CURRENT RESEARCH IN THE PLEISTOCENE

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A Peopling of the Americas Publication

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From the Editor

Each year since 1984 *Current Research in the Pleistocene* has published a broad mix of papers dealing with everything Quaternary. Volume 22 of *CRP* is no different. This issue of the journal contains 39 excellent papers covering the fields of archaeology, paleontology, paleobotany, and geosciences, from regions as diverse as the Caribbean coast of Venezuela and the desert mountains of central Asia. For their help in reviewing the papers presented in this volume, we wish to thank the following members of our review board: David Anderson, Daniel Fisher, Bradley Lepper, Thomas Stafford, Luis Borrero, Gary Haynes, and Sergei Slobodin.

With this volume of *CRP*, we are delighted to present a small group of "Special Focus" papers that focus on the theme "Paleolithic Humans of the Siberian Mammoth-Steppe." Some of these papers present new archaeological discoveries in northern Asia, while others focus on the human paleoecology of the mammoth-steppe. How did humans adapt to dramatic climatic oscillations during the late glacial, 14,000–10,000 RCYBP? Did human populations abandon Siberia during the Last Glacial Maximum, 19,000–18,000 RCYBP? When did microblade technologies emerge in the region? These are just some of the questions touched upon by these papers.

For Volume 23, the Special Focus section will be "New Developments in the Paleolithic of Japan." We are soliciting manuscripts that present new research results as well as reappraisals of previously investigated archaeological sites (in light of the recent Fujimura scandal). Although we are especially interested in receiving papers dealing with the Lower and Middle Paleolithic of Japan, papers on the Upper Paleolithic will also be considered for publication.

For Volume 24, we plan on soliciting manuscripts with a special focus on paleoclimates and paleoenvironments of the late Glacial. We are especially interested in the following questions: How are millennial-scale global climatic oscillations during the late glacial expressed in various regional proxy records? How did such oscillations impact human populations? Authors wishing to present new evidence of late-Glacial climates and environments, or regional syntheses of climate, environmental, and human adaptive change are welcome to submit manuscripts. Please contact the *CRP* Editor **(goebel@unr.edu)** for more information regarding these Special Focus sections.

Starting with the current volume, *CRP* is reviewing manuscripts electronically. From now on, we ask that authors submit manuscripts, figures, and tables via e-mail to address **csfa@tamu.edu** We prefer that manuscripts be in Microsoft Word or WordPerfect format for PC; Macintosh files should be saved so that they can be imported into one of these word-processing programs. Tables should be similarly submitted, while figures should be submitted in .JPG or .TIF format. For more information please visit the *CRP* Web site at **http://www.centerfirstamericans.com//**

Ted Goebel

Special Focus: Paleolithic Humans of the Siberian Mammoth-Steppe

Some Results of Fieldwork in Central Primorye

Alla V. Garkovik, Oleg S. Galaktionov, and Igor Iu. Sleptsov

Since 1997 systematic reconnaissance surveys have been carried out in the Arsenyevka River Valley by personnel of the Laboratory of Archaeology of Stone and Paleometal Epochs, Institute of History and Archaeology, Far Eastern Branch of the Russian Academy of Science. By the time of this writing, these surveys have led to the discovery of more than 70 archaeological sites assignable to various cultural-historical periods.

In the 2004 field season we carried out investigations of sites located near the village of Shekliaevo, including Shekliaevo 6, 7, and 16. These were discovered by N. A. Kliuev in 1999 and 2003. The sites are located close to each other on a southern extremity of an eastern spur of a range of hills flanking the boggy valley of the Arsenyevka River, 2 km northeast of Shekliaevo village. Shekliaevo 7 is assignable to the Neolithic and Iron Age and therefore is not considered further in this paper. Shekliaevo 6 and Shekliaevo 16, however, contain remains potentially assignable to the Upper Paleolithic. We discuss these two sites below in more detail.

Shekliaevo 6 occupies a gentle slope of a spur of a hill, the southern edge of which sharply breaks down to the marshy valley of the Arsenyevka River. To the east the hill connects to a small mountain upon which Shekliaevo 7 is situated. The two sites are divided by a ravine. Excavations reaching 16 m^2 exposed a buried cultural layer reaching 45–55 cm in thickness. Stratigraphy is described, from the top down, as humus, brown loam, light brown loam, and grayish yellow loam. The greatest quantity of finds are connected to the bottom part of the brown and the grayish yellow loams. As a result of the excavation, 380 artifacts were found. Most of these are made from stone, except for 11 small undecorated potsherds. All the latter occur in the upper layer.

Stone artifacts from Shekliaevo 6 were made mainly from light tuff and black obsidian. Some artifacts have attributes connecting them to microblade technology: the presence of microcores and boat-shaped artifacts, various core-rejuvenation removals and microblades, as well as microspalls, micro-flakes, and flakes produced by bipolar technique. Among the stone artifacts are two artifacts unusual to microblade complexes. One of them we interpret

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to represent the image of a man (a mask) on a flat pebble of light brown fine-grained sandstone. The pebble has a triangle-like shape. Its eyes, mouth, and nose are represented by the knocking out of small triangles. Two parallel grooves on the back side of the pebble (which has traces of polishing) probably represent elements of a hairdress. The second unusual piece is a pebble of light gray sandstone with a hole in the middle. It looks like a small vessel with a conical form. Traces of some treatment are visible on the inner surface. Most likely both these artifacts relate to some kind of ancient cult.

At Shekliaevo 16 the primary task of our field work has been to search for and determine the borders of a buried cultural layer. For this purpose a coordinate grid was broken into 1-by-1-m squares, and then a sample of these was excavated. Excavations reached 33 m^2 and focused on the southeast part of site. As a result of this work it was established that sediments are divisible into several horizons of loams of various colors: humus, brown loam, reddish brown loam, and light grayish yellow loam. Cultural remains were contained within light grayish yellow loam. Results of testing show that this horizon was preserved in all areas of the site. Its thickness varies from 4 to 45 cm. As a result of the excavation only 36 artifacts were found. All of them are made from stone and include an amorphous core and a removal from the front of an obsidian microcore, as well as small flakes, spalls, and splinters from gray-green flint and black obsidian.

As a result of the archaeological research near Shekliaevo village in Central Primorye, the following conclusions can be made. At Shekliaevo 6 the new microblade complex can be preliminarily assigned to the late-Paleolithic period. Interesting features include a possible mask and stone vessel. At Shekliaevo 16 a poorly preserved cultural horizon has been exposed. It contains material with some features that preliminarily enable us to attribute it to the final stages of the late Paleolithic.

Abandonment of the Siberian Mammoth-Steppe during the LGM: Evidence from the Calibration of ^{14}C-dated Archaeological Occupations

Kelly E. Graf

During the late Pleistocene arctic conditions (i.e., permafrost, summer temperatures < 10°C) in Eurasia extended farther south than today, as far south as 50° N latitude across Asia (Baulin and Danilova 1984; Velichko 1984; Vorob'eva and Medvedev 1984; Zykina 2003). Climate during this time was extremely continental and cold, producing a treeless holarctic biome that

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sustained large populations of herbivorous fauna, a special biome referred to as the mammoth-steppe (Guthrie 1990, 2001). Was the mammoth-steppe of Siberia so harsh that humans abandoned it during the Last Glacial Maximum (LGM)? The current paper addresses this issue by presenting calibrations of 122 ^{14}C-dated occupations from 72 sites across Siberia. Published ^{14}C dates (Goebel 2004; Vasil'ev et al. 2002) were averaged by calculating a weighted mean for each occupation layer. Aberrant dates (that did not overlap other more consistent dates at two-sigma) were not used in the calculations. Next, averaged dates were calibrated using "CalPal-Beyond the Ghost" calibration software (Weninger et al. 2004). Results are summarized in Figure 1.

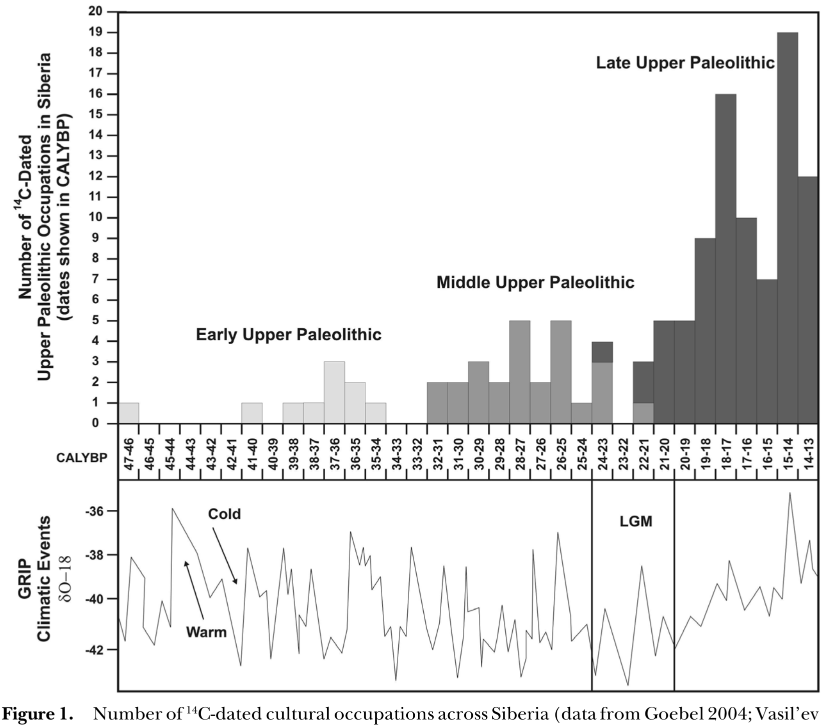

Figure 1. Number of ^{14}C-dated cultural occupations across Siberia (data from Goebel 2004; Vasil'ev et al. 2002), presented in CALYBP, alongside the Summit GRIP Oxygen Isotope Curve showing warm and cold oscillations during the last third of the Upper Pleistocene (Johnsen et al. 2001).

Sustained colonization of the Siberian mammoth-steppe did not occur until after 32,000 CALYBP, coincidental with the emergence of middle Upper Paleolithic (MUP) archaeological assemblages. MUP foragers may have explored the far north of Siberia during this time (Pitulko et al. 2004), and their occupation of southern Siberia lasted nearly 8,000 years, to about 23,500 CALYBP—the beginning of the LGM.

During the LGM, roughly 24,000–19,000 CALYBP (20,000–18,000 RCYBP) (Bowen et al. 2002; Johnsen et al. 2001; Owen et al. 2002; Yokoyama et al. 2000), large ice sheets expanded across northwestern Eurasia, environmental conditions were extremely harsh, and large mammal populations declined (Guthrie 2003; Svendsen et al. 2004). LGM-dated Siberian sites are rare, perhaps suggesting abandonment of the north by humans (Goebel 1999). In fact, no sites in Siberia can be unequivocally shown to date to between 23,000 and 22,000 CALYBP. Not surprisingly, this time corresponds to possibly the coldest 1,000-year interval of the late Upper Pleistocene (Figure 1). Some researchers (Kuzmin and Orlova 1998; Vasil'ev 1992; Vasil'ev et al. 2002), however, argue that the apparent decline in site densities is a sampling problem and that there is sufficient evidence indicating continued human settlement of Siberia during the LGM.

As climate ameliorated after 19,000 CALYBP, late Upper Paleolithic (LUP) foragers using new microblade technology recolonized the region and rapidly spread north and east into the Arctic (above 65°N), reaching areas previously unexplored by humans such as Alaska and eventually the Americas by 14,000 CALYBP (Dolukhanov et al. 2002; Goebel 1999; Vasil'ev et al. 2002; Yesner 2001).

Calibration of ^{14}C-dated Siberian Upper Paleolithic occupations suggests that the mammoth-steppe was first colonized by MUP peoples by about 31,000 CALYBP. MUP peoples rapidly adapted to this continental biome; however, extreme conditions of the mammoth-steppe during the LGM drove humans south to totally abandon the region (between ca. 23,000 and 21,500 CALYBP). During deglaciation after 19,000 CALYBP, the mammoth-steppe was recolonized by LUP humans who developed a successful arctic adaptation as they spread north into Beringia and the Americas.

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Characterizing the Bølling, Middle Dryas, and Allerød in the Transbaikal, Siberia

Mikhail V. Konstantinov

Through joint efforts Quaternary scientists have shown clearly that the late glacial (15,000–10,000 RCYBP) was a period of rapid and dramatic climate change. In the paleoclimatic scheme of western Eurasia, during the late Würm there were two periods of warming (Bølling and Allerød) with a brief intervening period of cooling (Middle Dryas). In North America there are two similarly aged interstadials called the Two-Creeks and Wallers. In Siberia, emerging evidence from different regions has also identified two warming periods during the late Sartan, called the Kokorevo and Taimyr interstadials. Between

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them is recognized a brief, unnamed stadial. In the Transbaikal region of southeast Siberia, geological deposits assignable to the late glacial occur in colluvial deposits of the second terrace of the Chikoi River, a major tributary of Lake Baikal. In this paper I briefly review these geological deposits, as they have been found at the Transbaikal Upper Paleolithic sites of Ust'-Menza-2, Ust'-Menza-4, and Studenoe 2 (Konstantinov 1994).

At Ust'-Menza-2, Ust'-Menza-4, and Studenoe 2, late-glacial deposits consist of a series of three 8- to 10-cm-thick bands of sandy loam. The lowermost and uppermost bands are brown to light reddish brown in color and bear distinct dark brown weakly humified stains. They represent a warming event and have been ^{14}C dated to 12,800–12,200 RCYBP and 11,800–10,800 RCYBP, respectively. The middle band is light brown to yellow in color, more homogeneous, and ^{14}C dated to 12,000–11,800 RCYBP. It represents a brief period of cooling. We assign the lower band to the Bølling, the middle band to the Middle Dryas, and the upper band to the Allerød.

A fundamental complication in isolating these three bands, however, is the weak differentiation of colors between the bands, as well as comparing them with lower-lying and above-lying sandy loam deposits that correspondingly are assignable to the Early Dryas (a prolonged period of cold at the beginning of the Sartan glacial epoch) and Younger Dryas (known in Siberia as the Noril'sk stadial). Both Early Dryas and Younger Dryas deposits are cut by ice-wedge pseudomorphs. Frost cracks and ice-wedge pseudomorphs are very important and elementary stratigraphic markers that occur at the base of the Younger Dryas deposits. These cut through both the "warm" and "cold" bands assigned to the Bølling, Middle Dryas, and Allerød episodes, and even penetrate into the lower-lying deposits of the Early Dryas.

Extensive archaeological assemblages have been recovered from the Bølling, Middle Dryas, and Allerød deposits at Ust'-Menza-2, Ust'-Menza-4, and Studenoe 2. In the lower "warm" (Bølling) band have been found dwellings of cultural horizon 3 at Studenoe 2. In the middle "cold" (Middle Dryas) band are the dwellings of cultural horizon 4 at Ust'-Menza-2. In the upper "warm" (Allerød) band are dwellings of cultural horizon 2 at Ust'-Menza-4. At all three sites, these dwellings are outlined by rings of boulders and contain one to three hearths within their interior spaces (Konstantinov 2002). Associated lithic assemblages are characterized by end (*tortsovyi*) microblade cores, microblades, choppers, orthogonal cores (large cores for flakes), side-scrapers, chisel-like tools (*pièces esquillées*), and other tools. Faunal remains are dominated by bones of deer.

In order to confirm and further clarify this late-glacial chronology, we require additional ^{14}C dates, paleopedological analyses, and palynological analyses. Our work at the sites of the Chikoi River will continue with this goal in mind.

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Timing of the Origin of Microblade Technology in the Russian Far East: Chronology of the Khodulikha 2 Upper Paleolithic Site

Yaroslav V. Kuzmin, Vladimir G. Petrov, and Kim Jong-Chan

The origin of microblade technology is an important event in the development of the Upper Paleolithic stone industries in northern Asia and North America (Elston and Kuhn 2002; Kimura 1993). In the Russian Far East, the earliest sites with definite microblades and wedge-shaped cores, such as Ust'-Ul'ma 1 in the Selemdzha River basin (Derevianko and Zenin 1995; Derevianko 1996) and Ogonki 5 on Sakhalin Island (Vasilevski 2003), were ^{14}C-dated to ca. 19,400–17,900 RCYBP (Kuzmin 2001; Kuzmin et al. 2004). New data related to the origin of microblade manufacture were obtained at the Khodulihka 2 site in 1999–2000. AMS ^{14}C dating of this site was conducted in 2003 at Seoul National University, Inter-University Center for Natural Science Research Facilities (Lab Code SNU).

The Khodulikha 2 site is situated in the central part of the Amur River basin (50° 40′ N latitude; 127° 20′ E longitude), 50 km northeast of the city of Blagoveshchensk, on the terrace of the Amur River 40 m above the water level. Two cultural layers are located in "covering" loam sediments up to 2 m thick, above alluvial sands and pebbles of middle-Pleistocene age. Total thickness of the cultural deposits is up to 1.2 m. The entire excavation area is 130 m^2; a test trench 1 m wide and 48 m long was also dug down the slope to investigate the composition of the river terrace.

In cultural layer 1 (the upper cultural layer of the site), 3,370 stone artifacts were excavated. The major part of this assemblage is debitage (3,136 items, or 93.1 percent); 49 cores, 7 end (*tortsovyi*) microcores, and 55 microblades were found in this layer. The microcores are boat shaped with a wide striking platform. Two bifacial preforms for end microcores were also found. Tools (123 specimens) are represented mainly by scrapers, burins, skreblos, bifaces, knives, borers, axes, chopping tools, and retouched flakes. A sample for ^{14}C dating was collected from a small concentration of charcoal in grid E-11, at a depth of 0.60 m below the surface; it yielded a date of 16,460 ± 170 RCYBP (SNU03-366).

In cultural layer 2 (the lower cultural layer), only 37 stone artifacts were found, mainly flakes (32 items), and also 3 cores, one knife, and one plane. No microblades or microcores were observed. A sample for ^{14}C dating was col-

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lected from a small concentration of charcoal in grid N-11 at a depth of 0.70 m and dated to 22,530 ± 320 RCYBP (SNU03-365).

Analysis of stone-tool typology shows that cultural layer 1 of the Khodulikha 2 site corresponds to the second complex of the Upper Paleolithic of the Selemdzha River basin, which is characterized by typical microblades and wedge-shaped cores and provisionally dated to older than ca. 14,000–13,000 RCYBP (Derevianko et al. 1998:49). Cultural layer 2 may be correlated to the fourth complex of the Selemdzha River basin, which has been estimated to be as old as ca. 25,000–23,000 RCYBP (Derevianko et al. 1998:50). Also, the ^{14}C date of ca. 16,500 RCYBP for Khodulikha 2 falls within a major hiatus in the Paleolithic chronology of the Middle Amur River basin spanning from 19,400 RCYBP (Ust'-Ul'ma 1) to 14,200–10,500 RCYBP (Malye Kuruktachi) (Kuzmin 2001).

Obvious doubt has recently been expressed about the reliability of the single conventional (i.e., non-AMS) ^{14}C date of ca. 19,400 RCYBP from the shallow context (depth of 0.60 m) of layer 2b of Ust'-Ul'ma 1, which was produced in Novosibirsk, Russia, from a combined charcoal sample (Goebel 2002:121). However, the original excavators (Derevianko and Zenin 1995) of Ust'-Ul'ma 1 clearly indicated that this charcoal came from a single concentration of charcoal in a pit of ca. 670 m^2 in a secure stratigraphic context. Almost all the Upper Paleolithic sites in the Russian Far East are located in shallow sedimentary contexts, usually less than 1 m deep, in colluvial deposits on the surface of low river terraces (Kuzmin 1992, 2003). We are confident about the reliability of this conventional ^{14}C date associated with the earliest microblades in the Russian Far East.

With the new ^{14}C dates for Khodulikha 2, we can provisionally estimate the appearance of microblade technology in the mainland Russian Far East as between ca. 22,500 RCYBP and ca. 19,400 RCYBP, certainly before the Last Glacial Maximum (ca. 20,000-18,000 RCYBP).

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Kuilug-Khem 1: A New Paleolithic Cave Site in Tuva (South Siberia, Russia)

Vladimir A. Semenov, Sergey A. Vasil'ev, Ganna I. Zaitseva, Marina E. Kilunovskaya, and Alexey K. Kasparov

In 2004, a second season of archaeological field work was conducted at the Kuilug-Khem 1 rockshelter, a deeply stratified Stone Age site in Tuva, southern Siberia. The site is situated on the right bank of Kuilug-Khem, a small right tributary of the Yenisei River (51° 69′ N latitude, 92° 58′ E longitude; elev. 1,019 m) (Figure 1). The river valley is located near the northern edge of the vast Ulug-Khem Depression in the Kurtushibinsky Mountains, the southernmost mountain range of the Western Sayan. The site consists of an oval-shaped grotto (the chamber measures 5 m by 3.8 m and up to 2.3 m high) and a flat entrance area oriented in a north-south direction 26 m long and up to 8 m wide. The excavations revealed 2 m of culture-bearing sediments with Neolithic (components 1 and 2) and Upper Paleolithic (components 3 to 5) strata.

The site is the first stratified Upper Paleolithic occurrence discovered in this part of Central Asia. Only surface scatters had been explored in Tuva before (Astakhov 1986). The upper components (layers 1 and 2) yielded comb-stamped ceramics, concave-based stone arrow points, inserts, and steep scrapers. Faunal remains are represented by roe deer, Siberian ibex, yak, and

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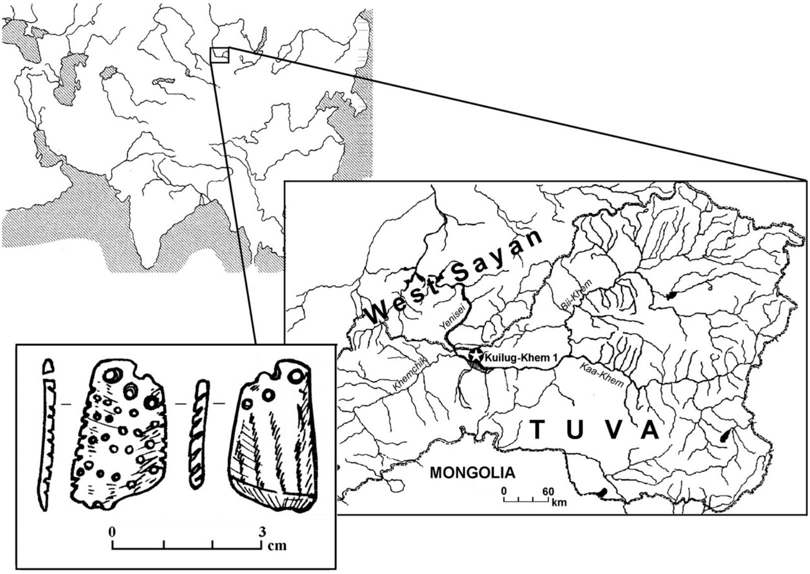

Figure 1. Location map of Kuilug-Khem 1 rockshelter and the bone pendant from layer 5.

rodents. The assemblage belongs to the Neolithic Upper Yenisei Culture identified by the senior author (Semenov 1992; Vasil'ev and Semenov 1993).

