Bonnichsen 1974). Casts of replica Clovis fluted points were used, along with scale replicas of shafts, wooden and ivory foreshafts, and splints. The wooden splint was made to fit onto the fluted surface of the point, and extended up the foreshaft. Both of the fluted point surfaces were coated with an adhesive, and the beveled ends of the foreshaft were set on the points surfaces (Lahren & Bonnichsen 1974: 149).

The osseous tools of the Upper Palaeolithic in Europe are recognised as projectile point technologies in the Aurignacian that change shape over time (Knecht 1993; Peyrony 1933). The earliest industries are split-based with distinctive haft widths and lengths (Peterkin 1993). Later examples are more simply lozenge-shaped and spindle-shaped, that do not have beveled ends. The earliest beveled-based hafts appear in the Gravettian assemblages (Knecht 1993; Pike-Tay & Bricker 1993). By the time of the Magdalenian in western Europe these implements were numerically very common in the archaeological record and the size ranges are remarkably consistent among the types with various bases (Peterkin 1993). The Clovis-aged specimens from North America although similar, do not include the split-based or lozenge-shaped bases. If the specimens from the Wizards Beach Clovis site in Nevada (Table 1) are made from mammoth ivory and bone, then the ranges of shape and size of the New World osseous tools are conspicuously similar to those from the Old World (see Haynes 2002). Amber or similar fossil resins have been found in eastern Upper Palaeolithic sites (e.g., Soffer 1985), and it seems likely that the use an adhesive can be traced from Clovis sites in North America to the European Upper Palaeolithic, and in doing so, add another shared cultural trait between Clovis and the Old World. The bone shaft straightener, or wrench, from the Murray Springs site has obvious similarities with the “bâton de commandement”, or “bâtons percés” from the Upper Palaeolithic Gravettian and Magdalenian, such as the examples from the Czech Republic and the Ukraine (see Augusta & Burian 1960;...
Boriskovsky 1958). Western European examples are similar in size but vary in shape, and often engraved. These European bâtons are generally thought of as shaft straighteners as well as having other uses too (Haynes 2002; Leroi-Gourhan 1957; Oakley 1982).

As yet there is no definite archaeological evidence of whether and how Clovis points were hafted. Perhaps with all the current work being carried out on the submerged sites in the southeast (e.g., Hemmings et al. 2004), and the work on the submerged landscapes on the eastern seaboard (e.g., Lowery et al. 2010) we might soon have direct evidence of hafting. Different hafting methods and techniques were perhaps employed on Clovis points of various shapes and sizes, and for varying functions (i.e., throwing spears, thrusting weapons, knives etc.). Indeed, this could go some way in explaining the variability within Clovis fluted points in North America (but see Buchanan et al. 2012).

Extensive evidence for the hafting of Clovis unifacial tools is present in the archaeological record, although it was originally thought that regular hafting by colonising hunter-gatherers and foragers would have decreased their toolkit portability (see Kuhn 1994; Morrow 1996). In the Great Lakes region of the Midcontinent of North America recent research supports the hypothesis of Clovis habitually hafting unifacial tools (Eren 2012). In this case, there is no reason to suggest that Clovis groups from elsewhere across North America, were not hafting Clovis fluted points as well.