The Pleistocene components are separated from overlying strata by a compact chalky layer. Layer 3 yielded numerous bone splinters in association with a microblade industry and large scrapers serving to work hide and wood. The layer 4 component yielded rich faunal remains belonging to bison, Asiatic wild ass, Siberian ibex, and rodents, while lithic artifacts are represented by a handful of bladelets. Bone samples produced a date of 15,500 ± 180 RCYBP (LE-6901) for layer 3 and 23,600 ± 400 RCYBP (LE-6899) for the underlying layer 4.

The lowermost layer 5 produced abundant bones (ibex or wild sheep, Asiatic wild ass, bear, pika, etc.) and lithics (large side scrapers, blades, and flakes). It is worth mentioning a unique bone pendant 3 cm long and 1.7 cm wide. There are three holes in the upper part of the artifact. The surface is covered by pits, while the margins bear traces of short incisions. Curiously, this kind of decoration is similar to ornamented pieces from Mal'ta, the famous middle Upper Paleolithic site of Siberia (Abramova 1967).

Only an area of 10 m^2 has so far been excavated during two years of testing. Future archaeological work at Kuilug-Khem 1 will provide a temporal and environmental framework for the Stone Age record of this poorly explored area.

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Geochemistry of Volcanic Glasses and Sources of Archaeological Obsidian on the Kamchatka Peninsula (Russian Far East): First Results

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Assigning obsidian artifacts to their geologic sources using analytical chemistry techniques is one of the best methods available for establishing prehistoric patterns of trade, exchange, and interaction. In northeast Asia, significant progress in this field has been achieved in Japan (Hall and Kimura 2002; Suzuki 1970; Yamamoto 1990), and more recently in the Russian Far East (Kuzmin et al. 2002a, 2002b). However, on the Kamchatka Peninsula no systematic collections or geochemical analyses of obsidian have taken place.

The Kamchatka Peninsula, situated in far eastern Russia, spans a region of approximately 400 by 1200 km. Located at the boundary between the Pacific and Eurasian plates, Kamchatka is one of the most active volcanic arcs in the world. Consequently, there are many obsidian sources, and approximately 800 archaeological sites with obsidian tools and debitage are known to exist. Source determination of artifacts will give us a better understanding of the prehistoric movement of people and artifacts in this region, and will contribute to the ongoing dialogue of the role that this area played in the colonization of Beringia and the Americas (Goebel et al. 2003).

In 2003, a joint University of Missouri and Russian Academy of Sciences collaborative research project was initiated to identify sources of archaeologi-

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cal obsidian in Kamchatka. During the 2004 field season, we collected obsidian from geologic contexts near the city of Petropavlovsk-Kamchatsky. Our samples were augmented with artifacts from extant collections and with geologic specimens housed in Russian reference collections. Thus far, 251 artifacts obtained from sites across Kamchatka and 43 source samples have been analyzed by instrumental neutron activation analysis (INAA) at the University of Missouri Research Reactor Center.

Thirteen distinct chemical groups, designated K-1 through K-13 (Figure 1), were determined; 11 samples are unassigned. Two groups, K-12 and 13, only contain geological samples. Seven groups (K-2, 3, 5, 6, 7, 9, and 11) comprise obsidian from both sources and archaeological sites. The distances between sources and sites, where obsidians from particular source groups were identified, vary from about 1 to 400 km. Four groups (K-1, 4, 8, and 10) included only artifacts, thereby making source attribution impossible. These groups provide us with an idea of the number of geological sources that must be located, and clues as to where to look. Fieldwork during the 2005 season will focus on the search for sources so far unknown.

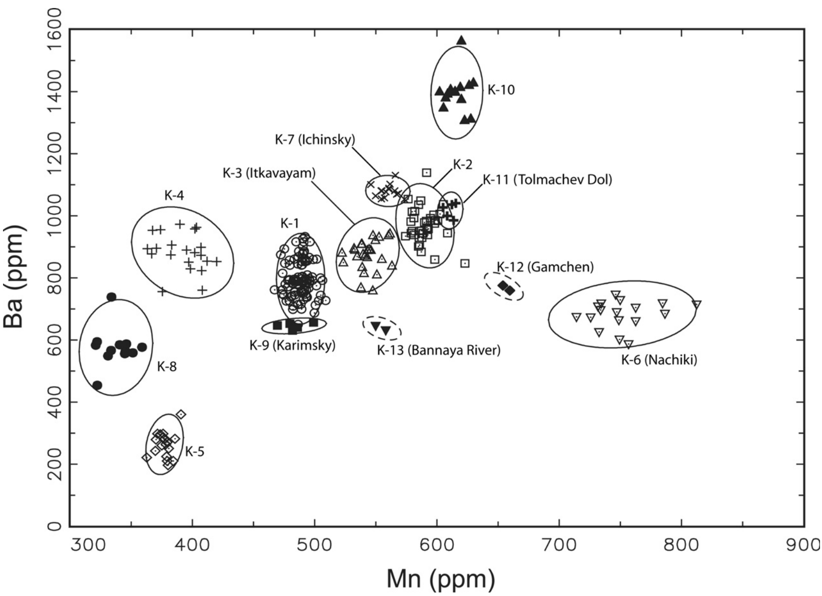

Figure 1. Bivariate plot of manganese and barium concentrations for obsidian source samples and artifacts from Kamchatka analyzed by INAA. Ellipses represent the 95 percent confidence interval for group membership. Unassigned specimens are not plotted. Manganese and barium are particularly useful for discriminating elements because as large ions these elements are incompatible with crystallizing solids; as magmas evolve the concentrations of incompatible elements will be different for each source.

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Raw Material Conservation at Chitkan (Siberia) and Its Implications for Late-Pleistocene Hunter-Gatherer Mobility

Karisa Terry, Ian Buvit, and Mikhail V. Konstantinov

Microblade technology is regarded as a means of reducing risk by conserving raw material (Elston and Brantingham 2002; Flenniken 1987; Rasic and Andrefsky 2001). In the Transbaikal microblade technology emerged ca. 18,000 yr B.P. at Studenoe 2 (Goebel 2002, 2004; Goebel et al. 2000). Cores from Chitkan in the Transbaikal indicate people conserved fine-grained material before microblade technology appeared in the area prior to the Last Glacial Maximum (LGM).

Chitkan is located along the Chikoi River near Russia's border with Mongolia. No chronometric dates exist for the site, but Konstantinov (1994) places the age of the Paleolithic component (cultural layers 2–7) at 20,000 to 30,000 yr B.P. (Figure 1). The artifact assemblage is characterized by subprismatic to subconical flake and blade cores and relatively small tools including scrapers, burins, perforators, and notches.

Cores exhibit two size groups: large (> 50 g) (n = 12), and small (< 50 g) (n = 9). Two of the small cores display removals of narrow flakes from one face and might represent early forms of microblade cores. Comparison of material from Chitkan with Studenoe 2, however, indicates that the former are not examples of microblade technology. Studenoe 2 microblade cores

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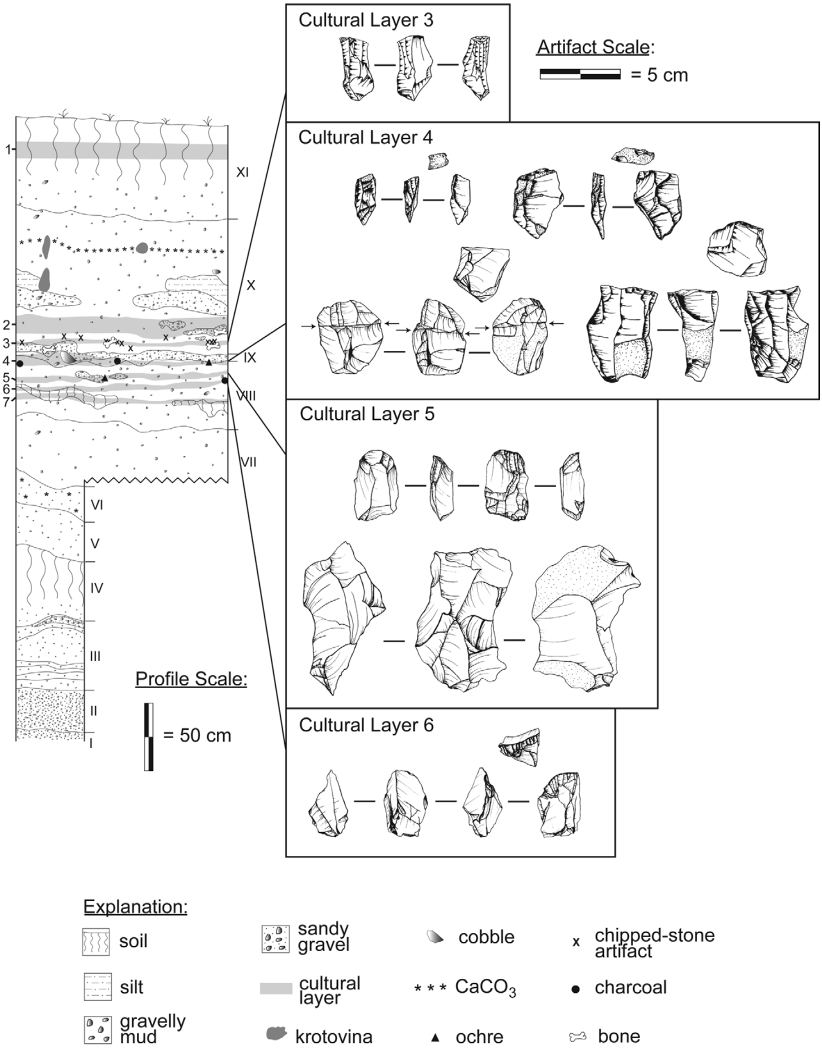

Figure 1. Stratigraphic profile and cores from Chitkan. Cultural layers are shown on the left of the column. Lithostratigraphic units are shown on the right.

are significantly smaller than Chitkan cores with regards to weight ($t = -3.51$, $df = 24$, $p < .05$) and maximum linear dimension ($t = -2.86$, $df = 24$, $p < .05$). Most importantly, chert and quartzite blades and flakes at Chitkan are outside the range of microblade sizes at Studenoe 2 with regards to weight (blades: $t = -7.93$, $df = 97$, $p < .05$; flakes: $t = -5.44$, $df = 184$, $p < .05$), maximum linear dimension (blades: $t = -12.06$, $df = 97$, $p < .05$; flakes: $t = -9.55$, $df = 184$, $p < .05$), width (blades: $t = -15.99$, $df = 97$, $p < .05$; flakes: $t = -14.39$, $df = 184$, $p < .05$), and thickness (blades: $t = -10.87$, $df = 97$, $p < .05$; flakes: $t = -10.12$, df = 184, $p < .05$). It appears that the goal of small-core reduction at Chitkan was the production of flakes and blades larger than those at Studenoe 2.

There is also evidence of raw material conservation at Chitkan. Four small cores exhibit wear suggesting they were placed in a wedge or on an anvil and reduced bipolarly. This likely occurred as a result of small nodule size (Andrefsky 1998). The majority of large cores are of lower-quality material. During the middle Upper Paleolithic in the Transbaikal most assemblages are dominated by local raw materials (Goebel 1999, 2004), but at Chitkan high-quality non-local cryptocrystalline materials are prevalent. Mobile groups in the area would have conserved tool stone material because of limited access to high-quality raw material sources.

The lack of microblade technology supports Konstantinov's (1994) assertion that the early occupations of Chitkan occurred prior to the LGM. The artifacts also provide evidence for raw material conservation prior to the emergence of microblade technology. This scarcity of quality toolstone and increased mobility may have been a catalyst for adopting a more resource-frugal technology.

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New Paleolithic Sites in Baikal-Patom Mountains, Siberia

A. V. Teten'kin

In 1999, 2001, and 2004 the author discovered new localities of Paleolithic artifacts in the valley of the Zhuia River, in the Baikal-Patom Mountains (58° 56′ N, 116° 46′ E): Mariinskii, Ust'-Homolho, and Predveschaiushii (Figure 1) (northeast Irkutsk Oblast', Russia). The distance between the sites is 3–4 km. The closest modern settlement is Perevoz, situated opposite the locality Ust'-Homolho.

In all cases finds are from collections of surface material from cobble beaches, situated not far from mouths of stream-tributaries. At Ust'-Homolho were found a blade core, choppers (Figure 1-1, 1-2, 1-3), and a sidescraper. At Mariinskii was found a cobble sidescraper (Figure 1-4). At Predveschaiushii was found a sidescraper (Figure 1-5) made of distal retouch on a flake. The raw materials of the artifacts are diorite and quartzite. Specifically, the raw material of the artifact from Mariinskii is diorite, which appears to be an exotic stone for the Zhuia River valley. Its origin may be a deposit situated in the southern, Baikal part of the mountains. In all cases, artifacts bear different degrees of traces of weathering and eolian corraision. To the greatest degree this is characteristic of the side scraper from Mariinskii. All finds possess archaic typological signs that emerged during the Lower Paleolithic. The artifacts occur exposed on cobble beds representative of buried thalwegs of ancient floodplains, which were formed along the Zhuia riverbed throughout the course of the Upper Pleistocene.

According to their morphology as well as their weathered surfaces, the discovered artifacts are much more ancient than the well-known sites of the Baikal-Patom region, namely Avdeikha and Bol'shoi Iakor, which are assigned to the Final Paleolithic. In the present cases, probably, we have the most ancient archaeological materials of the Baikal-Patom mountains. Of special importance, too, is that these discovered artifacts represent the first Paleolithic remains found in the northern part of the Baikal-Patom mountains, in the Lena gold-bearing region. Until now, the majority of archaeological sites in this mountainous region are tied to valley floors of major streams and rivers of the Vitim and Mama basins, while the new localities described here are situated more than 200 km north of the Vitim.

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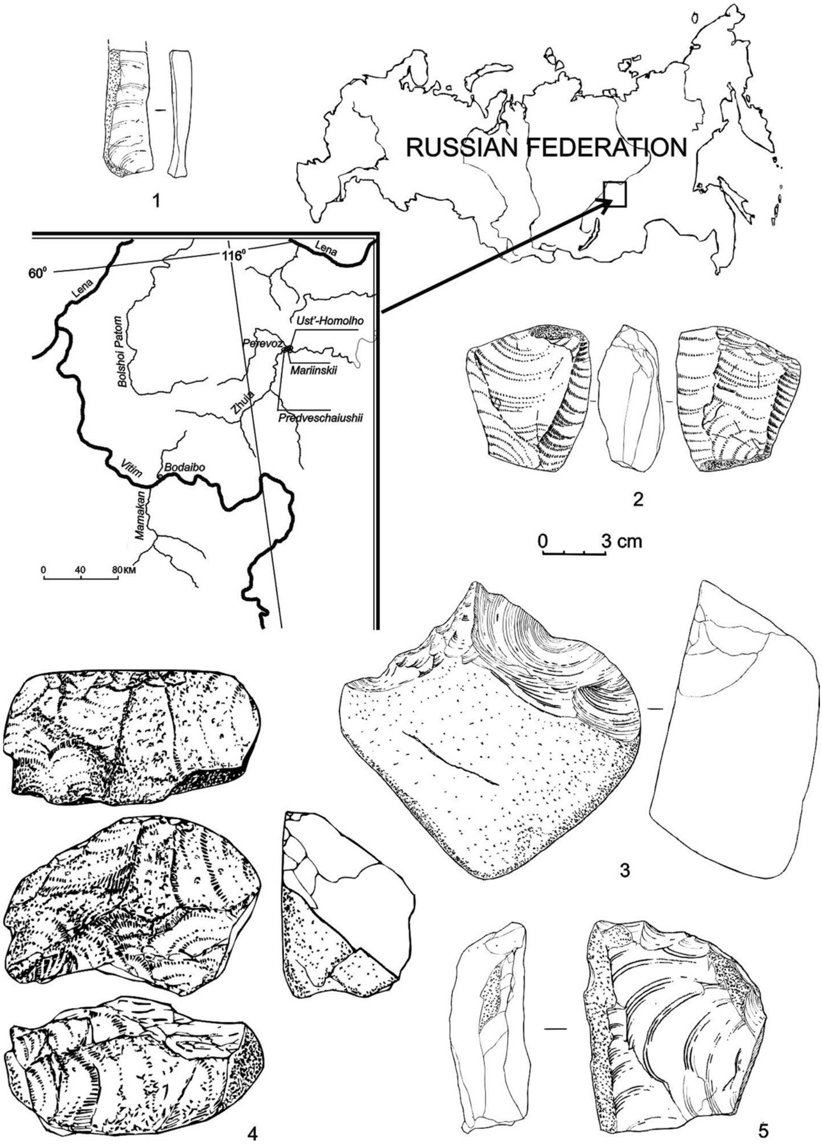

Figure1. Artifacts from localities Ust'-Homolho (1, 2, 3), Mariinskii (4), and Predveschaiushii (5).

Archaeology—Eurasia

Correlation of Paleolithic Industries and Paleoenvironmental Change in Hokkaido (Japan)

Masami Izuho and Keiichi Takahashi

Here we present a new perspective on the correlation between Paleolithic industries and paleoenvironmental changes in Hokkaido, Japan. Quaternary research in Hokkaido, particularly concerning both geochronology (Izuho and Akai 2005; Nakazawa et al. 2005) and paleoenvironmental change (Takahashi et al. 2004, 2005), has progressed significantly in the new millennium (Figure 1).

Although it is difficult to arrange sites in chronological order because of post-depositional deformation by periglacial processes, recent investigations using tephra and AMS ^{14}C dates from Paleolithic sites have provided a reliable geochronological framework in Hokkaido (Izuho and Akai 2005). Some of the widespread marker tephras, including Spfa-1 (ca. 45,000–40,000 RCYBP) and En-a (ca. 21,000–19,000 CALYBP), have played important roles as the key beds in Hokkaido. A microblade industry (Kashiwadai-1 LC-15), blade industry (Kawanishi C), flake industry (Kashiwadai-1 LC-11), and small flake industries (Shukubai Sankakuyama and Wakabano Mori) are assigned to a chronometric unit between Spfa-1 and En-a, while various microblade industries from the Oruika-2, Kiusu-7, Akatsuki, and Ozora sites postdate En-a. Reliable AMS ^{14}C dates compatible with marker tephras were obtained mainly from hearth features at several sites: Kashiwadai-1 (22,000–20,000 RCYBP), Kawanishi C (21,000 RCYBP), and the Wakabano Mori sites (> 27,000–24,000 RCYBP).

The period during which woolly mammoth (*Mammuthus primigenius*) and *Palaeoloxodon naumanni* were present in Japan has been reevaluated using AMS ^{14}C dates obtained from 10 of the 12 known animal specimens (Takahashi et al. 2004). The range of AMS ^{14}C dates of woolly mammoth is from ca. 45,000 RCYBP to 20,000 RCYBP, while *P. naumanni* existed ca. 30,000 RCYBP. The presence of two proboscidea in Hokkaido seems driven by vegetation/climate changes, including open taiga forest with grassy plains reflecting cold-dry climate from 60,000 to 35,000 RCYBP and 25,000 to 10,000 RCYBP, and

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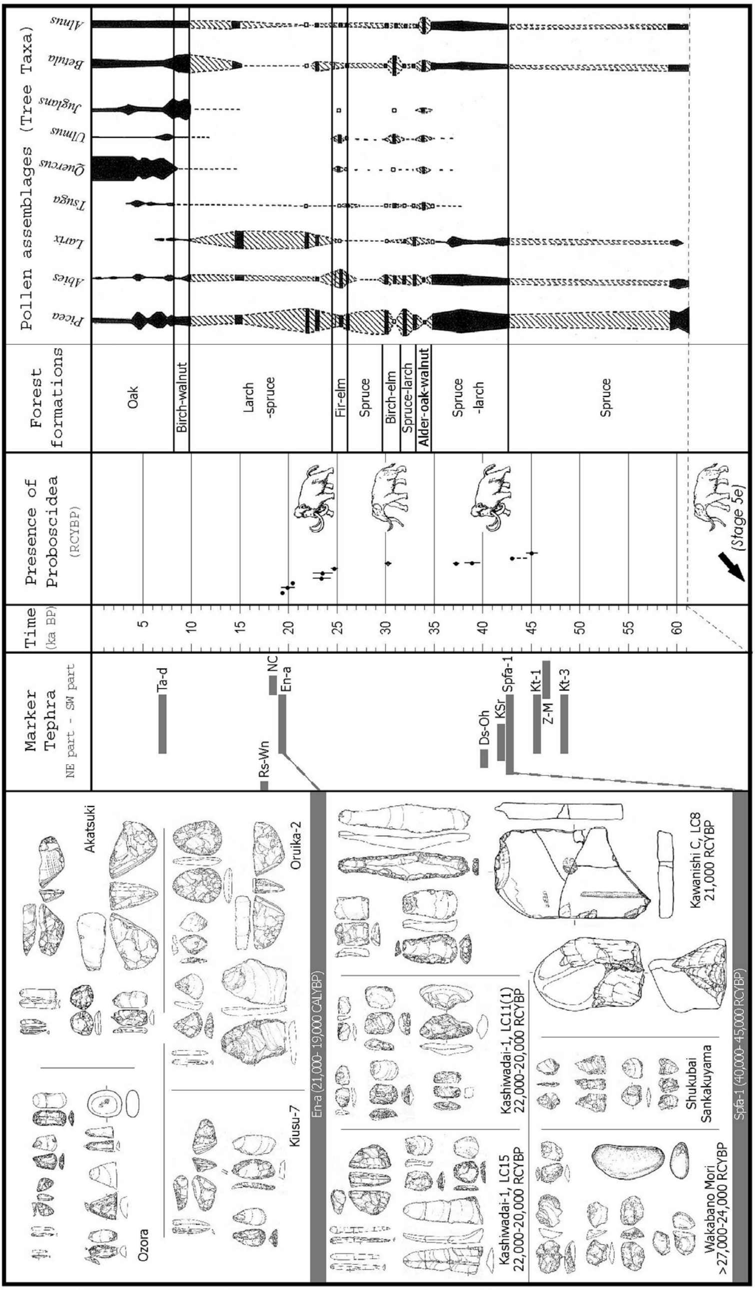

Figure 1. Correlation of Paleolithic industries and paleoenvironmental change in Hokkaido.

deciduous broadleaf forest reflecting climate amelioration from 34,000 to 26,000 RCYBP (Igarashi 1993).

It appears that microblade, blade, and flake industries around 22,000–20,000 RCYBP were associated with cold environments, represented by open forest taiga with grassy plains inhabited by woolly mammoth that migrated to Hokkaido from the Russian Far East via Sakhalin. In contrast, small flake industries (> 24,000–27,000 RCYBP and perhaps > 30,000 RCYBP in Honshu [Sato 2003]) were related to warm or cool environments consisting of deciduous broadleaf forests as suggested by the *P. naumanni* remains from Honshu. Thus, it tentatively appears that changes in lithic industries related to climate/environmental fluctuation after 30,000 RCYBP. Further research is needed in order to understand the process, mechanism, and meaning of this type of human-environmental interaction in Hokkaido.

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Archaeology—Latin America

Shell Tools in Early-Holocene Contexts: Studies of Early Settlements of the American Pacific Coast of Chile

Marcela J. Lucero and Donald S. Jackson

Studies of archaeological samples of the Huentelauquén complex early contexts (FONDECYT Project 1030585) dated between 11,000 and 9,000 RCYBP in the semiarid northern region of Chile (Jackson et al. 1999) show the presence of shell tools made on valves of mollusks, with natural and in some cases slightly modified edges (Lucero 2004a, 2004b).

Microscopic analysis with low augmentation (80x) and high augmentation (scanning electron microscope) of the edges of mollusk valves (*Mesodesma donacium, Retrotapes* sp. and Mytilidae) from archaeological contexts has allowed us to detect clear use-wear traces, identified as denticulates, striations, and erosion, though only striations are diagnostic of function (Figure 1A–B). These use-wear traces suggest that the shell instruments were used to cut and scrape, and had other multiple functions.

Analysis of taphonomic control samples allows us to differentiate with some accuracy the natural traces from those produced by anthropic action. At the same time, these experimental studies show the efficiency of using expedient shell instruments and allow us to establish and interpret comparative patterns of microwear use (Lucero 2004a). Other experimental studies also show the use of shells as knives to cut bone; their cut marks are indistinguishable from those made of lithic knives (Toth and Woods 1989).

Naturally edged instruments with traces of use-wear represent 5.4 percent of the analyzed sample, suggesting some planning, an expedient technological strategy more than an opportunist one (Nelson 1991). In contexts with abundant shells, these represent potential instruments used for multiple functions, and thus could have served as an alternative to lithic raw materials. This would have reduced costs in the elaboration of such instruments.

The planned character of this technological strategy is also supported by a long sequence of occupational events at the Punta Ñagué site, spanning more than 1,700 years, from 10,700 to 9000 RCYBP (Jackson and Mendez 2004), in all

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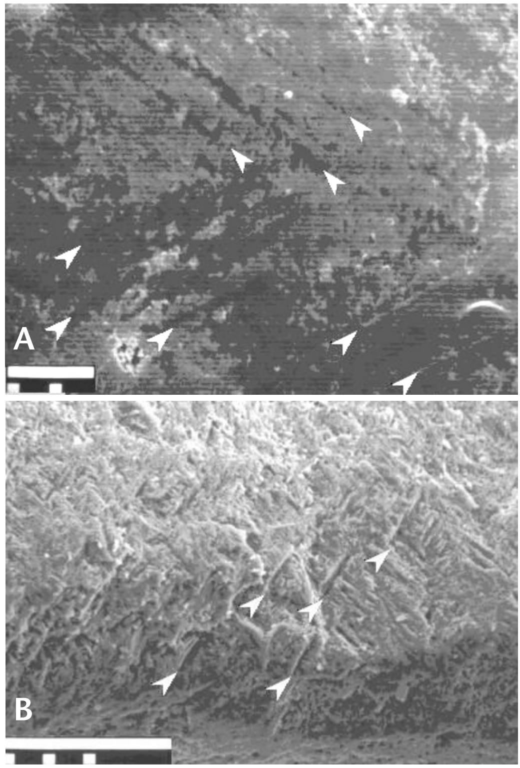

Figure 1. High-power images of use wear identified on mollusk valves from the Huentelauquén complex, Chile. **A,** intercrossed striations of the inner face, Artifact No. 9 (1500x); **B,** diagonal short striations on the edge and above the microdenticulate edge, Artifact No. 2 (300x).

of which some shell instruments with used edges have been identified.

The discovery of these expedient shell tools in coastal sites suggests a strong adaptation to the coast, which is also evident in permanent settlement patterns along the coast and a wide and diversified exploitation of sea resources. This was a well-established adaptation of at least 10,000 RCYBP (Llagostera 1977).

Several archaeological sites of the South American Pacific coast show early human settlements with clear cultural contexts dated between 11,000 and 9000 RCYBP (Sandweiss et al. 1998; Stothert and Quilter 1991). These evidences serve to support the hypothesis of an early coastal route for the first settlers' arrival to the continent (Fladmark 1979).

The early archaeological records of the South American coast attest that they are as ancient as settlements in the highlands of the Andean area, and that they are not, as it has been suggested, late settlements derived from Andean traditions.

The expedient shell tools found in the Huentelauquén contexts of the semiarid northern coast of Chile are solid evidence of an early coastal adaptation. This adaptation suggests that the first settlers in South America arrived via a coastal route, using abundant and predictable sea resources that furnished alternative raw material such as shells and at the same time reducing the uncertainty of dependence on a single technology and the availability of lithic material.

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Not Only Flaked Artifacts in Early Pampean Lithic Assemblages (Argentina)

N. Mazzia, N. Flegenheimer, and D. Poiré

The assemblages recovered from the early occupations at Cerro La China and Cerro El Sombrero localities, Argentina, consist mainly of flaked artifacts. They correspond to hunter-gatherer societies living in the Tandilia ranges in

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the Argentine Pampas and have been dated to the Pleistocene/Holocene transition (Flegenheimer and Zárate 1997). Great intersite variability has been described for the lithic assemblages recovered from the five excavated sites. Flaked tools include fishtail projectile points and a diversity of unifacial and bifacial retouched tools. One of the sites (El Sombrero Cima) also yielded pecked and ground tools such as small spheroids and an engraved discoidal stone (Flegenheimer and Zárate 1989). The inhabitants of these sites mostly used immediately available, local and regional rocks as toolstone, but a small proportion of long-distance materials has been recently identified (Flegenheimer et al. 2003).

Apart from these artifacts, lithic assemblages include fragments of mineral pigments, clays, and rocks with abrasive properties. These remains have only been mentioned so far; they are found at both localities but are unevenly distributed among the sites. Mineral pigments are abundant at other nearby early sites where they are being exhaustively studied (Mansur et al. 2004; Mazzanti 2003).

Mineral pigments are ochers or clays; mineralogical analysis has revealed they include iron oxide, impure hematite, and limonite. These pigments were found at all the sites, yet they are more abundant at La China 3 (110 g) and El Sombrero, Abrigo 1 (135 g). A few of the pieces are smooth, but no use traces were observed, suggesting the pigment was probably obtained by grinding (Flegenheimer 1986–87). These rocks are locally present in outcrops of the Ordovician Balcarce Formation, which is mainly composed of white unfossiliferous quarzites interbedded with pelites, heterolithic facies, and few fine-grained conglomerates, bearing abundant trace fossils (Poiré et al. 2003).

White soft rocks from these micaceous pelites show quartz, kaolinite, and scarce illita by X-ray diffraction (XRD) analysis. One large fragment (86 g) from La China 1 corresponds to laminated siltstones from heterolithic facies of the Balcarce Formation. It exhibits grooves, possibly from use wear. Smaller pieces were observed at La China 3, yet many could not be recovered due to poor preservation conditions.

Abrasive rocks were studied by petrographic and XRD analysis. They correspond to black basalts with a pale green weathered coating composed of abundant groundmass-bearing glass, with feldspar, quartz, clinopiroxene and mica (biotite, chlorite) crystals, and an aphanitic texture. Most clasts were recovered at La China 3 (in total 98 g), yet the largest clast (137 g) was obtained at El Sombrero Cima. These meteorized basalts have not been identified in the region.

These rocks exhibit several uses both in the past and nowadays. Basalt and different clay types are natural abrasives currently used for various purposes. Rocks with intermediate hardness such as basalt (5.5 to 7 on Mohs scale) are used for polishing, scratching, and cutting. Clays, of lower hardness (3 to 5.5 on Mohs scale), are used for soap, cleansing powders, and polishing creams.

Some current uses have their ethnographic and archaeological counterparts. Clay, kaolin, and ocher are commonly mentioned in preparations of paints for rock art, corporal paint, hair embellishment, or hide decoration (Caviglia 2002; Orquera and Piana 1999).

Whenever archaeological pigments of rock art are analyzed, clays are frequently mentioned as pigments or additives in the mixture. Abrasives were sometimes employed in the preparation of the rock support before painting, but are more often related to the final stages of ground and polished stone manufacture or as abrading stones with use wear. Nowadays, artisans in Patagonia use abrasive volcanic rocks for hide preparation (Gómez Otero 1996–97).

In our case, ocher, clay, and kaolin were probably used as reddish, yellow, and white pigments for paint preparation. Probably these paints were used in rock art, which is widespread in the Tandilia Range and has early dates in Patagonia. Other possible uses, however, must also be considered, such as paints for body art, hair embellishment, hide decoration, or use as very fine abrasives.

The meteorized basalt clasts could have been used in the final stages of stone manufacture for pecking, abrading, and polishing. As mentioned, this manufacturing technique was recorded at El Sombrero Cima, yet most basalt clasts were found at La China 3. Moreover, the engraved discoidal stone presents a very delicate surface that may have required a gentle abrasive. Clay could have served this purpose owing to its small grains and low hardness, but its presence is not significant at Cima. Also, basalts could have been used as abrasives on organic materials such as wood, bone, and hide that have not been preserved.

These rocks pose questions about intersite variability, areas of provenance, and behaviors other than those evidenced by flaked stone.

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Clovis on the Caribbean Coast of Venezuela

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Although the fluting technique has long been recognized in South America (Bird 1938), it has been observed mainly on stemmed/fishtail point types (Morrow and Morrow 1999). Approximately 18 lanceolate Clovis-like projectile points have thus far been described south of the Isthmus of Panama (Pearson 2002). Most of these have come from assemblages discovered at the El Cayude and Siraba sites in Venezuela (Ardila 1991; Ardila and Politis 1989; Jaimes 1999). Further south, several fluted and non-fluted lanceolate points were recorded at San Juan in Ecuador (Carluci 1963; Mayer-Oakes and Cameron 1971) and Fell's Cave in Chile (Bird 1988:146). However, these projectile points are either equivocal or do not appear to be directly related to Clovis (Nami 1998). At present, the Nochaco specimens from Chile (Dillehay 2000:159; Gruhn and Bryan 1977:255; Jackson 1995; Seguel and Campaña 1975) are the best candidates for a true Clovis presence in southern South America. Not only were gomphothere bones possibly associated with some of these points, but Dillehay (2000:159, 304) reported a date of 10,400 ± 90 RCYBP (no lab number) on charcoal found next to a buried example at the Rio Bueno site.

Here we report the discovery of additional Clovis-related material from the El Cayude localities in Venezuela. Artifacts described below were collected from deflated surfaces around Cerro Santa Ana on the Paraguaná Peninsula (approx. 60 km^2) in the state of Falcón. The peninsula extends into the Caribbean Sea and is connected to the northwest coast of Venezuela by a very narrow finger of land.

The projectile point assemblage that we examined consists mainly of broken preforms in various stages of production (Figure 1A–L). Most pieces have rough edges and irregular outlines. One specimen (Figure 1F) appears to have been recycled into a spurred tool. Points were manufactured by invasive bifacial thinning of large flake blanks (Figure 1M). In contrast with fishtail point assemblages, pseudo-flutes and large remnants of flake blank surfaces were not present on late-stage preforms. Overshooting scars were visible on many preforms, and none of the bases showed evidence of having been ground for hafting. Flutes were removed at every stage of the reduction

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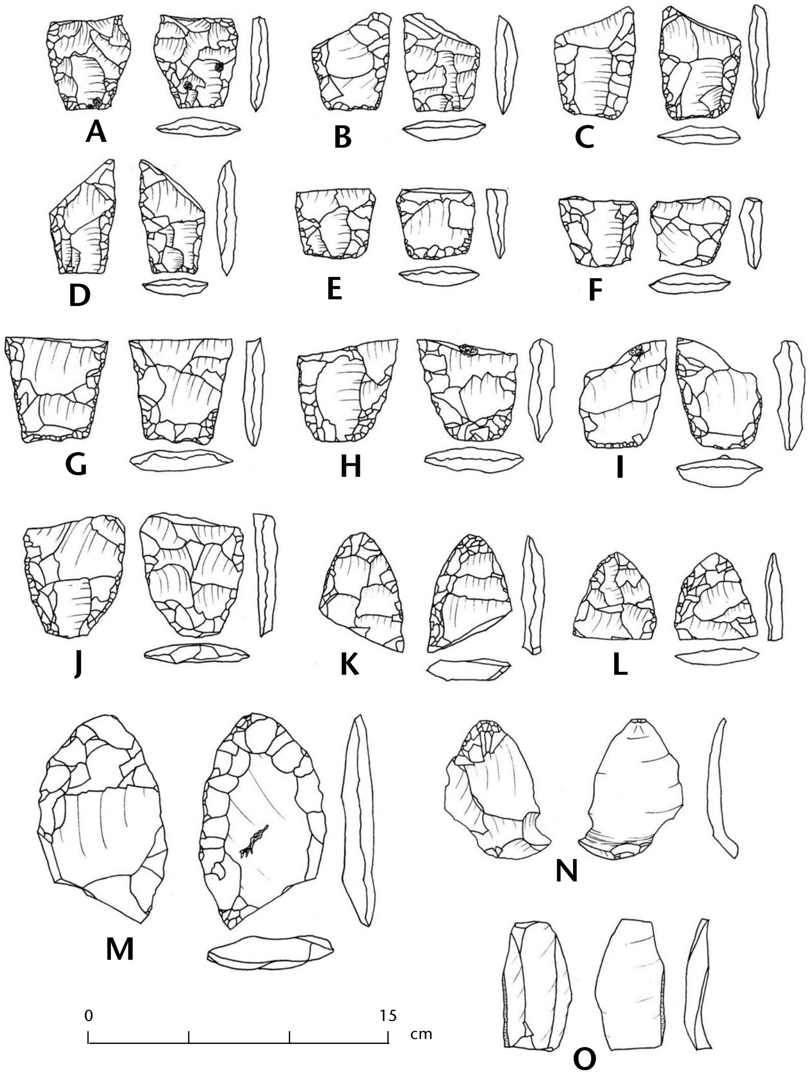

Figure 1. Sample of artifacts from the El Cayude localities, Venezuela. **A–J,** proximal and **K–L,** distal fragments of Clovis-like projectile point preforms; **M,** early-stage preform showing oveshooting scar on one side and flake blank surface on the other; **N,** overshot thinning flake with segment of a square edge at its termination; **O,** macroblade. (Note: specimen **C** was previously illustrated in Ardila 1991 and Ardila and Politis 1989.)

process whenever bases needed additional thinning. Isolated nipples on the bases of some preforms demonstrate that this technique was used to remove flutes on a few if not all specimens.

Other significant artifacts from the collection include a large overshooting thinning flake (Figure 1N) and a macroblade (Figure 1O). The overshot was apparently set up to remove a square edge on the other side of the biface—a pattern repeatedly observed in Clovis-related assemblages in lower Central America (Pearson 2002). The dorsal scars on the blade fragment indicate that it was removed from a prismatic core and leave no doubt as to the presence and association of this technology with Clovis-like industries in Venezuela.

It is important to note that Joboid projectile points were also found on these same eroded surfaces. Although the context of these discoveries does not shed light on the chronological relationship between Clovis-like and El Jobo points, one interesting pattern in the lithic materials was observed. All El Jobo points were manufactured from various types of coarser quartzite and basalt while Clovis-like points were made from high-quality cherts and chalcedonies. These observations are not all that surprising considering the different reduction strategies used and width-to-thickness ratios desired during the manufacture of both point styles. Harder materials may have been coveted by El Jobo hunters, whose needlelike points required different lithic physical characteristics to be functional penetrating weapons.

Although important questions remain with regards to the initial colonization of South America, these remarkable finds from Venezuela demonstrate quite convincingly that a Clovis-related *population* once occupied northern South America.

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The Potential Impact of the Río Negro Valley on the Late-Pleistocene Peopling of Patagonia

Luciano Prates and Heidi Luchsinger

Flowing eastwards along the Pampean-Patagonian border, the Río Negro drains Andean meltwaters across the Southern Cone for nearly 1,000 km before emptying into the Atlantic Ocean. Late-Pleistocene archaeological sites have not yet been detected in the Río Negro Valley for three reasons. First, previous explorations for early sites in southern South America have mainly focused on caves and rockshelters (Borrero 2001). In the middle and lower Río Negro Valley, however, exposed bedrock is a highly friable sandstone; therefore, rockshelters do not exist in this region nor were they likely present during the late Pleistocene. As a result, it is necessary to search for open-air sites preserved in stratified contexts, a significantly more difficult prospect. The second reason that early sites are not readily visible is that alluvial and eolian deposits likely buried these sites, requiring a thorough understanding of the regional landscape history of the late Quaternary. Third, sites in the original lower valley and coast have not been found because up to 200 km of this valley segment exposed during the late Pleistocene now lies submerged under the ocean (Zárate and Blasi 1993).

To the north and south of the Río Negro Valley, however, there are numerous late-Pleistocene sites in the Pampas and Patagonia (Borrero 1999a, 1999b, 2001; Gruhn 2004; Miotti 2004; Miotti and Salemme 2004; Politis et al. 2004). In fact, by 11,000 RCYBP humans occupied all major environmental zones throughout South America (Gruhn 2004), and by 11,000–10,000 RCYBP settlement was widespread in some areas of southern South America (Miotti and Salemme 1999; Rabassa et al. 2000). Clearly, late-Pleistocene populations could not avoid crossing the Río Negro Valley on their migratory routes even if they followed the Atlantic coast by land. Some groups, attracted by the landscape and environment, may have chosen to settle in the Río Negro Valley, perhaps delaying or impeding the intensity of initial colonization of Patagonia during the late Pleistocene.

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The Río Negro Valley is a prominent feature of the regional landscape. The largest river in southern South America, the channel averages 500 m across and the valley width varies from 5 to 25 km. River discharge varies from 1,000 to 4,000 m^3/s, producing a swift and potentially dangerous current posing great difficulty for crossing. Therefore, migratory groups would have needed to stop momentarily in this valley in order to locate a feasible crossing. During this period, populations may have been attracted to settle in this valley for two reasons. First, based on ethnographic evidence that this valley served as a thoroughfare (Nacuzzi 1998), the waterway provides a direct west-east route allowing access to a variety of environments along its length and provides access to the coast by groups inhabiting higher altitudes. In addition, Miotti (2004) suggests that river systems such as the Río Negro provided pathways for coastal groups to penetrate upstream into the mountains. Second, located on the border between the Pampas and Patagonia, the Río Negro Valley is an ecotone offering a wide diversity of natural resources for subsistence. As a rich ecotone which offered thoroughfare access to a range of environments from the mountains to coastal plains, this valley may have attracted long-term settlement.

Archaeological evidence from the Holocene implies that groups inhabiting the valley either were mobile within the valley or were migratory groups who settled temporarily en route to adjacent regions. Current analysis of 30 archaeological sites of the 219 sites recorded in the middle Río Negro Valley generally suggests that this valley was well inhabited and that the majority of occupations were short term (i.e., temporary campsites). Groups exploited a variety of locally available resources and primarily performed domestic activities, specifically lithic production and food processing. Lithics from these sites represent all phases of manufacture, from procurement to retouching, and primary materials nearly always originated from local fluvial gravels. Polished tools of local sandstone may have been used to process vegetables and make flour (e.g., of *Prosopis* sp.) or *Charqui*, the salty and dry meat of guanaco (*Lama guanicoe*). In general, faunal remains from these sites included numerous taxa: guanaco (*Lama guanicoe*), Pampas deer (*Ozotoceros bezoarticus*), ñandú (Rheidae), small armadillo (*Chaetophractus* sp., *Saedyus pichy*), mara (*Dolichotis patagonum*) and many species of freshwater mollusks and fish.

Detailed investigation of the landscape history and archaeological record of the middle Río Negro Valley is ongoing, and future work will help clarify whether this hospitable ecotone potentially affected settlement patterns by attracting long-term settlement, and whether this could have impeded migration further into southern South America.

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Initial Peopling of the Córdoba Mountains, Argentina: First Evidence from El Alto 3

Diego Rivero and Fabiana Roldán

This report focuses on the initial archaeological findings made in the Córdoba Mountains (Argentina), specifically the site of El Alto 3, a rockshelter located in the headwaters of a mountain stream (31° 24′ S, 64° 44′ W) at 1,640 m a.s.l. Temperatures in the region are low and the landscape is rough, with a vegetation dominated by herbs and grasses characteristic of high mountain environments (Cabido et al. 1998).

El Alto 3 has been under study during the last five years (Roldán et al. 2004). Excavations 5 m^2 in area have reached a depth of 140 cm. In the exposed profile we have identified four sedimentary units containing cultural remains and have obtained six ^{14}C dates (Figure 1).