References
Amick, D.S. 2017. Evolving views on the Pleistocene colonization of North America. Quaternary International, 431: 125-151. doi:10.1016/j.quaint.2015.12.030
Augusta, D.S., & Burian, Z. 1960. Prehistoric man. Paul Hamlyn, London, 45 p.
Beck, C.W. 1996. Comments on a supposed Clovis 'mastic'. Journal of Archaeological Science, 23: 459-460. doi:10.1006/jasc.1996.0041
Boldurian, A.T., & Cotter, J. 1999. Clovis revisited: New perspectives on Paleoindian adaptations from Blackwater Draw, New Mexico. University of Pennsylvania Museum Publications, Monograph Vol. 103. University of Pennsylvania, Philadelphia, 168 p.
Boriskovsky, P.I. 1958. Le Paléolithique de L'Ukraine. Annales du Service d'Information Géologique du Bureau de Recherches Géologiques, Géophysiques et Minieres Vol. 27. Bureau de Recherches Géologiques, Géophysiques et Miieres, Paris, 367 p. (in French) (“The Palaeolithic of the Ukraine”)
Bradley, B. 1995. Clovis ivory and bone tools. In: Le travail et l'usage de l'ivoire au paléolithique supérieur (Hahn, J., Menu, M., Taborin, Y., Walter, P., & Widemann, F., Eds.), Istituto poligrafico e Zecca dello Stato, Libreria dello Stato, Rome: p. 259-273.
Buchanan, B., & Hamilton, M.J. 2009. A formal test of the origins of variation in North American early Paleoindian projectile points. American Antiquity, 74(2): 279-298. doi:10.1017/S0002731600048605
Buchanan, B., Collard, M., Hamilton, M.J., & O'Brien, M.J. 2011. Points and prey: An evaluation of the hypothesis that prey size predicts early Paleoindian projectile point form. Journal of Archaeological Science, 38: 852-864. doi:10.1016/j.jasc.2010.11.007
Buchanan, B., O’Brien, M.J., & Collard, M. 2014. Continent-wide or region specific? A geometric morphometrics-based assessment of variation in Clovis point shape. Archaeological and Anthropological Sciences, 6(2): 145-162. doi:10.1007/s12520-013-0168-x
Buchanan, B., O'Brien, M.J, Kilby, D.J, Huckell, B.B., & Collard, M. 2012. An assessment of the impact of hafting on Paleoindian point variability. *PLoS ONE*, 7(5): e36364. doi:10.1371/journal.pone.0036364

Collins, M.B. 1999. *Clovis blade technology: A comparative study of the Keven Davis cache, Texas*. University of Texas Press, Austin. 248 p.

Copeland, J.M., & Fike, R.E. 1988. Fluted projectile points in Utah. *Utah Archaeology*, 1(1): 5-25.

Cotter, J.L. 1937. The occurrence of flints and extinct animals in pluvial deposits near Clovis, New Mexico, part IV: report on the excavations at the gravel pit in 1936. *Proceedings of the Philadelphia Academy of Natural Sciences*, 89: 1-16.

Cotter, J.L. 1954. Indications of a Paleo-Indian co-tradition for North America. *American Antiquity*, 20(1): 64-67. doi:10.2307/276722

Cressman, L.S. 1941. *Archaeological researches in the Northern Great Basin*. Carnegie Institution of Washington Publications 538. Washington, D.C., 628 p.

Cressman, L.S. 1956. Klamath prehistory: The prehistory of the culture of the Klamath Lake area, Oregon. *Transactions of the American Philosophical Society*, 46(4): 375-513. doi:10.2307/1005711

Dunbar, J.S. 1991. Resource orientation of Clovis and Suwannee age Paleoindian sites in Florida. In: *Clovis: Origins and Adaptations* (Bonnichsen, R., & Turnmire, K. Eds.), Center for the Study of the First Americans, Oregon State University, Corvallis: p. 185-214.

Dunbar, J.S., & Webb, D.S. 1996. Bone and ivory tools from submerged Paleoindian sites in Florida. In: *The Paleoindian and Early Archaic Southeast* (Anderson, D.G., & Sassman, K.E., Eds.), University of Alabama Press, Tuscaloosa: p. 331-353.

Dunbar, J.S., Webb, D.S., & Cring, D. 1989. Culturally and naturally modified bones from a Paleoindian site in the Aucilla River. In: *Bone Modification* (Bonnichsen, R., & Sorg, M., Eds.), Center for the Study of the First Americans, University of Maine, Orono: p. 473-497.

Eren, M.I. 2012. Were unifacial tools regularly hafted by Clovis foragers in the North American Lower Great Lakes region? An empirical test of edge class richness and attribute frequency among distal, proximal, and lateral tool-sections. *Journal of Ohio Archaeology*, 2: 1-15. URL: https://ohioarchaeology.org/journal-of-ohio-archaeology/52-volume-2-number-1-2012/361

Fagan, J.L. 1986. Western Clovis occupation in southcentral Oregon: Archaeological research at the Dietz site 1983 to 1985. *Current Research in the Pleistocene*, 3: 3-5. URL: http://csfa.tamu.edu/?page_id=834

Frison, G.C. 1982. The Sheaman site: A Clovis component. In: *The Agate Basin site: A record of Paleoindian occupation of the Northeastern High Plains* (Frison, G.C., & Stanford, D.J., Eds.), Academic Press, New York: p. 143-157.