In Sedimentary Unit 3, we have uncovered ten lanceolate projectile points

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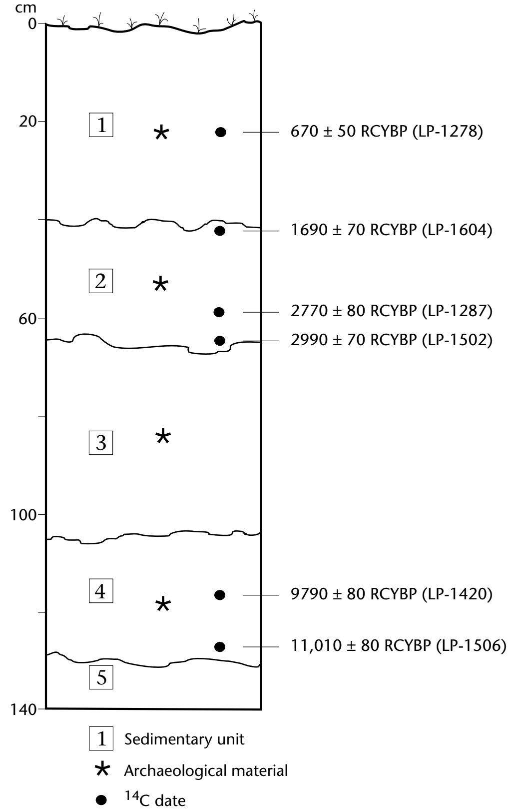

Figure 1. Representative stratigraphic profile of El Alto 3.

made of quartz and some debitage. Similar artifacts were recovered by González (1960) in the lowest level of Intihuasi, located 150 km southwest of El Alto 3 and dated to ca. 8000 RCYBP.

In Sedimentary Unit 4, the basal unit that lies at a depth of 110–130 cm, we have uncovered the oldest evidence for human occupation in the Córdoba Mountains. Lithic artifacts (a tool and some debitage) are the only materials recovered from this unit. Two charcoal concentrations associated with the cultural remains recovered from depths of 119 and 127 cm were dated to 9790 ± 80 (LP-1420) and 11,010 ± 80 RCYBP (LP-1506), respectively (Roldán et al. 2004).

Only one tool has been recovered from Sedimentary Unit 4, a graver made of opal, a non-local raw material. Lithic debitage is scarce, confined mainly to small internal flakes and a few resharpening and bifacial thinning flakes. Most of the debitage is of quartz, a local rock; however, one bifacial thinning flake is made of breccia, a non-local raw material. The analysis of the remains found thus far in this component indicates a low frequency of tools, low frequency of resharpening flakes, and high frequency of local raw material.

In the context of the human peopling model proposed by Borrero (1994) for southern South America, these results match Franco's (2002) expectations of an occupation assignable to the territorial exploratory stage. Thus the significance of El Alto 3 lies in the fact that it records the early stages of exploration and colonization of the Córdoba Mountains in Argentina.

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Piuquenes Rockshelter, the Earliest Human Pleistocene Settlement in the Andes Mountains of Central Chile

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Archaeological research in central Chile for the late-Pleistocene period has yielded meager results, owing chiefly to the paucity of systematic investigation programs focusing on the period. To date there are only three sites assignable to this period: Tagua Tagua 1 (11,380 ± 320 and 11,320 ± 300 RCYBP), which has evidence that human hunters exploited the American horse (*Hippidion principale*) and mastodon (*Cuvieronius hyodon*) in an old lagoon (Montané 1968); Tagua Tagua 2 (10,120 ± 130 and 9700 ± 90 RCYBP), 100 m distant from Tagua Tagua 1, with a clear association of fishtail projectile points and mast-

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odons (Núñez et al. 1994); and El Manzano I (9870 ± 250 RCYBP), which has evidence of modern faunal consumption in the Andean mountains (Cornejo and Saavedra 2003).

However, recent investigations performed by us at Piuquenes Rockshelter, a site located in the upper reaches of the Aconcagua River Valley, Central Andes (32° 16′ S, 70° 16′ W, ca. 2,100 m.a.s.l.), have yielded significant materials relating to the first inhabitants of the region and their adaptation to high-altitude environments. The very early occupation of this site, defined as "Momento 1," has a 2.4-m stratigraphic sequence with ^{14}C dates on charcoal and bone of 10,115 ± 80 (GX-21921-AMS), 9700 ± 120 (Beta 151284), 9470 ± 70 (GX-21923-AMS), 9320 ± 130 (GX-21920), and 9285 ± 75 RCYBP (GX-21919-AMS), which means a range of 12,310 to 9160 CALYBP ($p = 0.95$). This "Momento 1" occupation presents a number of cultural evidences. Lithic artifacts include formal and massive scraping tools made from fine-grained non-local materials, expedient cutting tools made from coarse-grained local stones, and a projectile point possibly of ornamental usage (Stehberg and Blanco in press). The bone tool assemblage mainly reflects penetration activities. Also, a wide range of preforms and bone debris was collected, suggesting on-site manufacturing of the instruments. A remarkable spear-thrower hook made from a camelid metapodial was also found (Labarca and Salinas 2003).

Evidence for subsistence of these groups is dominated by vizcacha (*Lagidium viscacia*), a colonial rodent easy to capture in the surroundings. Camelids (*Lama guanicoe*) occur in moderate amounts, while other animals such as birds are almost not represented (Labarca 2005; Prieto 2002). Remains of extinct fauna have not been recovered. Charcoal, seed, and pollen analyses indicate fruit consumption of cactus (*Echinopsis* sp. and *Eulychnia* sp.) and quilo (*Muehlenbeckia hastulata*), as well as the use of other plants as fuel (e.g., *Cryptocaria alba*) (Belmar et al. 2003).

Another interesting fact is the presence of two human burials with one date on charcoal of 9700 ± 120 (Beta-151284) and one direct date on bone of 9150 ± 40 (Beta-151285-AMS) RCYBP. These are among the oldest human remains in the Americas. They are two gracile female skeletons of about 35–40 years in age, both of them bent and sitting on their sides, occupying two pits excavated for the sole purpose of their burial (Aspillaga 2002). Associated with the buried bodies was found a bone awl and a loco shell (*Concholepas concholepas*), a mollusk of the Pacific coast, 120 km from the site.

All this information characterizes Momento 1 of Piuquenes Rockshelter as a base camp of possibly seasonal occupation. The artifact assemblage and the intensive use of abundant and easily captured resources found in the surroundings of the site are consistent with what is expected for groups in an early stage of environment exploration.

However, the impossibility of site occupancy throughout the year because of the high location, as well as the presence of mollusk shells from the Pacific Ocean, suggests that the inhabitants of Piuquenes Rockshelter went down to lower lands during the coldest months. In spite of not having formal similarities (i.e., raw materials) with Tagua Tagua 2, these two sites are contemporary. So it is possible that these groups seasonally exploited megafauna at other sites not yet discovered. This interpretation differs from that expressed for El Manzano 1 by Cornejo and Saavedra (2003), who postulate a way of life totally different from that inferred from the finds of Tagua Tagua 2. In our opinion, this is because there is no evidence in El Manzano 1 of movements toward lowlands, evidence that is present in Piuquenes. We emphasize that the Pleistocene-Holocene transition in central Chile was a period of constant change, when high mobility and flexibility in subsistence strategies were key to success.

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Archaeology—North America

Systematic Field Investigations at the Mueller-Keck Clovis Site Complex in Southwestern Illinois

Daniel S. Amick and Brad Koldehoff

This paper reports three field seasons conducted between 2001 and 2004 at Mueller (11-S-593) and Keck (11-S-1319) in southwestern Illinois. Although recorded as separate sites, they are best considered as parts of an associated archaeological landscape. Both locations have produced remarkably similar assemblages of Clovis artifacts and are situated about 1 km apart on an upland hilltop and ridge, dividing the Illinois and Kaskasia drainage basins and adjacent to the American Bottom. Mueller is well known from previous reports of its surface assemblage, significant for the hundreds of tools found there and for the predominant use of Attica and Holland chert transported at least 320 km from west-central Indiana sources (Koldehoff 1983, 1999; Koldehoff and Walthall 2004; Lepper 1999). Keck is not as well reported, but several artifacts from this site are illustrated on the "Early Paleo-Indian" poster available from the Lithic Casting Lab. Both assemblages are derived from plowzone surface exposures, but an undisturbed woodlot, which may contain buried Clovis deposits, is immediately adjacent to Mueller.

Most of our fieldwork focused on this woodlot, initially excavating 35 shovel tests (40 by 40 cm) at 10-m intervals. Excavations followed natural stratigraphy; fill was screened using 0.32- and 0.16-cm mesh. Despite the unavoidable limitations of using such methods in attempted discovery of low-density sites (McManamon 1984; Nance and Ball 1986), we found prehistoric cultural material in most units with concentrations in the A horizon (including the underlying thin and discontinuous E horizon) adjacent to the plowzone exposures. In addition, 12 percent of these artifacts were found in the underlying B1t horizon about 10–40 cm below surface. These shovel tests produced 89 chipped-stone artifacts, including two flakes of Attica chert probably from Clovis occupations and one from the basal B1t or underlying Bt24t horizon about 40–45 cm below surface (soil designations from the County Soil Survey). These positive shovel tests helped determine scattered block excavations of

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34.5 m^2 producing an excavated volume of 21.89 m^3. Depths ranged up to 95 cm below surface; fill was screened using 0.64- and 0.32-cm mesh. Another 171 chipped-stone artifacts were recovered from 0.64-cm screening of these units with 48 percent (n = 82) from the Ap and A horizons (densities of 15 and 10.5 lithic artifacts per m^3, respectively), 51 percent (n = 87) from the B1t (density of 9 per m^3), and 1 percent (n = 2) from the Bt24t (density of 0.5 per m^3). Diagnostic lithic artifacts were not recovered from these excavations, but three additional Attica flakes were found, two from the Ap horizon and one from the underlying B1t horizon. This slim evidence suggests a dispersed Clovis component may be buried within the B1t or upper Bt24t horizon (about 40–50 cm below the undisturbed surface), but the cost of recovery for these few Attica flakes was about 65 person-days each, which reflects the significant difficulty of locating and recovering them.

The relative concentration of Clovis artifacts in the adjacent plowzone may have been enhanced by deflation and erosion. Currently, the Ap horizon is underlain by lower Bt24t and B3t deposits, which indicates the loss of about 50 cm from the soil profile and potential mixing of A, E, B1t, and upper Bt24t deposits within the Ap. We have completed multiple collections of the plowed surface at both of these locations. At Mueller, we surveyed about 36,000 m^2 and piece-plotted 176 chipped-stone artifacts (including 11 Attica or Clovis diagnostics), 2,057 fire-cracked rocks, and 4 late-Woodland ceramics. At Keck, we surveyed about 180,000 m^2 and piece-plotted 623 chipped-stone artifacts (including 26 Attica or Clovis diagnostics), 4,998 fire-cracked rocks, 33 groundstone and hematite fragments, and 51 prehistoric ceramics. These efforts produced distributional maps that are helping to reconstruct the spatial patterning of artifacts across these plowed surfaces. Plans include continued surface collections on this landform and excavations at Keck to determine the potential for intact Clovis deposits below the plowzone there.

Finally, we are conducting detailed technological analysis of the associated avocational surface collections. This lithic assemblage from Keck includes 3 hammerstones, 228 waste flakes, 19 cores, 61 flake tools, 28 bifaces, and 39 projectile points. The Clovis component of Attica and Holland chert consists of 93 waste flakes, 10 cores, 44 flake tools, 14 bifacial preforms, and 11 fluted points. Mueller contains 11 hammerstones, 681 waste flakes, 68 cores, 332 flake tools, 75 bifaces, and 86 projectile points. The Clovis component of Attica and Holland chert consists of 259 waste flakes, 20 cores, 230 flake tools, 46 bifacial preforms, and 29 fluted points.

Our deepest appreciation goes to Paul Keck, Dave Keck, and the entire Keck family for their friendship and support in helping us accomplish these three seasons of fieldwork. Mr. Mueller kindly granted permission for us to dig in his woodlot. Tom Loebel, Shannon Fie, and Paula Bryant deserve special thanks for helping direct much of the fieldwork and lab analysis. Dr. Flip Arnold and Eleanor Shepard helped us accomplish the last few frantic days of fieldwork in 2001. The Loyola field school participants were simply outstanding and included: P. Allman, M. Ayzenberg, P. Bryant, W. Burroughs, S. Daily, C. Ecker, M. Ecker, S. Gallant, D. Heltibrand, L. Holsapple, L. Hernandez, K. Johnson, L. Kim, S. Kosmala, M. Machnica, L. Malekfar, L. Martinez, L. Melnyczenko, D. Munger, J. Nyden, S. Parekh, R. Pejovic, M. Prescott, L. Putrino, L. Radetic,A. Schaefer, V. Sevic, C. Torrence and M. Zolnierz. Thanks also to additional Loyola students who assisted in processing and analyzing artifacts back at the archaeology laboratory: A. Bednarz, H. Blatcher, M. Christus, A. Dailide, A. Jordan, M.

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The Significance of a Second Folsom Projectile Point from Bonfire Shelter, Texas

Judith R. Cooper and Ryan M. Byerly

On the Great Plains, projectile point typologies were traditionally believed to denote culturally and temporally discrete groups (Irwin and Wormington 1970). Recent work on the Northern Plains suggests a more complex story, highlighting the vague and often overlapping stratigraphic relationship between point types and questioning their appropriateness as the basis for interpreting Paleoamerican prehistory (Sellet 2001). Chronological overlap is most conspicuous ca. 11,000–10,000 RCYBP (Sellet 2001), notably coinciding with the Younger Dryas ^{14}C plateau, during which temporal resolution is reduced (Holliday 2000). On the Southern Plains, distinct types sometimes overlap in excavated deposits. The late-Glacial component at Bonfire Shelter (Bonebed 2, averaging 10,080 ± 100 RCYBP; Holliday 2000) is cited for its stratigraphic association of Folsom, Plainview, and possibly Midland types (Dibble 1968; Holliday 2000; Holliday et al. 1999).

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Bonebed 2 was originally interpreted to be the result of three separate bison jump kill events (Dibble and Lorrain 1968). The projectile point assemblage, consisting of four complete Plainview points (one of which may be Midland) and, at the time, a single Folsom point, was regarded as an oddity given the apparent sequence of the kill events and the known chronological order of Folsom and Plainview elsewhere on the Southern Plains (Dibble 1968; Holliday et al. 1999). Dibble (1968:73) reasoned that the single Folsom point might have entered the Bonebed 2 deposit by any number of intrusive agents (e.g., a pickup by a later group or carcass carry from previous hunting attempts).

Recent reanalysis of the Bonebed 2 assemblage has challenged some of Dibble's (1968) interpretations, namely the division of Bonebed 2 into separate stratigraphic components. Various indicators suggest that Bonebed 2 represents a single kill event (Byerly et al. 2005), and, as such, the Folsom and Plainview components are stratigraphically contemporaneous.

We report here on an additional Folsom point fragment recovered in a recent review of Bonebed 2 lithic artifacts. The fragment was screen-recovered from Bonebed 2 on February 26, 1964 (Pit C: F28, F15 Stratum [Dibble 1964]). Though originally catalogued as an unworked flake, the fragment demonstrates bifacial flaking, including a single flute on one face and multiple flutes on the obverse (Figure 1). Lateral grinding and basal retouch are minimal. Morphometrically the fragment conforms closely to the Folsom point type (Amick

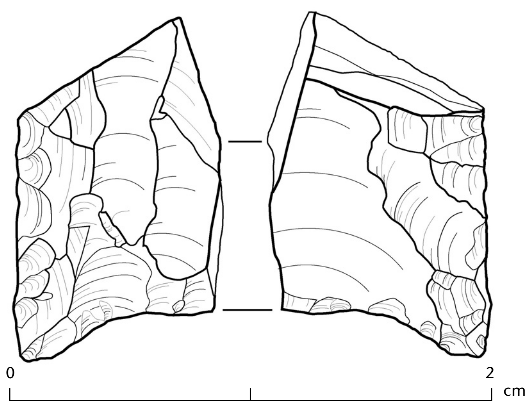

Figure 1. The second Folsom point fragment recovered from Bonebed 2, Bonfire Shelter, Texas (flute thickness 3.27 mm; maximum thickness 3.75 mm).

1995:30-31). The color and translucency of its raw material are similar to the other Folsom point found at Bonfire Shelter (Dibble 1975:67).

The discovery of another Folsom point greatly reduces the probability that the Folsom component is intrusive and thus strongly suggests that the Folsom-Plainview association at Bonfire Shelter is real. These findings demonstrate a close temporal association of Folsom and Plainview on the Southern Plains, indicating significant diversity and cultural interaction during Late Glacial times.

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Unifacial Stone Tool Analyses from the Paleo Crossing Site (33-ME-274), Ohio

Metin I. Eren, Brian G. Redmond, and Mark A. Kollecker

Paleo Crossing (33-ME-274) is an early Paleoamerican site in Medina County, Ohio, which has been dated to 10,980 ± 75 RCYBP (Brose 1994:65). The site exhibits an interesting lithic procurement pattern. Approximately 75 percent of

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the lithic artifacts consist of Wyandotte chert, which outcrops more than 600 linear km southwest of the Paleo Crossing site in southern Indiana and northwestern Kentucky (Tankersley and Holland 1994:62). Less distant (< 200 km) varieties of raw material such as Upper Mercer chert, Ohio Flint Ridge chalcedony, and Delaware chert make up the remainder of the stone tool assemblage. The Paleo Crossing fluted-point assemblage has been thoroughly analyzed (Barrish 1995; Brose 1994; Eren 2003; Eren et al. 2004), yet the significant unifacial stone tool assemblage has, until recently, largely been neglected.

Technological, metric, typological, and reduction analyses have been conducted on the entire Paleo Crossing unifacial stone tool assemblage for the primary author's undergraduate honors thesis (Eren 2005). For this preliminary analysis, descriptive and metric variables were recorded for 208 of the 444 unifacial side- and endscrapers in the assemblage. Of the total study sample (n = 208), 151 unifaces (73 percent) are made of Wyandotte chert and 57 unifaces (27 percent) are made from non-Wyandotte cherts; 138 specimens (66 percent) are fragmentary, and 70 specimens (34 percent) are complete; 78 specimens (38 percent) show evidence of heat damage, and 130 specimens (62 percent) do not. The breakdown of recognizable fragment categories is as follows: proximal, 38 pieces (18 percent); distal, 50 pieces (24 percent); midsection, 22 pieces (11 percent); longitudinal half, 13 pieces (6 percent); indeterminate forms, 15 pieces (7 percent); and complete, 70 pieces (34 percent).

As the metric summaries in Table 1 show, a variety of values exist for each metric variable, though the Paleo Crossing unifacial scrapers are, on average, small, thick, and reduced. The medians of each metric variable should be taken as a more accurate measure of central tendencies than the means, as there are a small number of larger, less-modified scrapers that skew the mean values. At first glance, the length-to-width ratio mean and median values of 1.7 might seem to indicate that close to half of the assemblage are made on blade blanks or blade-like-flake blanks. This is impossible to confirm, however, as the scrapers are so heavily reduced distally, laterally, and proximally that the high length-to-width ratio may be due to excessive retouch and blank modification rather than a reflection of the original blank morphology. Other

Table 1. Metric variable values for the Paleo Crossing unifacial stone tools.

Measurement (mm or mm²)	PT n = 76	PL n = 76	PA n = 76	L n = 70	W n = 70	T n = 70	MD n = 70	SA n = 70	L:W n = 70
Mean	3.0	7.3	25.7	34.9	20.9	8.1	36.4	750.3	1.7
SD	1.6	2.9	25.8	9.4	4.8	2.1	9.8	310.5	0.4
Min	0.7	2.6	2.8	13.9	10.9	4.0	17.3	223.8	0.9
Q1	2.0	5.5	11.5	30.0	18.3	7.0	30.9	576.3	1.4
Median	2.7	6.7	17.3	34.5	20.3	8.1	35.4	683.8	1.7
Q3	3.8	8.5	33.2	41.3	24.1	9.9	43.6	1126.1	2.0
Max	9.7	18.5	179.5	64.7	34.5	14.7	65.3	1468.7	2.9
IQR	1.8	3.1	21.8	11.3	5.8	2.9	12.7	549.8	0.6

PT platform thickness
PL platform length
PA platform area
L length
W width
T thickness
MD maximum dimension
SA surface area
L:W length-to-width ratio
SD standard deviation
Q1 first quartile value
Q3 third quartile value
IQR inter-quartile range

features like dorsal-scar pattern that might help distinguish blade versus flake blanks are almost completely eliminated due to the extreme invasiveness of the retouch. If the Paleoamericans from Paleo Crossing acquired Wyandotte chert through direct procurement, one could imagine them extensively modifying their stone tools over the long distance between the Wyandotte chert source area and northeast Ohio. With almost three-fourths of the sample presented here made from Wyandotte chert, it should come as no surprise that the Paleo Crossing scraper assemblage is as small, broken, and reduced as it is.

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An Early-Holocene Eccentric Crescent from Daisy Cave, San Miguel Island, California

Jon M. Erlandson

Chipped-stone crescents are unusual artifacts in early sites of the western United States, including eccentric crescents from early-Holocene sites of California (Erlandson 1994). Crescents, probably used for a variety of purposes, are often described as transverse projectile points for hunting waterfowl. As temporal markers in early California sites, crescents have been found from Bodega Bay to

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Baja California, but they are more common along the south coast. Data presented by Fenenga (1984) indicate that 26 of 85 crescents he described were from the Channel Islands, but none of these island specimens came from stratified contexts. In 2003 I found an eccentric crescent embedded in a paleosol at Daisy Cave, the first island crescent from a well-dated context.

Located on the northeast coast of San Miguel about 40 km from Santa Barbara, Daisy Cave has been excavated multiple times, most recently by University of Oregon teams. Our excavations focused on stratified shell midden deposits just outside the cave, where over 40 ^{14}C dates identify multiple occupations between at least 700 and 11,500 CALYBP (Erlandson et al. 1996). The most extensive occupation is represented in strata E and F, dated between 10,000 and 8600 CALYBP. The eccentric crescent, found in the middle of these strata exposed in the sea cliff, probably dates to about 9000 ± 200 CALYBP.

Made from a marbled black-and-gray Monterey chert generally believed to come from mainland sources, the crescent is 48 mm long, 20.6 mm wide, and weighs 4.2 g. It was carefully retouched bifacially, primarily through pressure flaking, to produce a crescent shape with a convex axial blade, lateral notches, and a shallow axial notch (Figure 1). Similar crescents, classified by Jertberg (1978) as Type 3 and Fenenga (1984) as Type 3b, are the most common type found on the Channel Islands. The function of the Daisy Cave crescent is uncertain, but the abundance of bird bones in strata E and F is consistent with

Figure 1. Eccentric crescent from Daisy Cave, length 48 mm (drawn by Deana Dartt).

a use as a transverse projectile point. Whatever its function, the specimen provides clear evidence that eccentric crescents were used by early maritime peoples on the Channel Islands, and its manufacture from a probable mainland chert type provides additional evidence for regular connections between the Paleocoastal inhabitants of the Northern Channel Islands and the adjacent mainland.

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An Update on Recent Work at Sloth Hole (8JE121), Aucilla River, Jefferson County, Florida

C. Andrew Hemmings

The probable association of diagnostic Clovis artifacts and remains of mastodon (*Mammut americanum*) previously reported from Sloth Hole (8JE121) is now felt to demonstrate a secure association based on additional lab and field work and the direct dating of an ivory point fragment found in a sealed context in 1999 (Hemmings 1998).

The terraced margins of this underwater sinkhole site contain a nearly continuous stratigraphic section spanning the period of 33,000 to roughly 4,000 RCYBP. The most recent recognizable terrestrial surface now lies under 5 m of water. This terrestrial surface contained quantities of wood, a single fragment of which was dated 12,300 ± 50 RCYBP (Beta-95341; Unit 22, Level 8). Embedded in this surface are the remains of an enormous mastodon. An unstained calcaneum of this mastodon has been directly ^{14}C dated 12,180 ± 60 RCYBP (Beta-119350; Unit 210, Level 14).[1] In 1999 an unstained haft element of an ivory point was found 63 cm above the 12,300 RCYBP land surface in the 1-m^2 unit immediately to the north. This ivory tool fragment was directly AMS ^{14}C dated to 11,050 ± 50 RCYBP by Stafford Laboratories (CAMS-71705; Unit 105, Level 5). This is a particularly early date for eastern North America, and it fits well within the known chronology of Clovis material elsewhere (Haynes 2002:12).

Five stone Clovis points have been documented from Sloth Hole, and a sixth has been seen only in photographs of the former owner's collection. One of the Clovis points is made of greenish chert believed to be from Alabama. This green chert is represented in Sloth Hole by only the Clovis point and one bifacial thinning flake fragment. To date, no other non-local chert has been recognized in the Sloth Hole assemblage. No late-Paleoindian (Simpson or Suwannee) materials have been documented in Sloth Hole, contrary to initial reports that were based on line drawings of material in a large artifact collection later donated to the Florida Museum of Natural History (FLMNH) by the Ohmes family, formerly of Monticello, Florida (Hemmings 1998).

In total, 33 curved foot-long ivory points and 74 additional non-mended fragments are documented in the assemblage. For several years only two of the ivory points in the Aucilla River Prehistory Project's collection of the FLMNH

[1] Unit 210 is downslope of Unit 22. Distinguishable unconsolidated Holocene fluvial sediments were described and numbered in the field during excavations. As a result, field designations of stratigraphic layers become more refined as work progressed. Despite numbering differences, the wood from Unit 22, Level 8, and mastodon calcaneum from Unit 210, Level 14, really came from the same level. These numbering differences between excavations will be fully resolved once excavations are complete and a final report is prepared.

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were complete (FLMNH VP #136393 and 136394). Results of an aggressive ivory tool refit exercise include complete restoration of a third ivory point. A fourth reconstructed ivory point, found in six mended pieces, while still incomplete, measures 33.3 cm long and would have been roughly 40 cm long if the haft element were intact. The long curved ivory points, often incorrectly referred to as foreshafts, are complemented by two ivory bead preforms, a 3-cm-long ivory needle tip, an ivory socketed handle fragment, and a complete 13-cm-long straight ivory point (Hemmings 2004:145; Webb and Hemmings 2001). Thus, there are now 152 ivory tools known from Florida, the majority of which have been recovered from Sloth Hole. These consist of 13 different forms used for a variety of functions (Hemmings 2004:168).

The overall wealth of preserved faunal material is readily apparent in even a

Table 1. Sloth Hole taxa present for all time periods.

Taxon	Common name	Comments
Fish	Numerous UID	Many from in situ deposits▪
Reptiles—particularly snakes	Numerous UID	Many from in situ deposits
Geochelone crassiscuttata	Extinct large tortoise	Unassociated carapace sections
Unidentified turtles	Numerous UID	Includes 1 undated drilled artifact
Alligator mississippiensis	Alligator	Many, some from in situ deposits
Holmesina septentrionalis	Giant armadillo	Present, currently unassociated
Dasypus bellus	Armadillo	Present, currently unassociated
Glyptotherium floridanum	Glyptodont	Present, currently unassociated
Megalonyx jeffersonii	Ground sloth	Both unstained radii of 1 animal cut (UF VP #21337)
Scleroporus pinckneyi	Bat	Only 3 said to exist, simple presence
Canis dirus	Dire wolf	Present, currently unassociated
Canis sp.?	Unspecified	Drilled teeth in Ohmes Collection
Tremarctos floridanus	Bear (spectacled?)	Tooth, present.
Monachus tropicalis	Monk seal	1 distal metatarsal, extirpated 1959
Lutra canadensis	Otter	Present, currently unassociated
Smilodon fatalis	Saber cat	Present, currently unassociated
Lynx rufus	Lynx (wildcat)	Incised spirals on undated mandible
Panthera leo atrox	American lion	Present, currently unassociated
Felis amnicola	Small cat	Type site, currently unassociated
Castoroides ohioensis	Giant beaver	Present, currently unassociated
Castoroides canadensis	Beaver	Present, currently unassociated
Ondatra zibethicus	Muskrat	MNI 30, extirpated, unassociated
Microtus sp.	Vole	Present, currently unassociated
Neochoerus pinckneyi	Capybara	Teeth present, currently unassociated
Hydrochaeris holmsei	Capybara	Teeth present, currently unassociated
Hemiauchenia macrocephala	Small camel	Present, currently unassociated
Paleaolama mirifica	Llama	Many, 1 metatarsal distal end cut
Odocoileus virginianus	Whitetail deer	>1000 tools, some likely Clovis
Equus sp.	Horse	Present, currently unassociated
Tapirus veroensis	Tapir	Many, 1 cut mandible fragment
Mammut americanum	Mastodon	>33 tools and 74 fragments, MNI 4 Skeletons, some cut bones
Mammuthus columbi	Mammoth	1 molar plate section, MNI 1

▪Discovery of a species among in situ deposits indicates it will be assigned to a specific time period in the final report, regardless of whether or not the animal is directly associated with human activity at Sloth Hole. The simple presence of many extinct species in a datable context at a terminal-Pleistocene archaeological site is significant for how they contribute to our understanding of both the local environment and animal populations immediately prior to the extinction event.

brief listing of the identified taxa from Sloth Hole covering all time periods (Table 1). The total NISP is in the hundreds of thousands of identifiable vertebrate specimens. Several extinct species of fauna were exploited by the Clovis occupants of Sloth Hole. Identified skeletal elements of mastodon, Jefferson's ground sloth, tapir, and palaeolama have possible cutmarks on them. Several additional extant animals were used in the manufacture of formal bone tools and were potentially food sources as well. Much of the extant fauna cannot be confidently assigned to particular cultural units at present, but continuing research (e.g., detailed analyses of in situ finds and direct ^{14}C dating of significant artifacts) will improve this situation. Among the notable finds, turtle, canids, lynx, and deer were used in the manufacture of numerous formal bone tools.

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A Flattop Chalcedony Clovis Biface Cache from Northeast Colorado

Steven R. Holen and Mark P. Muniz

The CW Cache of Clovis bifaces was discovered during the 1990s by two private individuals near an upland playa lake and has been named for the discoverers. This is the second Clovis cache from northeast Colorado, the Drake Cache being the first (Stanford and Jodry 1988). The cache comprises 14 artifacts, which were found in a tight surface concentration in a cultivated field. Freshly broken surfaces indicate that some of the bifaces were damaged by agricultural practices.

The CW Cache consists of nine complete or nearly complete bifaces, two partial bifaces, and three large flakes. All artifacts are made from Flattop chalcedony, a variety of White River Group cryptocrystalline silicates that

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outcrops 160 km from the cache. The original upward surfaces of all the artifacts are heavily patinated to the degree that the original light purple color is almost completely obscured. The undersides have accumulated scattered deposits of pedogenic calcium carbonate ranging up to 1 mm thick.

Eleven of the artifacts are categorized as either late-stage bifacial cores or early-stage projectile point preforms (Figure 1). Technologically, the bifaces exhibit a generally ovoid outline form with rounded to flat bases that are very consistent with outline forms of bifaces from the Anzick, Fenn, and

Figure 1. A Clovis biface from the CW Cache. Note the calcium carbonate concretions attached to the face.

Simon caches (Frison and Bradley 1999; Wilke et al. 1991; Woods and Titmus 1985). The CW Cache bifaces have broad, flat flake scars that occur in serial collateral, slight diagonal, and more random patterns that are also morphologically consistent with the flake scar patterns on bifaces from the Anzick, Fenn, and Simon caches. Thinning flakes on the CW Cache bifaces frequently end in wide spatulate terminations, often traveling across the midline, and were most probably made with soft hammer percussion. Longitudinal thinning flakes are present on some pieces but none is technically fluted. Lengths for complete pieces range from 11.1 to 14.0 cm with a mean of 12.6 cm; widths range from 5.8 to 8.0 cm and average 6.7 cm; and thicknesses range from 1.1 to 1.6 cm with a mean of 1.3 cm. Compared with point performs and bifacial cores from the Fenn Cache, the CW Cache bifaces are slightly wider with very similar width:thickness ratios.

Our preliminary interpretation is that the CW Cache represents a collection of utilitarian tools consisting of bifaces that are either late-stage bifacial cores or early-stage projectile point preforms. Functionally, caching this type of biface assemblage would provide some flexibility for Clovis peoples in that one more round of thinning flakes could be removed to provide a variety of blanks for flake tools, the bifaces themselves could be turned into other types of bifacial tools that are not on a projectile point trajectory, and if needed, at least 11 large projectile points could easily be made from the bifaces. Furthermore, length:width and width:thickness measurements indicate these artifacts form a tight cluster with small standard deviation. This standardization in manufacture and the fact that the cache is made of a single high-quality lithic material may indicate that the cache was produced by a single individual.

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Possible Proboscidean Petroglyph Found at China Lake Naval Air Weapons Station

Russell L. Kaldenberg

China Lake Naval Air Weapons Station contains 1.1 million acres of Great Basin and Mojave Desert land, ranging in elevation from ca. 615 to 2,775 m above sea level at Maturango Peak in the Argus Mountain Range. Archaeologists and paleontologists have worked around the Station's many playas for decades, collecting fossil remains of megafauna loosely associated with human artifacts (Davis et al. 1978). Others have focused on the tens of thousands of petroglyphs that are scattered throughout basalt cliffs. The famous Coso-style bighorn sheep petroglyphs dominate the landscape, along with Great Basin

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abstract squiggles and rectilinear and curvilinear elements. Radiometric dates going as far back as 16,000 yr B.P. have been suggested as a result of Whitley and Dorn's work (1987, 1988). Parts of the Station have been the focus of Paleoindian research for decades (Davis et al. 1978). The playas were the habitat of *Mammuthus columbi as* well as many other species of megafauna (Webb 1992:24).

Recently, Basgall (2004) conducted an intricate study of the distribution of Paleolithic fossil remains and associated cultural remains. Owing to deflation of the soils the relationship continues to be equivocal. Rock art researchers such as Alice Tratebas nonetheless have theorized that rock art depicting Pleistocene megafauna should be present in the China Lake region, but it may be repatinated to such an extent that it would be difficult to see (A. Tratebas, pers. comm. 2003).

During the last weekend of February 2005 volunteers Carol Ormsbee, Jerry Grimsley, and Steve Swartz spent their daylight hours photographing and accurately locating several previously undocumented sites containing petroglyphs using their hand-held GPS units. When they downloaded their digital photographs they found that they had an image that resembled a proboscidean (or mammoth).

The mammoth petroglyph site is situated on the western flanks of the Argus Range approximately 20 km from China Lake, at approximately 1,540 m in elevation. The vegetation is Joshua tree woodland. Sites in the area tend to be on basalt uplifts dissected by east-west drainages flowing into China Lake to the west and, at the divide, into Panamint Valley to the east.

The site contains numerous petroglyphs, several hunting blinds, and large table-like basalt boulders surrounded by stacks of rocks ranging in size from basketballs to those that had to be lifted by several individuals to provide shelter, shade, or solitude. This is one of several dozen petroglyph loci within the Etcherran Valley immediately west of the Argus Mountains, and may be associated with the Carricut Lake petroglyphs discussed by Grant et al. (1968). These particular loci are not mentioned and were not mapped by them.

The mammoth-like figure is on the top of the basalt table rock (Figure 1). The length of the body measures approximately 33 cm from the tip of the curved tusks to the upturned tail, and approximately 23 cm from the bottom of the feet to the top of the head. It is lightly patinated and is facing northward. It has upward-turned tusks, what appears to be a bib of hair (or perhaps a trunk) between its front legs, a large crested head, and the traditional hump. It most resembles the mammoth depicted by Martin and Wright (1967:Figure 3[2]). Hair, though, is not depicted on the petroglyph. The other associated petroglyphs are curvilinear abstracts with various degrees of patination, as well as a rake-shaped form that may represent an equid.

Better documentation is needed. Work at the petroglyph site has focused on simply identifying and mapping the petroglyphs. The next step will be to thoroughly document the site's loci and to look more closely at the basalt flow to see if there are any additional features that could be interpreted to represent Pleistocene megafauna.

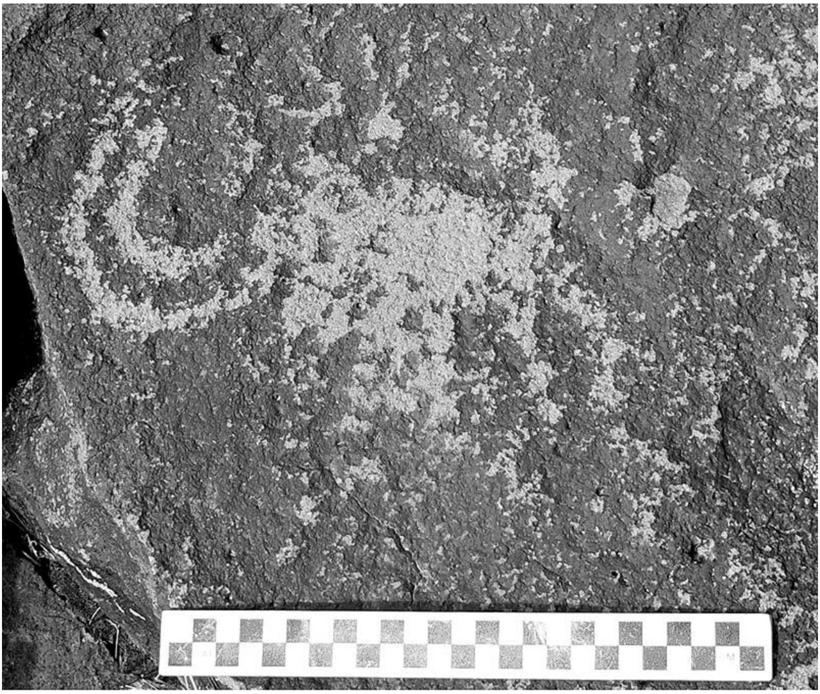

Figure 1. The mammoth-like petroglyph, Argus Range, California.

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Demolition Road, a New Clovis Site in the Middle Rio Grande Valley of New Mexico

J. David Kilby, James D. Gallison, Roberto Herrera, David Wilcox, and Valerie Renner

In January of 2004, archaeologists with engineering-environmental Management, Inc. visited a previously recorded lithic artifact scatter of unknown affiliation on Kirtland Air Force Base near Albuquerque, New Mexico, for the purpose of determining site eligibility to the National Register of Historic Places (Kilby and Gallison 2005). Surface inspection revealed a single diagnostic artifact, a Clovis projectile point fragment, along with a scatter of 161 lithic artifacts. The site is located on a residual fan with a west/southwest aspect adjacent to a low-gradient drainage with dense grass cover. Immediately north of the site are two low hills that provide open views east toward the Manzanita Mountains and south and west along the Rio Grande Valley.

A series of test excavations uncovered 296 additional lithic artifacts from a compact soil formed in silt loam. The 30- to 40-cm-deep A/C-Bt-Btk profile represents a soil that formed over a period of from a few thousand to a few tens of thousands of years. While no single occupation surface was identifiable, artifacts are concentrated in the Bt horizon 10–25 cm below the surface and normally distributed, suggesting potential for an interpretable stratigraphic context for the assemblage. Geomorphic investigation of the drainage indicates that it represents a former marsh or cienega with at least two major stands, the earliest dating 5450 ± 80 RCYBP (Beta-193087). Any record of earlier stands of the marsh along this portion of the drainage appears to have been eroded at some time in the early Holocene.

The Clovis point is a heavily reworked basal fragment made on obsidian from the Jemez Mountains, located 90 km to the north. The point exhibits dense scratches in a cross-hatched pattern within the channel flake scars on both faces, similar to the vertical scratches visible upon specimen #107 from the Fenn Cache (Frison and Bradley 1999:19). The distal end is either heavily reworked or curiously resharpened to a narrow point on an otherwise obtusely angled tip. It is not clear if the point was reworked during the Clovis period or at some later time; however, there is no noticeable difference in the degree of weathering on the original surface compared with the retouched surface.

In addition to the point base, 3 cores, 1 complete biface, 5 biface fragments, and 11 flake tools were identified. Flake tools include marginally retouched flakes, notched flakes, and gravers. The complete biface is a large early-stage basalt bifacial core with edge grinding. Each of the biface fragments repre-

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sents the margin of a relatively large biface characterized by sinuous edges and some edge-grinding. A substantial remnant facet (Wilke et al. 1991) is visible on one of the margins.

The vast majority of the assemblage consists of tan chert, with few exotic toolstones represented. The tan chert is locally available in secondary alluvial deposits as small cobbles and was reduced on site. The reduction was systematic, often with careful platform preparation and sequential parallel detachments resulting in the production of blade-like flakes. Platform rejuvenation flakes and the conical distal end of a unidirectional core are additional indications of this blade-like reduction technology. Other raw material types include chalcedony, obsidian, black chert, and silicified wood. Most of the flakes are from early- and late-stage biface reduction. In addition to the lithic artifacts, a single piece of tooth enamel of a size consistent with a large ungulate was recovered from 15–30 cm below the surface.

The information gathered from Demolition Road indicates that the site preserves a record of a Clovis occupation and may potentially represent a single-component Clovis site. The one diagnostic lithic artifact is Clovis, and the assemblage, although diagnostically ambiguous, is consistent with Clovis technology. The lithic technological and raw material data together suggest that the site represents a camp and workshop. Based upon the condition of the tools and the raw material patterning, it is hypothesized that a Clovis group arrived at the site with few remaining lithic raw material stores. In addition to carrying out routine campsite activities, the group gathered and intensively reduced the locally available tan chert both for immediate use as expedient tools and to replenish exhausted materials.

Future studies include geomorphic investigations to decipher the environmental history of the site. In the meantime, Kirtland AFB is committed to protecting the site and monitoring the activities along Demolition Road.

Special thanks are extended to Valerie Renner, Environmental Management, for her continued interest and support of the cultural resource programs at Kirtland AFB and to Bruce Huckell, University of New Mexico, for sharing his insights into the early prehistory of the area.

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Geoarchaeology of Clovis and Possible Pre-Clovis Cultural Deposits at the Kanorado Locality, Northwestern Kansas

Rolfe D. Mandel, Steven Holen, and Jack L. Hofman

The Kanorado locality is in Middle Beaver Creek in northwestern Kansas. This locality is high in the drainage network and, like other draws in the region, is along an intermittent stream which carries water only immediately after heavy rainfalls. Late Quaternary alluvium is stored beneath two geomorphic surfaces: a low, narrow floodplain (T-0) and a broad, flat terrace (T-1). The Quaternary alluvium is inset into the Tertiary-age Ogallala Formation.

The Kanorado locality was first investigated by the Denver Museum of Natural History in 1976 and 1981 and was reported as a paleontological find consisting of mammoth bone in two levels exposed along a channelized reach of Middle Beaver Creek (Lindsey 1981). However, according to K. Don Lindsey, the paleontologist in charge of the 1976 investigation, a large cobble found with the mammoth bones in the lower level appeared to be out of place in the fine-grained sediment. He also noted that spiral fractures and wear patterns on some mammoth elements did not appear to be caused by natural processes.

In 2003 and 2004, the Denver Museum of Nature & Science and the University of Kansas conducted archaeological testing and soil-stratigraphic studies at Kanorado. These investigations revealed that the locality includes three stratified Clovis-age campsites—14SN101, 14SN105, and 14SN106—contained in silty alluvium beneath the T-1 terrace (Mandel et al. 2004). The cultural deposits are in the lower 10 cm of the A horizon of a buried paleosol, or about 1.5 m below the T-1 surface. One or more components are present in this paleosol and represented by chipped-stone artifacts (flakes and tools) made from exotic materials, including Alibates flint, Flattop chalcedony, Smoky Hill jasper, and Hartville chert. Faunal elements associated with the lithics are camel and bison size. Also, one element appears to be mammoth cortical bone. Purified collagen samples representing one bone from each of the three sites, all collected from the lower 10 cm of the buried A horizon, yielded AMS ^{14}C ages of 10,150 ± 500 (CAMS-112740), 10,950 ± 60 (CAMS-112741), and 11,005 ± 50 RCYBP (CAMS-112742).

During the 2003 field season, a concentration of in situ mammoth bones, including a proximal fibula, a vertebra, and rib fragments, was exposed about 2.5 m below the Clovis-age component at site 14SN105. The bones were contained in loamy and fine-sandy alluvium about 30 cm above coarse-grained point bar facies. This concentration of mammoth bones is correlated with the

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lower mammoth level excavated by Lindsey in 1976. Spiral fractures were observed on the fibula and rib fragments and on one piece of cortical limb bone. The vertebra, however, showed no evidence of breakage. Also, a phalanx and fragment of pelvis from a *Camelops* were found among the mammoth bones. There is no identified evidence of carnivore gnawing, and we consider human action as a possible explanation for the bone modification. Purified collagen from a mammoth fibula, *Camelops* tibia, and mammoth radius yielded ^{14}C ages of 12,215 ± 35 (UCIAMS-11213), 12,255 ± 40 (UCIAMS-11212), and 12,375 ± 35 RCYBP (UCIAMS-11214), respectively.

In 2004, a quartzite flake was found in the lower mammoth/camel bone level. The flake exhibits a prominent bulb of percussion and dorsal flake scars, but exhibits some wear probably caused by movement in alluvium. Quartzite occurs naturally in local gravel, but the morphology of the flake suggests it was produced by human action and may represent a hammerstone spall. Analysis of the flake is underway.