Frison, G.C. 1989. Experimental use of Clovis weaponry and tools on African elephants. *American Antiquity*, 54(4): 766-784. doi:10.2307/280681

Frison, G.C. 1991a. *Prehistoric hunters of the High Plains* (2nd Edition), Academic Press, San Diego, 426 p.
Frison, G.C. 1991b. The Clovis cultural complex: New data from caches of flaked stone and worked bone artifacts. In: Raw material economies among prehistoric hunter-gatherers (Montet-White, A., & Holen, S., Eds.), University of Kansas Press, Lawrence, Kansas: p. 321-334.

Frison, G.C., and Bradley, B.A. 1999. The Fenn cache: Clovis weapons and tools. One Horse Land & Cattle Company, Santa Fe, New Mexico, 111 p.

Frison, G.C., & Stanford, D.J. (Eds.). 1982. Agate Basin site: A record of Paleoindian occupation of the Northeastern High Plains. Academic Press, New York, 430 p.

Gramly, M.R. 1991. Blood residues upon tools from the East Wenatchee Clovis site, Douglas County, Washington. Ohio Archaeologist, 41(4): 4-9.

Gramly, M.R. 1993. The Richey Clovis cache: Earliest Americans along the Columbia River. Persimmon Press, New York, 70 p.

Harrington, M.R. 1948. An ancient site at Borax Lake, California. Southwest Museum Papers Vol. 16, Southwest Museum, Los Angeles, 131 p.

Haynes, C.V. Jr. 1982. Were Clovis progenitors in Beringia? In: Paleoecology of Beringia (Hopkins, D.M., Mathews, J.V., Schweger, C.E., & Young, S.B., Eds.), Academic Press, New York: p. 383-398.

Haynes, C.V. Jr., & Hemmings, E.T. 1968. Mammoth-bone shaft wrench from Murray Springs, Arizona. Science, 159: 186-187. doi:10.1126/science.159.3811.186

Haynes, G.D. 2002. The early settlement of North America: The Clovis era. Cambridge University Press, New York, 360 p.

Haynes, G.D., Anderson, G., Ferring, C.R., Fiedel, S.J., Grayson, D.K., Haynes, C.V. Jr., Holliday, V.T., Huckell, B.B., Kornfeld, M., Meltzer, D.J., Morrow, J.E., Surovell, T.A., Waguespack, N.M., Wigand, P., & Yohe, R.M. II. 2007. Comment on “Redefining the age of Clovis: Implications for the peopling of the Americas”. Science, 317: 320. doi:10.1126/science.1141960

Hemmings, C.A. 2004. The Organic Clovis: A Single Continent-wide Cultural Adaptation. Ph.D. dissertation at the Department of Anthropology, University of Florida, Gainesville, 335 p.

Hemmings, C.A., Dunbar, J.S., & Webb, S.D. 2004. Florida's early Paleoindian bone and ivory tools. In: New perspectives on the first Americans (Lepper, B.T., & Bonnichsen, R., Eds.), Center for the Study of the First Americans, Texas A&M University, College Station: p. 87-92.

Hester, J.J. 1972. Blackwater Draw locality no. 1. Fort Burgwin Research Center SMU, Rancho de Taos, 239 p.

Holen, S.R. 2004. Long-distance movement of a Clovis obsidian projectile point. Current Research in the Pleistocene, 21: 44-45. URL: http://csfa.tamu.edu/?page_id=834

Howard, C.D. 1990. The Clovis point: Characteristics and type description. Plains Anthropologist, 35(129): 255-262. doi:10.1080/2052546.1990.11909542

Hughes, R.E. 2008. Energy dispersive X-ray fluorescence analysis of a Clovis point from Seagull Bay (10PR89), American Falls Reservoir, Power County, Idaho. Geochemical Research Laboratory Letter Reports 2008-4. Portola Valley, CA, number of pages forgotten.
Jenks, A.E., & Simpson, H.H. 1941. Beveled artifacts in Florida of the same type as artifacts found near Clovis, New Mexico. *American Antiquity*, 6(4): 314-319. doi:10.2381/275921

Jones, S., & Bonnichsen, R. 1994. The Anzick Clovis burial. *Current Research in the Pleistocene*, 11: 42-44. URL: http://csfa.tamu.edu/?page_id=834

Judge, W.J. 1973. *Paleoindian occupation of the central Rio Grande Valley in New Mexico*. University of New Mexico Press, Albuquerque, 361 p.