In sum, the Kanorado locality is significant because it represents the first recorded in situ Clovis-age cultural deposits in the Kansas/Nebraska region. It also may have a pre-Clovis archaeological component and therefore may shed light on the timing of human entry into the Great Plains. This site may have great potential for providing new information concerning Clovis and possibly pre-Clovis subsistence and mobility strategies on the High Plains.

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Evidence for Early-Paleoindian (Gainey) Occupation of the Taylor No. 2 Site (11EF129), Effingham County, Illinois

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Between 1991 and 2001 Mr. James Taylor collected over 200 points, end-scrapers, cores, debitage, and cobble tools from the surface of an 88,000-m^2

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area of a plowed upland ridge overlooking the headwaters of a creek near Montrose, Illinois. Artifacts indicate that this area, designated as the Taylor No. 2 site (11EF129), was occupied during the early-Paleoindian (Gainey), early-Archaic (Thebes, St. Charles, Kirk and LeCroy), and late-Archaic (Table Rock) time periods. This article focuses on evidence of the Gainey-phase occupation of the Taylor No. 2 site.

Stone tools collected from Taylor No. 2 include a fluted point, a fluted-point tip, and a stage-4 (Morrow 1996) fluted preform, a fragment of a large, thin bifacial core, 32 endscrapers, and a utilized flake. The complete fluted point of Wyandotte chert is a Gainey point (Figure 1A) based on its thickness (4.6 mm) between the flutes relative to that of the average Clovis point (5–7 mm), its deeper basal concavity (7.5 mm) than the average Clovis point, and its outline morphology. Its length is 60 mm, maximum width is 30.1 mm, and maximum thickness is 5.8 mm. This heavily resharpened point exhibits an impact fracture on the tip. Resharpening has partially obliterated the distal end of a single long flute on both faces. The edge angle of the blade ranges from 60 to 70 degrees. The heavily ground lateral margins of the haft measure 25.0 to 25.7 mm. The outline morphology of the base is similar to that of the Rummels-Maske fluted points (Morrow and Morrow 2003).

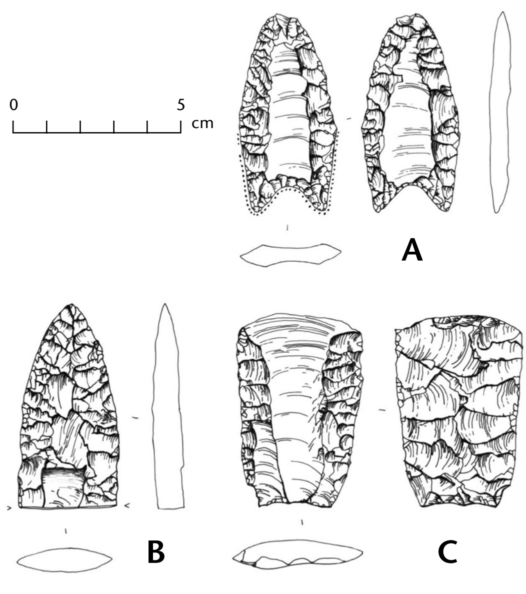

Figure 1. Gainey-phase tools from the Taylor No. 2 site. **A,** Gainey point; **B,** fluted point tip; **C,** Gainey preform.

The Attica chert fluted projectile point tip from Taylor No. 2 shows the distal end of a single flute on one face (Figure 1B). The lack of the haft portion makes it difficult to type this specimen. Its association with two other Gainey artifacts, however, suggests that it may be a Gainey point. With an edge angle from 40 to 50 degrees, the point appears fairly pristine.

An overshot basal fragment of a Wyandotte chert Gainey preform from

Taylor No. 2 is 33.4 mm at its maximum width and 6.6 mm in maximum thickness (Figure 1C). Three features indicate this is a Gainey-style preform: (1) the width and placement of the fluting platform (narrow and low relative to the fluting face), indicative of Gainey-style fluting; (2) the thickness of the preform at this stage of fluting (Morrow and Morrow 2002); and (3) the primarily medial percussion blade flaking pattern.

Other tools recorded in the Taylor No. 2 site collection include 31 endscrapers and a single utilized flake of Holland chert. Of the endscrapers, 24 are complete; 7 lack the proximal (haft) portion. The maximum thickness of 31 specimens ranges from 19.1 to 5 mm and averages 10.6 mm. The maximum width of 13 specimens ranges from 36 to 22.2 mm and averages 12 mm. The total length of 12 specimens ranges from 60 to 25.7 mm and averages of 38.1 mm. The striking platform was trimmed off 7 of the 31 endscrapers. Eleven of the endscrapers have simple or cortical platforms suggesting that they were manufactured from non-bifacial core forms. The endscraper sample contains the following identified raw materials: Attica (n = 1), Burlington (n = 11), Chouteau (?) (n = 1), Silurian (n = 1), and Wyandotte (n = 3). Except for specimens made of Wyandotte and Attica cherts, the most likely source of stone for most of these endscrapers is glacial till. The three endscrapers of Wyandotte chert are probably associated with the Gainey occupation.

One large, thin bifacial core fragment of Wyandotte chert is probably a Paleoindian-era artifact. The Wyandotte chert artifacts (two fluted points, three end scrapers, and one biface core fragment) from Taylor No. 2 may represent the remnants of a Gainey toolkit.

Hide scraping/woodworking, hunting, and fluted-point manufacture are some of the activities indicated. Stone raw materials present in the collection suggest that in addition to local sources of glacially transported chert cobbles, also used were stones from sources in west-central Indiana (Attica), approximately 100 km northeast of the site, and southern Indiana (Wyandotte), approximately 160 km miles to the southeast, and possibly west-central Illinois (Chouteau), approximately 150 km southwest of the site.

The Taylor No. 2 site contains a small but typical Gainey stone toolkit made from Wyandotte chert from southern Indiana. While Attica chert from west-central Indiana has been well documented in early-Paleoindian assemblages across Illinois (Koldehoff 1999), Wyandotte has not. This near absence of Wyandotte fluted points in Illinois, particularly southwestern Illinois, may denote the western limits of a Gainey-phase band territory in east-central Illinois. Continued research can test this hypothesis.

We thank Pete Bostrom for bringing this collection to our attention and avocational archeologist James Taylor for sharing it with us. We take responsibility for any errors herein.

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Early-Holocene Land Use and Subsistence on Eastern Santa Rosa Island, California

Torben C. Rick, Douglas J. Kennett, and Jon M. Erlandson

California's Channel Islands are well known for the number and diversity of early Pacific Coast archaeological sites, including evidence of human occupation dated to at least 13,000 CALYBP (Erlandson et al. 1996; Johnson et al. 2000). Recent research on Santa Rosa and San Miguel islands has targeted terminal-Pleistocene and early-Holocene sites to investigate early human subsistence, settlement, and land use (Erlandson et al. 1999; Kennett 2005; Rick et al. 2001). Here we report the analysis of faunal remains from CA-SRI-666, an early-Holocene deposit that is currently the oldest known site on eastern Santa Rosa Island. Because data from early Pacific Coast shell middens are limited, our analysis of CA-SRI-666 provides important information on early New World coastal adaptations, especially the early maritime peoples who settled the Channel Islands.

CA-SRI-666 (also known as SRI-91-15 [Erlandson 1994]) is a badly eroding shell midden and lithic scatter with cemented clusters of partially deflated shell midden in pockets roughly 1–2 m in diameter. The site is currently about 30–50 m from the shoreline and appears to be situated on an old dune ridge. During surface investigations, we observed a mix of shellfish remains from rocky intertidal (California mussel, abalone) and estuarine (Washington clam, oyster, and venus clam) habitats. In 2003, we observed three Monterey chert bifaces and numerous Monterey chert and metavolcanic flakes on the site surface. The Monterey chert artifacts appear to have been obtained from the adjacent mainland through trade or direct procurement.

A ^{14}C date obtained on a Washington clam shell from one of the midden clusters produced a calibrated age range (1 sigma) of 8100 to 7930 CALYBP (7780 ± 70 RCYBP) (Erlandson 1994:193), the oldest date from the island's eastern coast. The relatively crude bifaces found on the surface, the absence of shell beads or other later cultural indicators, and the presence of estuarine shellfish all support the early-Holocene age of the site.

To investigate early land use and subsistence on the island, we excavated a 5-liter bulk sample from one of the site's cemented midden clusters. Analysis of

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1/8-inch screen residuals from this deposit produced over 1 kg of shell and bone. At least six shellfish taxa were present in the sample, including barnacle, California mussel, red abalone, and limpet (Table 1). California mussel makes up about 99 percent of the sample by weight and about 81 percent of the MNI. Fourteen mammal, fish, and undifferentiated bone fragments were also recovered, indicating scavenging or hunting of vertebrates. Our surface observations suggest that people also collected shellfish from the nearby Abalone Rocks paleoestuary, albeit in smaller numbers than rocky intertidal taxa (Rick et al. 2005).

Table 1. Midden constituents from CA-SRI-666, bulk sample 1 (1/8-inch).

Constituent	Weight (g)	% Total weight	MNI/Ct.▪	% MNI/Ct.
Barnacle undif.	10.79	1.1	—	—
Haliotis rufescens	1.03	0.1	1	3.1
Haliotis spp.	1.20	0.1	1	3.1
Limpet undif.	0.09	< 0.1	4	12.5
Mytilus californianus	1006.36	98.6	26	81.3
Pollicipes polymerus	0.05	0.0	—	< 0.1
Subtotal	1019.52	99.9	32	—
Bone undif.	0.03	< 0.1	3	21.4
Fish bone	0.38	< 0.1	10	71.4
Mammal bone	0.22	< 0.1	1	7.1
Subtotal	0.63	0.1	14	—
Total	1020.15	—	—	—

▪MNI given for shellfish, counts given for vertebrates.

The available data from CA-SRI-666 suggest that the site was a temporary camp or possibly a base camp used by early-Holocene peoples on the island. Site disturbances, including extensive wind deflation, limit our interpretation of the precise function of the site. Shellfish remains from our excavated sample and the surface suggest a mix of rocky intertidal and estuarine taxa, however, demonstrating that early coastal peoples on Santa Rosa Island made use of all available shellfish habitats in the area. The presence of estuarine shell in the CA-SRI-666 deposits is unique for Channel Islands sites, which generally lack estuarine taxa (Rick et al. 2005).

Our research at CA-SRI-666 adds to the growing body of data on the subsistence and settlement strategies of early foragers on the Pacific Coast. These data suggest that early coastal peoples relied on a variety of shellfish species and made use of all available local habitats. In this case, people may have focused largely on California mussel because of its local abundance over estuarine or other taxa. Our research at CA-SRI-666 and other eastern Santa Rosa Island sites demonstrates significant environmental change over the last 8000 years, including infilling of an ancient estuary, expansion of sandy beaches, and decline in some rocky intertidal habitats (Rick et al. 2005). Future research at CA-SRI-666 and other island sites will provide valuable information on how early New World peoples adapted to these dynamic coastal and island environments.

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A Clovis Blade from Northeast Kansas

Craig A. Smith

In this paper I report the discovery of an extensively patinated and river-polished prismatic blade from the Kansas River valley in northeast Douglas County, Kansas. It meets the criteria of Clovis blades first established by Green (1963). More recently, Roper (1999:70) has stressed the need for "a detailed comparison of certain Clovis artifacts and similar specimens from known later contexts" that "could establish the more subtle attributes that would reliably identify specimens . . . where neither corroborating evidence for cultural affiliation nor an appropriate radiometric age is available." Collins's comparative work has differentiated "a constellation of attributes" of Clovis blades that are "almost as diagnostic of Clovis technology as are fluted points" (1999:182; see also 22–26, 56, 86, 179; 1990:73).

The Douglas County blade in Figure 1 (itemized metric data and indices are presented in the figure caption) falls within the range of Collins's comparative Clovis data from South-Central and Western specimens (1999:Table 6.1). It has a virtually negligible percussion bulb and ripples, and a length-to-width ratio exceeding 3:1. At 85 mm, it is in the shorter range of Clovis blades, which are usually more than 100 mm in length. Parallel and subparallel scars of previous blades removed are evident; the platform remnant is damaged, but the striking angle is tentatively reconstructed as 130 degrees. Right dorsal edge retouch confirms actual use.

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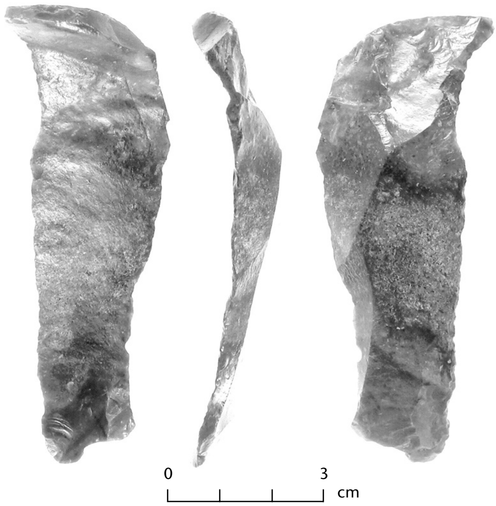

Figure 1. Blade found along the Kansas River, northeast Douglas County, Kansas (maximum length = 85 mm, maximum width = 26.75 mm, maximum thickness = 9 mm, platform angle = 130 degrees (?), curvature index = 9.64, length-to-width ratio = 3.18, length + width + thickness = 120.75, length + width + thickness/length = 0.70, length + width + thickness/ width = 0.22, length + width + thickness/thickness = 0.07, amount of cortex = 0 percent).

The Douglas County blade was produced from Permian Florence D chert that outcrops 130 km west-northwest as the Kansas River flows from the find location, where Riley, Pottawatomie, and Wabaunsee counties converge. This locality is cited here as the blade's original source.

Regionally, Holen (2001:Figure V.12, 127–132) has reported three blades from the South Platte River in Keith County, southwest Nebraska. Two were produced from Edwards chert, one from White River Group silicates. He reports two more from 150 km of the Little Blue River in Nuckolls, Thayer, and Jefferson counties, southeast Nebraska, and Washington and Marshall counties, northeast Kansas. One was produced from Edwards chert, the other from a clear chalcedony. In the context of Collins's (1999:Figure 3.1, Table 3.1) distribution study, the blade reported here now appears to represent the east-central boundary for blades technologically identical, and otherwise within the range of, those from definite and reconstructed Clovis contexts primarily in the south-central United States (Collins 1999:149). Tankersley's (2004:54–57, Figure 5.2, 5.3) more recent and more generic Clovis blade and blade core distribution maps, and remarks on regional distinctions of blade core types, provide some comparative basis from the eastern United States.

I thank Jack Hofman, from whom I first learned of Clovis blades, and Janice McLean for lithic identification. I also thank Donna Roper and Martin Stein for identifying Florence D outcropping sources, Juliet Morrow for consultation, and Rob Steffens for photography.

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Pre-Archaic Mobility at the Parman Localities, Humboldt County, Nevada

Geoffrey M. Smith

In 1968, archaeologist T. Layton identified four spatially discrete archaeological sites in Five Mile Flat, a small upland basin located in northwest Nevada (Layton 1979). The sites, which he referred to as the Parman localities, contained stemmed projectile points and associated lithic tools similar to those from other pre-Archaic sites in the Great Basin dated to between 11,500 and 7500 RCYBP (Beck and Jones 1997). In June 2004, a crew supported by the Sundance Archaeological Research Fund of the University of Nevada, Reno, revisited Five Mile Flat to assess the potential for early-period archaeological resources in the area. In total, approximately 200 stemmed points and 700 lithic tools were mapped and collected from the Parman localities. As part of our effort to consider pre-Archaic mobility and technological organization in the region, 225 obsidian artifacts from these sites were submitted for X-ray fluorescence (XRF) analysis. These results provide a sense of how early-period hunter-gatherers moved across the landscape (Jones et al. 2003).

A total of 15 known and 3 unknown geochemical types were identified in the XRF sample. The sources are located between ca. 5 and 230 km from Five Mile Flat (Figure 1). These data indicate the occupants of the Parman localities were far-ranging, often traveling hundreds of kilometers to procure toolstone and/or other critical resources. The obsidian sources are predominantly located in northwest Nevada, northeast California, and south-central Oregon. This "radial" lithic procurement pattern is consistent with those observed at other pre-Archaic sites in the northern Great Basin (Amick 1997; Connolly 1999; Oetting 1993) and contrasts greatly with the linear north-south patterns observed at pre-Archaic sites in the western and central Great Basin (Graf 2002; Jones et al. 2003). Whether such differences are a function of toolstone availability, topography, or other factors, however, is currently unknown.

Analyses of unhafted bifaces and finished projectile points from the Parman localities permit a more fine-grained consideration of pre-Archaic mobility and technological organization. The majority of specimens manufactured on

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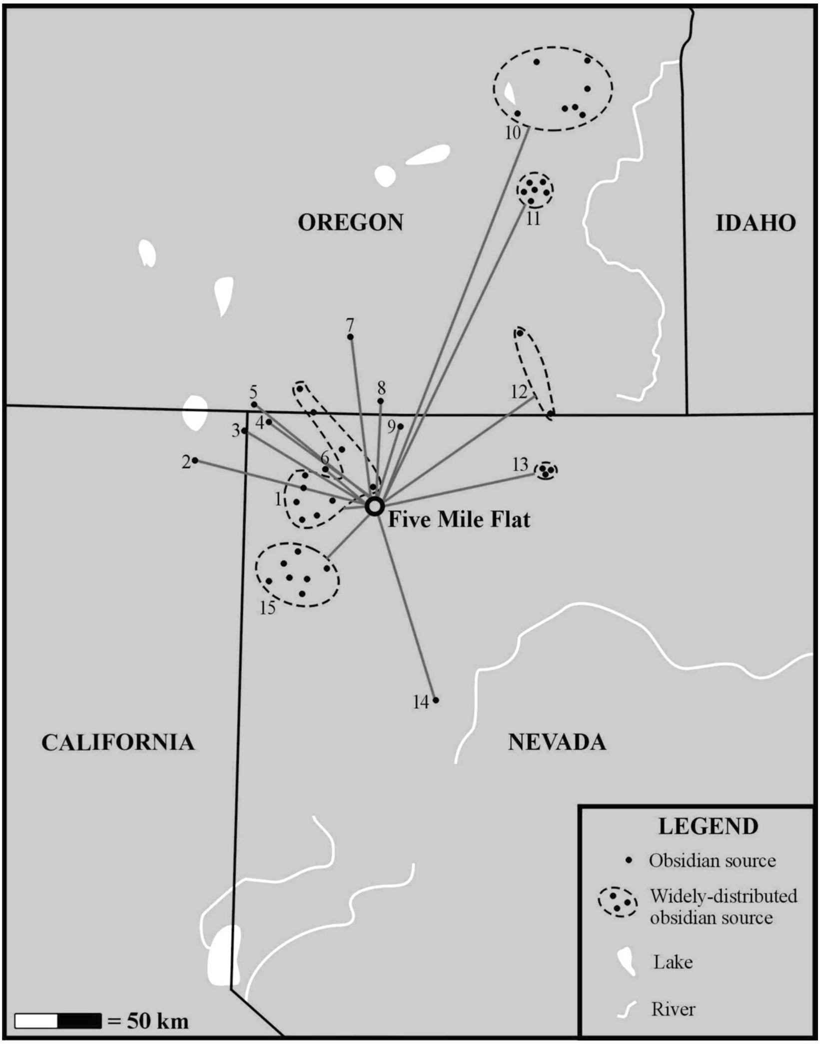

Figure 1. Five Mile Flat with locations of obsidian sources represented in XRF sample: **1,** Massacre Lake/Guano Valley; **2,** Buck Mountain; **3,** Cowhead Lake; **4,** Long Valley; **5,** Surveyor Spring; **6,** Coyote Spring; **7,** Beatys Butte; **8,** Hawks Valley; **9,** Bog Hot Springs Unknown 1; **10,** Venator; **11,** Indian Creek Butte; **12,** Whitehorse; **13,** Double H; **14,** Mt. Majuba; and **15,** Bordwell Springs/Pinto Peak/Fox Mountain.

non-local obsidians (> 5 km from the sites) are late-stage and/or finished products (60 of 62; 96.7 percent). Conversely, those manufactured on local material (Massacre Lake/Guano Valley obsidian, located < 5 km from the sites) occur at all stages of production. They include 21 early-stage bifaces (20.4 percent of local sample), 17 mid-stage bifaces (16.5 percent of local sample); 16 late-stage bifaces (15.5 percent of local sample), 17 finished bifaces (16.5 percent of local sample), and 32 projectile points (31.1 percent of local sample). These data suggest pre-Archaic hunter-gatherers arrived at the Parman localities with heavily used stone implements and restocked their lithic toolkits using locally available raw material.

Similar reprovisioning behavior has been observed at other pre-Archaic sites, including the Sadmat and Coleman sites in the western Great Basin (Graf 2001, 2002) and Butte Valley in the central Great Basin (Beck and Jones 1990). Kuhn (1995) suggests that a strategy of provisioning individuals rather than places may indicate residential mobility. While it remains unclear whether early-period hunter-gatherers in the Great Basin were residentially mobile, logistically mobile, or a combination of the two, it is encouraging to note that pre-Archaic groups living in several different regions of the Great Basin appear to have practiced similar strategies of lithic procurement and/or mobility. Further inter- and intra-site examinations of lithic technological organization and toolstone procurement will hopefully contribute additional data to this debate.

Thank you to the following organizations for supporting this project: University of Nevada Reno Anthropology Department and Graduate Student Association, Sundance Archaeological Research Fund, Desert Research Institute (Reno), Nevada Archaeological Association, and Nevada Am-Arcs Association. Special thanks to Ted Goebel for providing helpful comments on this manuscript and Craig Skinner of the Northwest Research Obsidian Studies Laboratory, Corvallis, Oregon, for providing the XRF data used in this study.

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Paleoenvironments: Plants

Late-Pleistocene/Early-Holocene Pollen Record at Bull Creek, Oklahoma Panhandle

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Research at the Folsom-age Cooper site and Clovis- and Folsom-age Jake Bluff site within the Beaver (North Canadian) River drainage of northwestern Oklahoma has identified the opening and subsequent filling of gullies used for bison kills. A paleoenvironmental study has been initiated to better understand this landscape evolution. Fossil pollen records provide one basis for paleoenvironmental reconstructions. Reviews of southern Plains pollen analyses conclude that late-Pleistocene/early-Holocene pollen is often poorly preserved or nonexistent (Hall 1995; Hall and Valastro, Jr. 1995). Exceptions include pollen indicating a grassland prairie found at the 11,000 RCYBP Domebo site in west-central Oklahoma (Wilson 1966), in 13,000 RCYBP deposits at the Aubrey site in north Texas (Hall 2001), in 11,800 RCYBP deposits at Ferndale Bog in eastern Oklahoma (Bryant and Holloway 1985), and in early Holocene-age pollen from the Cheyenne Bottoms in central Kansas (Fredlund 1995:77). Other pollen analyses for this time period yielded no pollen, have low pollen counts, or show evidence of selective pollen preservation (Hall 1995).