Keeley, L.H. 1982. Hafting and retooling: Effects on the archaeological record. *American Antiquity*, 47(4): 798-809. doi:10.2307/280285

Knecht, H. 1993. Early Upper Palaeolithic approaches to bone and antler projectile technology. In: *Hunting and animal exploitation in the later Palaeolithic and Mesolithic of Eurasia* (Peterkin, G.L., Bricker, H.M., & Mellars, P., Eds.), Archaeological Papers of the American Anthropological Association Vol. 4., American Anthropological Association, Arlington, Virginia: p. 33-47.

Kuhn, S.I. 1994. A formal approach to the design and assembly of mobile tool kits. *American Antiquity*, 59(3): 426-442. doi:10.2307/282456

Lahren, L., & Bonnichsen, R. 1974. Bone foreshafts from a Clovis burial in southwestern Montana. *Science*, 186: 147-150. doi:10.1126/science.186.4159.147

Leroi-Gourhan, A. 1957. *Prehistoric man*. Philosophical Library, New York, 121 p.

Lowery, D., O’Neal, M.A., Wah, J.S., Wagner, D.P., & Stanford, D.J. 2010. Late Pleistocene upland stratigraphy of the western Delmarva Peninsula, USA. *Quaternary Science Reviews*, 29(11-12): 1472-1480. doi:10.1016/j.quascirev.2010.03.007

Lyman, R.E., & O’Brien, M.J. 1999. Prehistoric osseous rods from North America: Arguments on function. *North American Archaeologist*, 20(4): 347-364.

Lyman, R.E., O’Brien, M.J., & Hayes, V. 1998. A mechanical and functional study of the bone rods from the Richey-Roberts Clovis cache, Washington, U.S.A. *Journal of Archaeological Science*, 25: 887-906. doi:10.1006/jasc.1997.0270

Miller, S.D., Holliday, V.T., & Bright, J. 2013. Clovis across the continent. In: *The Paleoamerican Odyssey* (Graf, K.E., Ketron, C.V., & Waters, M.R., Eds.), Texas A&M University Press, College Station, Texas: p. 207-220.

Morrow, T.M. 1996. Bigger is better: Comments on Kuhn's formal approach to mobile tool kits. *American Antiquity*, 61(3): 581-590. doi:10.2307/281842

Morrow, J.E., & Morrow, T.A. 1999. Geographic variation in fluted projectile points: a hemispheric perspective. *American Antiquity*, 64(2): 215-231. doi:10.2307/2694275

Musil, R.R. 1998. Functional efficiency and technological change: a hafting tradition model for prehistoric America. In: *Early human occupation in far western North America: The Clovis-Archaic interface* (Willig, A., Aikens, C.M., & Fagan, J.J., Eds.), Anthropological Papers Vol. 21, Nevada State Museum, Carson City, Nevada: p. 373-387.

O'Grady, P., Thomas, S.P., & Rondeau, M.F. 2009. Recent flute-point finds in eastern Oregon. *Current Research in the Pleistocene*, 26: 100-102. URL: http://csfa.tamu.edu/?page_id=834

Oakley, K.P. 1982. *Man the Tool-Maker*. University of Chicago Press, Chicago, 159 p.
Ozbun, T.L., & Fagan, J.L. 1996. *Archaeological testing and evaluation of the Seneca Clovis site (35DO634)*. Archaeological Investigations Northwest, Inc. Report No. 102. Bureau of Land Management, Roseburg, Oregon, number of pages forgotten.

Pearson, G.A. 1999. North American Paleoinindian bi-beveled bone and ivory rods: A new interpretation. *North American Archaeologist*, 20(2): 81-103. doi:10.2190/3H6Q-5Y0R-Y1JU-FLPW

Peterkin, G.I. 1993. Lithic and organic hunting technology in the French Upper Palaeolithic. In: *Hunting and animal exploitation in the later Palaeolithic and Mesolithic of Eurasia* (Peterkin, G.I., Bricker, H.M., & Mellars, P., Eds.), Archaeological Papers of the American Anthropological Association Vol. 4, American Anthropological Association, Arlington, Virginia: p. 49-67.

Peyrony, D. 1933. Les industries “aurignaciennes” dans le bassin de la Vézère. *Bulletin Société Préhistorique Française*, 30: 543-559. (in French) (“The Aurignacian Industries from the Vezere Basin”) doi:10.3406/bspf.1933.6793

Pike-Tay, A., & Bricker, H.M. 1993. Hunting in the Gravettian: An examination of evidence from southwestern France. In: *Hunting and animal exploitation in the later Palaeolithic and Mesolithic of Eurasia* (Peterkin, G.I., Bricker, H.M., & Mellars, P., Eds.), Archaeological Papers of the American Anthropological Association Vol. 4, American Anthropological Association, Arlington, Virginia: p. 127-143. doi:10.1525/ap3a.1993.4.1.127

Prascianus, M.M. 2011. Mapping Clovis: Projectile points, behaviour, and bias. *American Antiquity*, 76(1): 107-126. doi:10.7183/0002-7316.76.1.107

Reid, K.C., Root, M.J., & Hughes, R.E. 2008. The Copper Creek Clovis point from Hells Canyon, northeastern Oregon. *Journal of Californian and Great Basin Anthropology*, 28(1): 75-84. URL: http://www.jstor.org/stable/27825877

Rendall, D.L. 1966. A barbed antler point found at Pyramid Lake, Nevada. *American Antiquity*, 31(5): 740-742. doi:10.2307/2694501

Riddell, F.A. 1973. Fossilized California bone artifacts. *The Masterkey*, 47: 28-32.

Reid, K.C., Hughes, R.E., Root, M.J., & Rondeau, M.F. 2015. Clovis in Idaho: An update on its distribution, technology, and chronology. In: *Clovis: On the edge of a new understanding* (Smallwood, A.M., & Jennings, T.A., Eds.), Texas A&M Press, College Station: p. 53-81.

Rondeau, M.F. 2006. *Analysis of the Poker Brown fluted point base from Pershing County, Nevada*. CalFluted Research Report No. 28. Rondeau Archaeological, Sacramento, number of pages forgotten.

Rondeau, M.F. 2008. *Additional studies on the Dietz site fluted points and associated bifaces, Lake County, Oregon*. CalFLUTED Research Report 39, Rondeau Archeological, Sacramento, number of pages forgotten.

Rondeau, M.F. 2009a. *The analysis of two fluted point casts from the Hoyt Site, Lake County, Oregon*. CalFLUTED Research Report 59. Rondeau Archeological, Sacramento, number of pages forgotten.

Rondeau, M.F. 2009b. *Fluted specimens from the Hoyt site, Oregon*. CalFLUTED Research Report 63. Rondeau Archeological, Sacramento, number of pages forgotten.
Rondeau, M.F. 2009c. The Shell Rock Butte fluted point, Vale BLM district, Malheur County, Oregon. CalFLUTED Research Report 72. Rondeau Archeological, Sacramento, number of pages forgotten.

Rondeau, M.F., & Temple, C.R. 2010. The Shell Rock Butte fluted point, Malheur County, Oregon. Current Research in the Pleistocene, 27: 134-136. URL: http://csfa.tamu.edu/?page_id=834

Saunders, J.J., & Daeschler, E.B. 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. URL: https://www.jstor.org/stable/4064981

Sellet, F. 2015. A fresh look at the age and cultural affiliation of the Sheaaman site. PaleoAmerica, 1(1): 81-87. doi:10.1179/2055556314Z.0000000009

Slade, A.M. 2010. Clovis: What’s the point? A study in thick-bodied and thin-bodied fluted point variability. Master’s dissertation at the Department of Archaeology, University of Southampton, Southampton, 84 p. URL: https://www.academia.edu/3602456/

Slade, A.M. (2016). To haft and to hold: Evidence for the hafting of Clovis fluted points. presented at the Immersed in Lithics Conference 2016, University of Manchester, and Manchester Museum, Manchester.