The Bull Creek site in the Oklahoma panhandle provides a 6-m-tall cutbank exposure along Bull Creek, a second-order right-hand tributary to the Beaver River (Carter and Bement 2004). The cutbank contains at least eight buried soils. The lowest buried A horizon yielded a bulk soil ^{14}C age of 11,070 ± 40 RCYBP (Beta-184854). Stratigraphically higher buried A horizons sequentially yielded ages of 10,350 ± 210 (Beta-184853), 10,850 ± 210 (Beta-180546), 10,400 ± 80 (Beta-184852), 9850 ± 90 (Beta-184851), 8670 ± 90 (Beta-191040), 7660 ± 80 (Beta-184850), and 6200 ± 90 (Beta-191039) RCYBP. The site has an unidentified Paleoindian component consisting of butchered bison bone and associated lithic flakes in the 10,850 RCYBP soil. This date places the cultural component in the Clovis-to-Folsom transition.

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Pollen analysis of 34 samples taken at 10-cm intervals yielded pollen densities suitable for 200-grain pollen count analysis and non-arboreal-to-arboreal pollen taxa ratios in excess of 11/3, suggesting differential pollen preservation is not a major factor in these deposits (Varney and Scott Cummings 2004). The resultant profile (Figure 1) indicates grasslands were in place in the region before 11,000 RCYBP and account for 25–40 percent of the pollen count until at least 8500 RCYBP, before decreasing to 10 percent of the total pollen count by 6200 RCYBP. Grass pollen dominates levels contemporary with regional Clovis- and Folsom-age bison kills (Bement 1999; Carter and Bement 2003). Variations in *Artemisia* (sagebrush), high-spine Asteraceae (sunflower family), and Cheno-Am contributions in the pollen assemblage indicate local

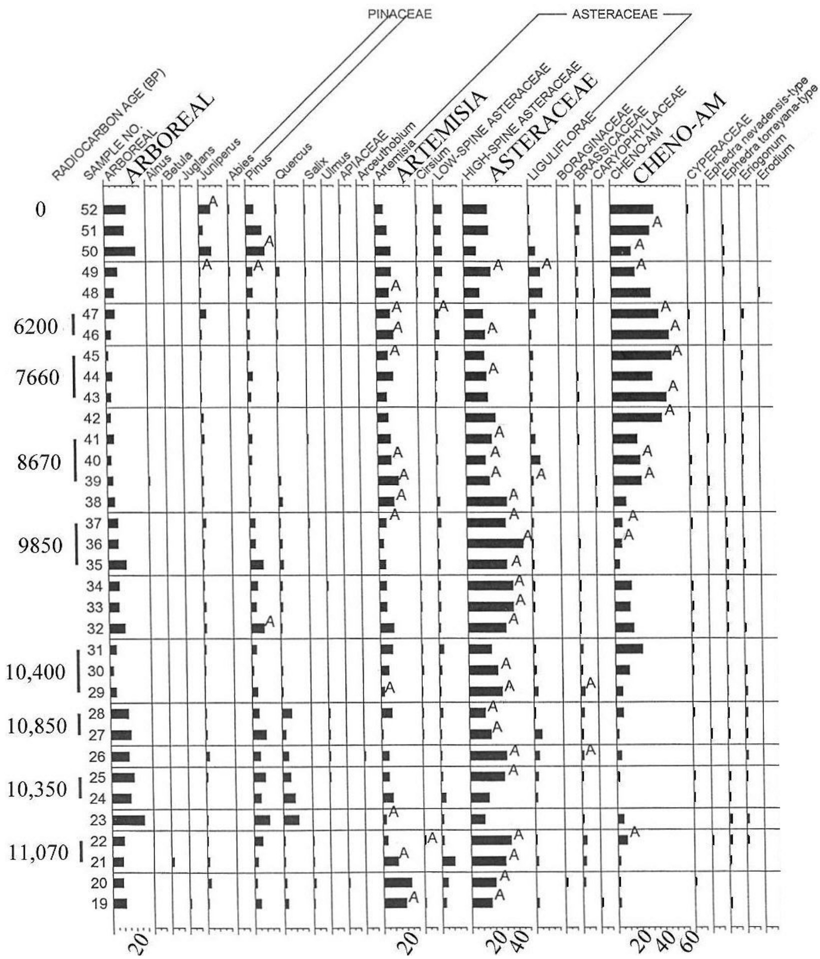

Figure 1. Pollen diagram for the Bull Creek site, Oklahoma panhandle. "A" denotes grain aggregates counted as single grains.

fluctuations in precipitation patterns toward mid-Holocene xeric conditions consistent with the Altithermal (Antevs 1948, 1955). Ongoing phytolith, particle size, and stable isotope analyses will refine the general trends suggested by the pollen analysis.

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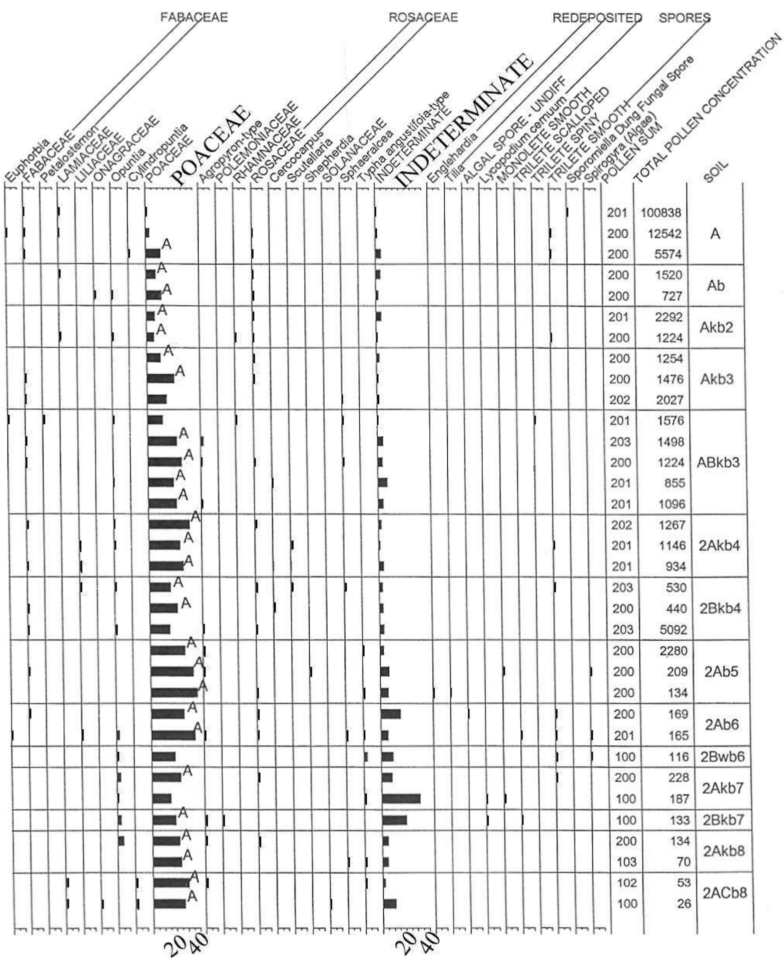

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Paleoenvironments: Vertebrates

Functional Morphology and Wear Patterns of American Mastodon (*Mammut americanum*) Mandibular Tusks: An Aid in Feeding?

Jeremy L. Green

American mastodon (*Mammut americanum*) mandibular tusks are sometimes recovered in fossil localities (Laub 2003) and are controversial, as their intended function or purpose is not clear. Osborn (1936) and Laub (1999, 2002) both argue that mastodon chin tusks are representative of male specimens, while Haynes (1991) suggests both sexes possessed them. Recent research by Green (2004) for Florida mastodons agrees more with Haynes's suggestion. If sexual dimorphism in chin tusks is presumed to be false, why did mastodons possess them? Haynes (1991) suggests these tusks could have aided in food procurement (bark scraping), as such tusks commonly exhibit a polished surface on the distal end due to attrition (Haynes 1991; Laub and Fisher 1996), but whether chin tusk wear is incidental or functional is in question. Lambert (1992) examined gomphothere chin tusks and determined that wear patterns suggest feeding behavior. Mastodons were browsers (Saunders 1996), so a dietary function hypothesis fits paleoecological implications. The purpose of this study is to examine whether or not mastodon mandibular tusks had a dietary function similar to that of gomphothere mandibular tusks (i.e., are the wear surfaces on chin tusks random or intentional?).

An "adult" tusk is defined here as having a dorsoventral diameter at the distal end > 25.0 mm, which is in agreement with Hiscock mastodon mandibular tusk data (Laub 2003; Laub and Fisher 1996). Eight adult mandibular tusks from the Pleistocene of Florida were examined and their wear facets qualitatively described using Lambert's (1992) model of mandibular tusk wear in gomphotheres. All specimens were grouped into three categories (scraping, stripping, vegetation cutting [Lambert 1992]) based on the shape of wear facets. Specimens include six isolated tusks (DMAS 459, UF 81511-81513, 209175, 211114) and two tusks in situ in a mandible (UF 215059). All specimens are housed in the

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Florida Museum of Natural History vertebrate paleontology collection in Gainesville, Florida. Only "adult" tusks were examined, since juvenile tusks (< 25.0 mm) are assumed here to be too small to be functional.

No chin tusks examined possessed "vegetation cutting" wear patterns. Seven chin tusks exhibit wear most similar to what Lambert (1992) identified as "scraping," with the wear surface isolated on the distal end of the tusk (not extending onto the lateral surface). "Scraping" patterns suggest that mastodons used tusks to scrape bark from tree trunks, as originally proposed by Haynes (1991). UF 215059 has both tusks in place on either side of the symphysis, and more wear is visible on the dorsal than on the ventral surface of the tusks. This could be a result of the downward orientation of the tusks in the mandible. Presumably, as the animal moved its tusks horizontally, due to labial-lingual movement of the mandible (Laub 1996) against trees, the downward orientation of the tusks caused more wear on the dorsal rather than the ventral surface.

UF 81512 suggests "stripping" rather than "scraping" behavior, with the wear facet extending onto the externo-lateral portion of the tusk and not on the dorsal or ventral surfaces. The animal using the trunk and the mandibular tusks together to "strip" leaves and twigs from a tree could generate this sort of wear.

Morphology of the mastodon hyoid suggests a tongue length of 70–90 cm. (Shoshani 2003). This proposed length is long enough to reach past the mandibular symphysis to the distal end of the mandibular tusks. Mastodons could have used their mandibular tusks to scrape bark or strip vegetation off a tree, while the tongue was used for gathering scraped bark into the mouth for consumption.

This research is intended to expand upon the idea that mastodon chin tusks could have aided in feeding. It is possible that the tusk wear facets described here are incidental and that chin tusks had no feeding function. In this situation, tusk wear would occur randomly as the animal contacted trees while feeding. If such tusks were used in feeding, then the chronologic variation in Florida mastodon mandibular tusks (Green 2004) could represent a possible chronologic dietary change. Also, if sexual dimorphism is present in mastodon mandibular tusks, then the feeding function discussed here is doubtful, since only males would have been able to utilize chin tusks in feeding. A comprehensive study examining chin tusk wear patterns while utilizing a larger and more chronologically diverse sample would be ideal, but such samples from Florida are currently lacking.

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A 20,000 CALYBP Caribou Mandible from a Cave Site in East-central Iowa

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During the excavation of a geoarchaeological test unit inside Bogus Cave, Jones County, Iowa, a fragment of a cervid mandible (Figure 1) was recovered from a buried accumulation of boulder-size dolostone clasts—the result of one or more episodes of cave ceiling collapse (Josephs 2000, 2002). The 15-cm-long bone is identified as a portion of the left mandibular corpus (horizontal ramus) from a woodland caribou (*Rangifer tarandus*). Despite its having been wedged tightly within the collapse unit, almost a meter below the existing cave floor, the piece was in remarkably good condition. All three molars (M_1, M_2, and M_3) were in situ. No other tooth or bone specimens were found. Based on observable physical attributes such as overall robusticity, tooth wear patterns, and degree of tooth eruption, the age of the animal at its time of death is estimated to have been between six and nine years old (A. E. Spiess, pers. comm. 2000). How the mandible entered the cave is open to speculation. Carnivore predation is a likely explanation.

Following examination at the University of Iowa Department of Geoscience vertebrate paleontology lab, the roots of the third molar (M_3) were separated

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Figure 1. Buccal view of a portion of a 20,550 CALYBP left mandible from a woodland caribou (*Rangifer tarandus*) recovered from a ceiling collapse unit within Bogus Cave, Jones County, Iowa, USA.

from the tooth crown and submitted to the Rafter Radiocarbon Laboratory, Lower Hutt, New Zealand, for AMS ^{14}C dating and analysis of the $\delta^{13}C$ content. An AMS date of 17,260 ± 120 RCYBP (NZA 10448) together with a $\delta^{13}C$ value of -18.4‰ were returned for this sample. The AMS ^{14}C date is equivalent to 20,550 CALYBP (Stuiver et al. 1998). The $\delta^{13}C$ value of -18.4‰ falls well within the range for a terrestrial herbivore (browser) feeding on C_3 (cool, moist climate) vegetation (Herz 1990; Reitz & Wing 1999; van der Merwe 1982) and supports the paleoenvironmental reconstructions for this region during the Last Glacial Maximum (LGM)—open tundra and parkland inhabited by arctic and subarctic flora and fauna (Baker et al. 1986; King and Graham 1986).

The sediment filling the interstices of the collapse unit was sampled for particle size analysis, micromorphological examination, and analysis of $\delta^{13}C$ content (Josephs 2000). The sediment is a silt loam composed of well-sorted, unoriented, angular to subangular, silt-size, exogenous mineral grains, predominantly quartz and feldspar, in a yellowish clay matrix. Distinct microstratification suggests this sediment was deposited episodically by water infiltrating the void spaces throughout the collapse unit (Josephs 2000). A sample of the silt loam was submitted to Geochron Laboratories, Cambridge, Massachusetts, to determine its $\delta^{13}C$ content. The sample yielded a value of -24.1‰ (CR-101624), further evidence for a paleoenvironment dominated by C_3 vegetation (Boutton 1996; Josephs 2000, 2002; Nordt 2001).

The open tundra and parkland that existed 20,000 CALYBP across this region of present-day Iowa would have been an ideal habitat for woodland caribou. Their presence is well represented throughout the state's Pleistocene fossil record (Anderson 1998; Baker et al. 1986; King and Graham 1986).

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^{14}C Chronology of Culturally Modified Proboscidea in Wisconsin

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Four culturally modified proboscideans have been reported in southeastern Wisconsin (Blazina-Joyce and Joyce 1993; Dallman et al. 1997; Johnson 2002, 2006, Joyce 2002, 2003, 2006; Joyce and Blazina-Joyce 2002, Overstreet 1998; Overstreet and Kolb 2003; Overstreet et al. 1995). Woolly mammoths (*Mammuthus* cf. *primigenius*) excavated at the Schaefer (47KN252) and Hebior (47KN265) sites yielded disarticulated bone piles, stone tools, and culturally modified bones (Johnson 2002, 2006; Yerkes and Weinberger 1998). AMS XAD-collagen dates on Schaefer and Hebior span 12,290–12,590 RCYBP (Joyce 2002, 2003, 2006; Joyce and Blazina-Joyce 2002; Overstreet and Kolb 2003). Accidentally recovered remains from Fenske (47KN240) and Mud Lake (47KN 246) sites also show butchering marks (Johnson 2002).

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Conventional ^{14}C dates on bone in the area have been found to be too young by over 1,000 years (Dallman et al. 1997). AMS (XAD-collagen) ^{14}C dates have been employed on all four sites for greater accuracy. For this study the Mud Lake radius and Fenske femur were cored directly in order to extract clearly controlled, uncontaminated collagen.

The cored samples from Mud Lake yielded two AMS ^{14}C dates of 13,460 ± 50 (CAMS-72139) and 13,490 ± 40 (CAMS-72138) RCYBP (Table 1). These correlate well to the previously published Mud Lake dates of 13,440 ± 60 and 13,530 ± 50 RCYBP (Overstreet 1998; Overstreet and Kolb 2003).

Table 1. ^{14}C dates for the Fenske and Mud Lake proboscideans.

Fenske mastodon	
"Associated humerus fragment"	13,470 ± 50 (CAMS-36642)
	13,510 ± 50 (CAMS-61138)
Direct femur sample	11,220 ± 40 (CAMS-72253)■
	11,230 ± 50 (CAMS-72137)■
	11,240 ± 50 (CAMS-72355)■
Mud Lake mammoth	
Trapezoid	13,440 ± 60 (CAMS-36643)
Unreported element	13,530 ± 50 (CAMS-61136)
Directly cored ulna sample	13,460 ± 50 (CAMS-72139)■
	13,490 ± 40 (CAMS-72138)■

■ Newly reported ages.

Cored samples from the Fenske femur yielded AMS ^{14}C dates of 11,230 ± 50 (CAMS-72137) and 11,220 ± 40 (CAMS-72253) RCYBP. Previously, AMS assays on a Fenske humerus (?) fragment yielded dates of 13,470 ± 50 and 13,510 ± 50 RCYBP (Overstreet 1998; Overstreet and Kolb 2003). These dates are 2,200 years older than the directly cored new dates on the Fenske femur. Chemistry completed by Stafford Research Laboratories and AMS processing by Lawrence Livermore Laboratories were checked for possible errors in the new dates. None was found. T. Stafford ran another Fenske femur sample, which was consistent with the other two new directly sampled dates (11,240 ± 50 [CAMS-72355] RCYBP).

Why is there a difference between the old and new dates from Fenske? The reason is straightforward. Previously dated samples were not from the Fenske femur but instead from a Fenske "associated humerus" fragment found in the Kenosha County Historical Society collection (D. F. Overstreet, pers. comm. 2003). The Mud Lake and Fenske bones were both in the same uncatalogued museum collection and probably became mixed at some time. The Fenske "humerus fragment" was more likely a Mud Lake specimen because its dates are consistent with other Mud Lake bone dates (Table 1). Regardless, the previously published ca. 13,500 yr B.P. dates for Fenske should be discarded.

In 1990, K. Hallin of the Milwaukee Public Museum identified the Fenske femur as mastodon (Overstreet et al. 1993). The femur has subsequently been identified in the literature as a mammoth (Overstreet 1998; Overstreet and Kolb 2003; Overstreet and Stafford 1997). J. Saunders (pers. comm. 2003) confirmed Hallin's identification as mastodon. The new 11,200 RCYBP dates correlate well with other mastodon dates in the area, which are consistently younger than mammoth (Dallman et al. 1997; Overstreet and Stafford 1997).

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^{14}C Dating of the Late-Pleistocene Faunal Remains from Sakhalin Island (Russian Far East)

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Until recently, data about the Pleistocene fauna of Sakhalin Island were very scanty. Only a few pre-WWII reports about a small number of proboscidean teeth found in Sakhalin have been published (Matsumoto 1937), and no age determinations existed for the Pleistocene animal remains. In 2002–2004, several bone samples were collected and ^{14}C-dated. They were excavated from two caverns located in the mountain region of central Sakhalin, Tronnyi Grotto (49° 55′ N, 143° 20′ E) and Ostantsevaia Cave (49° 54′ N, 143° 20′ E), where animal bones were preserved in favorable non-acidic conditions of limestone matrix. Collagen for dating was extracted at the Novosibirsk ^{14}C laboratory (for details on sample pretreatment see Arslanov and Svezhentsev [1993], Kuzmin and Orlova [2004:144–145], and Orlova et al. [2004:365]). Briefly, we dissolved the mineral part of whole pieces of bone in cold diluted hydrochloric acid, making it possible to obtain non-contaminated collagen. The reliability of this extraction method was repeatedly proven by parallel dating of the same pieces of bone in Russian, U.S., and western European laboratories (Kuzmin et al. 2001; MacPhee et al. 2002; Vasil'chuk et al. 2000). Radiocarbon measurements of collagen extracted in Novosibirsk were performed at two laboratories, Novosibirsk (LSC method, lab code SOAN) and Tucson (AMS method, lab code AA).

In the Ostantsevaia Cave area, two localities were studied: (1) entrance 1 of the small niche, and (2) main chamber of the cave. Remains of horse (*Equus* sp.) and polar fox (*Alopex lagopus*) were identified in shallow sediments of entrance 1 at a depth of ca. 0.30 m below the modern surface. The horse bone was dated to ca. 15,200 RCYBP (AA-606264), and tooth of polar fox to ca.

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16,300 RCYBP (AA-60769) (Table 1). Brown bear (*Ursus arctos*) bones from the main chamber, collected at depths of 5.00–0.30 m below surface, were dated to between ca. 11,400 RCYBP (SOAN-5178) (bottom) and ca. 8000 RCYBP (SOAN-5176) (top). The dating results are evidence that bone accumulation in the cave occurred during the late Glacial and early Holocene. It should also be noted that artifacts (flakes, bifacial points, blades, and scrapers) in the main chamber sediments occur from a depth of 4.90 m below surface, a depth that corresponds to an age of ca. 11,400 RCYBP, up through to the top of the chamber's fill (Gorbunov 2002).

Table 1. ^{14}C dates of faunal remains from Sakhalin Island.