Slade, A.M. 2017. The Centre for the Archaeology of Human Origins (CAHO) Paleoindian Cast Collection. Manuscript on file in University of Southampton, Department of Archaeology, Southampton, number of pages forgotten.

Slade, A.M. 2018. Is there a regional variability within Clovis fluted points?: A study of lithic raw material selection and analysis of basal concavity shape. M.Phil. thesis at the University of Southampton, Southampton, p. 241.

Soffer, O.A. 1985. The Upper Palaeolithic of the Central Russian Plain. Academic Press, New York, 539 p.

Stanford, D.J. 1991. Clovis origins and adaptations: An introductory perspective. In: Clovis: Origins and adaptations (Bonnichsen, R., & Turmire, K.I., Eds.), Center for the Study of the First Americans, Corvallis: p. 1-13.

Stanford, D.J. 1996. Foreshaft sockets as possible Clovis hafting devices. Current Research in the Pleistocene, 13: 44-46. URL: http://csfa.tamu.edu/?page_id=834

Stanford, D.J., & Jodry, M. 1988. The Drake Clovis cache. Current Research in the Pleistocene, 5: 21-22. URL: http://csfa.tamu.edu/?page_id=834

Sutton, M.Q., & Wilke, P.J. 1984. New observations on a Clovis point from the Central Mojave Desert, California. Journal of California and Great Basin Anthropology, 6(1): 113-115. URL: http://www.jstor.org/stable/27825174

Tankersley, K.B. 1994. Clovis mastic and its hafting implications. Journal of Archaeological Science, 21: 117-124. doi:10.1006/jasc.1994.1012

Tankersley, K.B. 1996. Archaeological paradigms, provincialism, and semantics: A reply to Beck's comments. Journal of Archaeological Science, 23: 455-458. doi:10.1006/jasc.1996.0040
Tankersley, K.B. 1997. Sheridan: A Clovis site in eastern North America. *Geoarchaeology, 12*(6): 713-724. doi:10.1002/(SICI)1520-6548(199709)12:6<713::AID-GEA9>3.0.CO;2-1

Taylor, D.C. 1969. The Wilsall excavations: An exercise in frustration. *Proceedings of the Montana Academy of Science, 29*: 147-150.

Thomas, S.P., O'Grady, P.W., & Rondeau, M.F. 2011. New finds and related obsidian studies at the Sage Hen Gap fluted-point site, Harney County, Oregon. *Current Research in the Pleistocene, 28*: 89-91. URL: http://csfa.tamu.edu/?page_id=834

Waters, M.R., & Stafford, T.W. 2007. Redefining the age of Clovis: Implications for the peopling of the Americas. *Science, 315*: 1122-1126. doi:10.1126/science.1137166

Waters, M.R., Pevney, C.D., & Carlson, D.L. 2011. *Clovis lithic technology: Investigation of a stratified workshop at the Gault Site, Texas*. Texas A&M University Press, College Station, 256 p.

Wilke, P., Flenniken, J., Jeffrey, J., & Ozbun, T. 1991. Clovis technology at the Anzick site, Montana. *Journal of California and Great Basin Anthropology, 13*(2): 242-272. URL: http://www.jstor.org/stable/27825463

Wilmeth, R. 1968. A fossilized bone artifact from southern Saskatchewan. *American Antiquity, 33*(1): 100-101. doi:10.2307/277780

Wilmsen, E.N., & Robert, F.H.H. 1978. *Lindenmeier, 1934-1974: Concluding report on investigations*. Smithsonian Contributions to Anthropology Vol. 24. Smithsonian Institution, Washington, D.C., 188 p. doi:10.5479/si.00810223.24.1

Wormington, H.M. 1957. *Ancient man in North America*. 4th Edition. The Denver Museum of Natural History Popular Series No. 4. Denver, 322 p.

Yesner, D.R. 1994. Subsistence diversity and hunter-gatherer strategies in late Pleistocene / early Holocene Beringia: Evidence from the Broken Mammoth site, Big Delta, Alaska. *Current Research in the Pleistocene, 11*: 154-156. URL: http://csfa.tamu.edu/?page_id=834