Site, locality, layer, depth	Species	^{14}C date (RCYBP) and lab code	$\delta^{13}C$ (‰)
Ostantsevaia Cave, entrance 1, depth 0.30 m	*Equus* sp.	15,220 ± 170 (AA-60264)	-20.7
Ostantsevaia Cave, entrance 1, depth 0.30 m	*Alopex lagopus*■	16,350 ± 210 (AA-60769)	-20.4
Ostantsevaia Cave, main chamber, depth 0.30 m	*Ursus arctos*	8040 ± 85 (SOAN-5176)	—
Ostantsevaia Cave, main chamber, depth 4.20 m	*U. arctos*	9620 ± 135 (SOAN-5522)	—
Ostantsevaia Cave, main chamber, depth 4.60 m	*U. arctos*	12,685 ± 140 (SOAN-5523)	—
Ostantsevaia Cave, main chamber, depth 5.00 m	*U. arctos*	11,400 ± 100 (SOAN-5178)	—
Tronnyi Grotto, layer 7	*Rangifer tarandus*	12,520 ± 120 (AA-60618)	-18.2
Tronnyi Grotto, layer 4	*Cervus* sp.	12,370 ± 130 (AA-60768)	-18.9
Tronnyi Grotto, layer 4	*Ovis nivicola*	15,860 ± 180 (AA-60617)	-20.0
Tronnyi Grotto, layer 1	*O. nivicola*	12,960 ± 110 (AA-60616)	-21.0
Aniva Bay, sea bottom	*Mammuthus primigenius*	> 41,000 (AA-36477)	-21.1

■Collagen yield 22.2%

In general, bear bones dominate the mammal assemblage of Ostantsevaia Cave owing to long-term use of the main chamber as a bear den. Perhaps burrowing activity of bears caused the inversions in the ^{14}C date sequence; the age of bones at a depth of 4.60 m is older than of those at a depth of 5.00 m (Table 1). Also, in the Holocene part of the chamber fill at a depth of 1.55 m the age of the bear bones is 6455 ± 90 RCYBP (SOAN-5177).

In the Tronnyi Grotto, the majority of mammalian remains belong to snow sheep (*Ovis nivicola*), reindeer (*Rangifer tarandus*), and wolf (*Canis lupus*) (Kirillova 2003). Taphonomic observations, such as presence of gnaw marks and traces of rolling and chemical dissolution on the bone surfaces, along with finding of bone fragments from the same individual in different lithological layers (Kirillova 2003), show clearly that the disturbed nature of the sediments is possibly caused by carnivore activity and erosion; no traces of human occupation have been found. Results of dating suggest that the bones were to some extent redeposited, because their age at the bottom part (layer 7) is slightly younger than in the upper parts (layers 1 and 4) (Table 1). In general, mammal remains from the Tronnyi Grotto correspond to the late Glacial, ca. 15,900 (AA-60617) to 12,400 RCYBP (AA-60768).

Small pieces of woolly mammoth tooth from the sea bottom off the coast of

Aniva Bay near the modern City of Korsakov, former Odomari (46° 30′ N, 142° 47′ E), found originally in the 1930s (Matsumoto 1937) and preserved in the collection of Sakhalin State Museum, were dated by AMS method to > 41,000 RCYBP (AA-36477) (Table 1). This is the only ^{14}C value known so far for the mammoths from Sakhalin. On neighboring Hokkaido Island, recent studies show that mammoths occupied the island from > 42,000 RCYBP to ca. 16,200 RCYBP (Takahashi et al. in press).

Thus, in the second part of the late Pleistocene megafauna such as woolly mammoth and horse existed in Sakhalin. Polar fox occupied some areas of Sakhalin during the late Glacial. Cervid species (*Cervus* sp.) that today are unknown on Sakhalin Island but common in the temperate forest zone of the continental Russian Far East, inhabited the central part of Sakhalin at ca. 12,400 RCYBP, possibly during the warm Bølling interstadial.

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An Unusual Erosional Feature on Late-Pleistocene Mastodon Tusks from the Hiscock Site (Western New York State): Cultural or Natural?

Richard S. Laub

Hiscock is a rich late-Quaternary paleontological and archaeological site between Buffalo and Rochester, New York (Laub 2003; Laub et al. 1988). It appears to have been a mineral lick during the late Pleistocene (McAndrews 2003; Ponomarenko and Telka 2003) that attracted mastodons (*Mammut americanum*) and other megafauna, as well as humans.

Twenty-three mastodon tusks (15 male, 8 female) have been found to date. Of these, five bear a unique erosional feature, a beveling along all or most of the length, exposing the growth increments, so that the cross section is shaped like a "D" rather than an "O." Each tusk (with field number) is described below.

H6SW-154 (Figure 1). This is a possible old female, right(?) tusk, 142 cm long, pulp cavity 18 cm long, entire length profoundly beveled on lingual(?) side, with nearly half thickness removed, found with beveled surface upward. Specimen is separated into two segments along a growth plane, suggesting ancient drying. Much of its proximal end is missing.

Figure 1. Tusk H6SW-154, showing beveled surface and exposed growth increments. Illustration by William L. Parsons.

H7NW-181. This is a female, left(?) tusk, 87 cm long, pulp cavity 19 cm long, entire length weakly beveled on buccal(?) side, found with beveled surface down.

I2NE-105. This is a young male, right tusk, 97 cm long, pulp cavity 29 cm long, profoundly beveled on buccal side, found with beveled surface up. Its distal 1/3 of length curves out of bevel plane and is unaffected by it.

I2NE-170. This is a male, left tusk, 135 cm long, pulp cavity 62 cm long, profoundly beveled on buccal side (and found lying on this side), with weaker bevel on lingual side. Beveled surface is a single plane, but some wear continues on distal-most end, which curves out of bevel plane.

I6NW-180. This is a male, left tusk, 162 cm long, pulp cavity 33 cm long, moderately beveled on buccal side, found with beveled surface up. Beveling follows curve of tusk axis over distal-most ¾ of length, then disappears, reappearing at proximal-most end of tusk.

In all cases, the flat surface extends over the proximal-most end, including the entire length of the surviving pulp cavity. As most of this area would have

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been socketed in the alveolus (Elder 1970), the inference is that the erosion was post mortem. This conclusion is supported by a lack of obvious tertiary dentine deposits (Avery 2002) on the pulp cavity walls, and by the fact that the bevel does not follow the axial growth twist of the tusk. Unfortunately, microscopic wearmarks that might provide clues to the genesis of the beveling have not been detected.

Could this feature be from natural erosion? Two other male tusks, I3NW-117 and G4NE-92 (a right and a left respectively, from two different individuals), show a degree of beveling. In both cases it occurs on the lingual (concave) side, on which the tusk lay. The worn surfaces occupy only the middle one-third of the axial length and are somewhat uneven. Both tusks lay near spring vents. Perhaps the erosion is due to shifting of the gravelly substrate by water currents. It has not, however, produced the extensive smooth planes discussed here, even though one of these tusks (I3NW-117) lay very close to two of the beveled tusks (I2NE-105, 170).

A cultural origin must also be considered. Besides a number of lithic artifacts, several bone tools have been reported from Hiscock (Tomenchuk 2003; Tomenchuk and Laub 1995). Hide processing appears to have been a major activity, and the long, smooth surfaces produced on these tusks resemble those of traditional hide-scraping beams (Ladd 2004).

There is presently insufficient information to distinguish between natural and cultural origins for this beveling, or even to determine if there is but a single agency at work. Hopefully, future discoveries at Hiscock and other sites will shed light on this phenomenon.

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Fossil Ground Sloths, Megalonyx and Paramylodon (Mammalia: Xenarthra), from the Doeden Local Fauna, Montana

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Fossil vertebrates from the Doeden gravel pit, Yellowstone River Valley near Miles City, Montana, document a diverse fauna with ground sloths (*Megalonyx jeffersonii* and *Paramylodon harlani*), mammoths (*Mammuthus columbi*), mastodon (*Mammut americanum*), horse (*Equus* sp.), artiodactyls (*Camelops* sp., *Bootherium* sp., cervid and antilocaprid), and giant short-faced bear (*Arctodus simus*) (Hill 2001; Wilson 2003; Wilson and Hill 2000, 2002). This paper discusses Doeden Local Fauna (DLF) sloth material.

Megalonyx jeffersonii is represented by a left femur (proximal half, machine-broken), a right tibia (Table 1), and an ungual phalanx, all stained orange-brown from oxidation. *Paramylodon harlani* is represented by a mature left tibia, missing portions of both ends, and referred vertebral centrum, both machine-damaged. Both are medium gray, indicating reducing conditions. The tibia (MOR PL-084: 0005) has a midshaft breadth of 98.4 mm and midshaft anteroposterior diameter of 57.6 mm. The distal condylar facet has an estimated breadth of 97 mm and estimated anteroposterior diameter of 80 mm.

The endemic *Megalonyx*, the most widespread North American ground sloth

Table 1. Measurements of Doeden local fauna *Megalonyx* limb elements (mm) in Museum of the Rockies (MOR) collections, Bozeman, Montana.

Femur (MOR X.79.36.1)		
1	Mediolateral diameter of head	116.9
2	Anteroposterior diameter of head	121.4
Tibia (MOR X.79.36.2)		
1	Length	322.0
2	Mediolateral width medial condylar surface proximal end	91.4
3	Anteroposterior diameter medial condylar surface proximal end	130.7
4	Least mediolateral shaft width	78.8
5	Mediolateral width of proximal end	156.8
6	Anteroposterior length of distal end medial side	89.9
7	Anteroposterior length distal end lateral side	79.5
8	Mediolateral width lateral condylar surface proximal end	61.8
9	Anteroposterior dimension lateral condyle proximal end	80.5
10	Greatest mediolateral width proximal end	192.4
11	Greatest anteroposterior dimension proximal end	189.0

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genus, evolved from immigrant *Pliometanastes* by the late Hemphillian. *M. jeffersonii*, the only late-Pleistocene species, ranged north to Alaska and from east to west coasts (McDonald 1977; McDonald and Ray 1990; McDonald et al. 2000). *Megalonyx* was a forest-edge to riparian gallery forest browser (McDonald and Ray 1990; Schubert et al. 2004). *Paramylodon harlani* was also wide-ranging, from Florida to Washington (McDonald et al. 2004). It has been interpreted as a "grazing" sloth, but isotopic and other evidence suggests it was a mixed feeder able to digest grasses (Coltrain et al. 2004). Its relative rarity in the Southwest suggests it avoided xeric conditions (McDonald et al. 2004). Co-occurrence of *Megalonyx* and *Paramylodon* at Doeden is consistent with a riparian gallery forest bounded by grasslands.

The DLF postdates the Lava Creek B tephra (ca. 600,000 yr B.P.) and from terrace correlations predates the 160,000 to 124,000 yr B.P. calcretes in the tributary Tongue River drainage (Wilson and Hill 2000), a timespan from late Irvingtonian (Yarmouthian/early Illinoian) to early Rancholabrean (later Illinoian/Sangamonian). Apparent absence of *Bison* sp. is consistent with an Irvingtonian age, and other DLF species were present by this time. *Megalonyx* steadily increased in size from Blancan through Rancholabrean times. Based upon femoral head diameter and tibial length, DLF material fits best with late Irvingtonian and Rancholabrean *Megalonyx* and is much larger than the earlier *M. wheatleyi*. *Megalonyx* tibial lengths correlate with latitude, expressing either Bergmann's Rule (Blackburn and Hawkins 2004) or dispersal into expanding habitat (Geist 1971). The DLF tibia is large, yet smaller than others from similar latitudes. This could indicate that it is older, from a late-Irvingtonian northward-dispersing population. If this is true, overall size increase in *M. jeffersonii* could not be explained by dispersal theory alone, unless there were multiple dispersal events as glacial advance/retreat cycles repeatedly opened up new habitat; therefore, Bergmann's Rule seems a more parsimonious explanation.

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Paleoenvironments: Geosciences

Stratigraphy at the Jensen Mammoth Site in the Central Platte River Valley, Dawson County, Nebraska

David W. May and Steven R. Holen

Late-Wisconsin Peoria Loess mantles the Nebraska landscape (Mason 2001a). It overlies a well-developed Mid-Wisconsin soil referred to as the Farmdale Interstadial Soil (Reed and Dreeszen 1965) or Gilman Canyon Soil (Johnson and Willey 2000). The thickness and age of Peoria Loess vary from valley to valley and even within a single valley in the Central Great Plains, largely because of fluvial activity during the late Wisconsin. For instance, May (2002) has shown that an alluvial fill in the South Loup River Valley of central Nebraska that dates to less than 14,000 RCYBP is overlain by less than 7 m of loess, where locally loess up to 30 m thick is present on the uplands. Beshore et al. (1999) have suggested that varying loess thickness in the Platte River Valley near Cairo, Nebraska, is a response to late-Wisconsin lateral channel migration of the Platte River. This paper focuses on the stratigraphy of Peoria Loess at the Jensen mammoth site in the Platte River Valley in central Nebraska.

The Jensen mammoth was discovered during county road construction 16 km northwest of Cozad, Nebraska. Excavations were first undertaken in 1993 by paleontologists from the University of Nebraska State Museum, who were later joined by the authors. Excavations yielded the remains of a single old adult male mammoth (*Mammuthus columbi*). The mammoth appears to have died naturally. Some limb bones exhibit spiral fractures indicating these elements were broken soon after the mammoth died. Impact fractures on some limb bones and the presence of bone flakes indicate humans may have used the site to quarry bone. A sample of bone collagen from a thick cortical mammoth limb bone yielded a radiocarbon age of 13,880 ± 90 RCYBP (Beta-68859). Humates in a bulk sample of Peoria loess from adjacent to the mammoth provided a more accurate age of 14,830 ± 220 RCYBP (Tx-8135).

The mammoth was recovered from 3.5–3.8 m below the surface of late-Wisconsin Peoria Loess where the loess locally overlies alluvium. The loess-

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mantled fluvial landform is the third terrace above the modern floodplain on the north side of the Platte River Valley. Locally the loess is at least 8.5 m thick. The upper 4 m of the loess was exposed in the excavation and described. From the surface to 55 cm deep the loess is brown (10YR 5/3) with weak, subangular blocky structure and many vertical carbonate concretions. From 55 to 100 cm deep the loess is brown (10YR 5/3) to dark brown (10YR 4/3) with weak, subangular blocky structure and few fine vertical carbonate concretions. From 100 to 163 cm deep the loess is brown (10YR 5/3) to dark brown (10YR 4/3) with low-chroma (gray) mottling in horizontal bands each 0.5–1.0 cm thick. Furthermore, moderately thick argillans are common on ped surfaces in this interval. This interval is the B horizon of the modern soil. From 163 cm to about 400 cm depth the loess is generally brown (10YR 4/3) and massive with some fine, dark yellowish brown (10YR 4/4) mottles and common fine carbonate concretions. The Jensen mammoth came from this interval.

A test hole was drilled just north of the mammoth excavation by the University of Nebraska–Lincoln Conservation and Survey Division. Vernon L. Souders (pers. comm. 1993) provided a copy of the field log of the drill core and an interpretation of it. He stated that at least 8.5 m of Peoria Loess is present at the site. The eolian silt grades downward into very fine to fine silty sand and sandy silt and then silt-free sand below 13 m. No buried soil that might be equivalent to the Gilman Canyon soil is present. The test-hole stratigraphy and the modern morphology of the valley floor indicate that the Platte River was shifting southward across the valley during the late Wisconsin when Peoria Loess was being deposited. The Platte River was probably at the Jensen mammoth site early within the interval of Peoria Loess fall (about 24,000–20,000 RCYBP), because the increment of loess at the Jensen mammoth site is relatively thick.

The stratigraphy of loess and alluvium at the Jensen mammoth site is similar to that in the north end of the abandoned Todd Valley in the lower Platte River basin (May 2004) and to that below the Fort Calhoun Terrace in the Missouri River Valley (Mason 2001b; Miller 1964). The presence of the Jensen mammoth in Peoria Loess is also similar to numerous mammoth sites in Nebraska, including the La Sena and Shaffert sites (Holen and May 2002; May and Holen 1993).

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Databases

Paleoindian Database of the Americas: 2005 Status Report

David G. Anderson, D. Shane Miller, Stephen J. Yerka, and Michael K. Faught

Locational and attribute data on Paleoindian materials from all across the Americas are now being posted on a Web site located at **http://pidba.utk.edu** We encourage our colleagues to contribute to this effort by submitting information they would like to see posted in hardcopy or electronic form. All data and contributors will be fully referenced and acknowledged.

At present distributional data on ca. 20,000 Paleoindian projectile points from Canada, the United States, and Mexico are posted, together with measurement data for several thousand Paleoindian tools, mostly fluted or unfluted projectile points, blades, and other tool types. In addition to attribute and distributional data, the Web site also includes links to drawings, photographs, ^{14}C dates, bibliographic references, and other Paleoindian Web sites.

The Paleoindian Database of the Americas (PIDBA) Web site is a work in progress that we plan to markedly expand. We have the resources to enter data from hardcopy records, and are doing that with recording forms from several fluted point surveys at present, and from published sources as we find the references. We can translate most data formats or work from hardcopy records. Check the Web site for details on how to submit information, or send material to us at the address listed at the end of this paper.

PIDBA represents a marked expansion of our earlier efforts, which focused on materials from North America, specifically summary data on the occurrence of Paleoindian projectile points by state and county within the United States (Anderson 1990; Anderson and Faught 1998, 2000; Faught et al. 1994). Exploring the early occupation of our hemisphere requires a perspective that transcends individual countries. The Web site can accommodate data from every country in North, Central, and South America, and is designed to truly encompass the Americas.

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Database development represents a cooperative effort among many people, and we thank all those who have participated to date. We welcome and encourage data contributions, as well as references to published information and relevant Web sites. We are particularly looking for colleagues in Latin America to help to develop mirror sites in languages other than English. Finally, we encourage colleagues to start compiling data in those areas where recording projects have not been initiated.

Send information to David G. Anderson electronically at **dander19@utk.edu** or mail hardcopy data to Anderson, Department of Anthropology, The University of Tennessee, 250 South Stadium Hall, Knoxville, TN 37996-0720.

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Updating and Georeferencing the South Carolina Paleoindian Point Survey

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Over four decades of data collection on Paleoindian bifaces from South Carolina are currently being updated, reanalyzed, and georeferenced to improve the quality and research potential of the database (Charles 1986; Goodyear et al. 1989; Michie 1965, 1977). Improved typology, georeferencing for geographic information system (GIS) analyses, and electronic distribution to colleagues (Anderson et al., this volume) are the primary goals of the current effort. To date, nearly 500 Paleoindian bifaces (n = 479) have been recorded in South Carolina, consisting primarily of Clovis, Redstone, and occasionally Simpson and Suwannee points (Figure 1).

The current South Carolina Paleoindian Database consists of paper files and a spreadsheet with metric attributes, drawings and/or photographs, and hand-drawn maps and/or photocopied USGS 7.5-minute topographic quad

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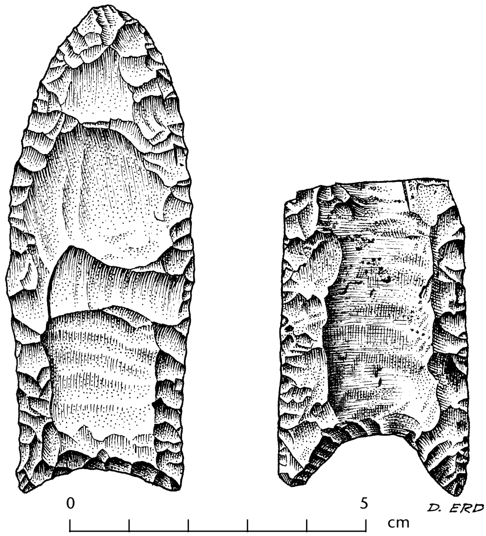

Figure 1. Clovis (SC 7, left) and Redstone (SC 214, right) fluted points, from South Carolina.

sections illustrating the approximate or known locations of point finds. The first phase of the project involved updating the database with recent discoveries and improving the typological classification of extant records. The second phase, currently underway, entails converting the spreadsheet to a geographically referenced database (geodatabase) for use with ESRI's ArcGIS software and scanning drawings and photographs to electronically link to the database. Georeferencing the database will enable GIS analyses during the third phase to examine the environmental context of Paleoindian point distributions and provide a means to examine sample bias and other factors influencing our knowledge of early human populations across the region. If sample size and data quality permit, then archaeological predictive models for each environmental zone in South Carolina will be developed from the database.

The research potential of such Paleoindian geodatabases cannot be overstated. For example, South Carolina's lithic-poor landscape lends itself to understanding seasonal band ranges during the Pleistocene. With high-quality lithic resources restricted to the geographic extremes of Allendale County (coastal plain chert) to the south (Goodyear et al. 1985) and the Uwharries Mountains (rhyolite) to the north (Daniels 1998), the GIS will enable cost-distance, nearest neighbor, and distance decay analyses highlighting Paleoindian land-use practices (Gillam 1999). Likewise, predictive models of Paleoindian site location will improve our ability to identify potential landscape features containing significant archaeological deposits dating to the Pleistocene.

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An Inventory of Paleoindian Ornamentation

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Personal ornamentation is an under-utilized tool for better understanding Paleoindian culture complexes. Unfortunately, there is no one source documenting all known ornaments from the late Pleistocene to the early Holocene. Thus, in order to create a more coherent picture of Paleoindian ornamentation, a synthesis based on a literature search was begun. This paper presents the initial findings of that search.

Thus far, 104 individual ornaments from 10 different sites in North America (Table 1) have been recorded in a database written in Microsoft Access. Artifacts were considered for the study if they could be worn on the body either directly or by a suspension hole. Some ornaments exhibit wear patterning along the suspension hole, such as striations or sheen. Not all ornaments, however, particularly those used as grave embellishments, show such patterning. Incised bone represents a possible artistic tradition, but it does not fit the ornament definition and therefore has not been included in the inventory. Ocher, however, has uses which may be labeled ornamental, but not in all cases.

Ornaments have been classified on the basis of material type, species when applicable, perforation size and shape, surface texture, dimensions, and associated lithic culture. Material types include seashell, animal teeth, bone/horn, and stone. Shell accounts for about half of all the ornaments inventoried. The double burial at Horn Shelter (Redder and Fox 1998) produced the highest number of ornaments (n = 84).

Ocher apparently played an important role in ornamentation, but exactly how is not yet understood. In one instance, a perforated chunk of ocher may represent a pendant (Wilmsen 1974), but for the time being it is not listed in the inventory.

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Table 1. Summary of current inventory of ornamental artifacts recovered from North American Paleoindian sites.

Site	Material type	Associated tithic type	Reference
Blackwater Draw	2 bone beads	Clovis and Folsom	Hester et al. 1972
Charlie Lake Cave	1 stone bead	Charlie Lake points	Driver 1998
Gordon Creek	1 elk incisor pendant	unknown	Breternitz et al. 1971
Hell Gap	1 steatite stone bead	Folsom?	M. Kornfeld, pers. comm. 2004
Hell Gap	1 sandstone bead	Folsom?	M. Kornfeld, pers. comm. 2004
Hell Gap	1 tubular bone bead	Frederick	M. Kornfeld, pers. comm. 2004
Hiscock	1 stone bead	unknown	Laub 1995
Horn Shelter	83 *Neritina* shell beads	Folsom/Plainview	Redder and Fox 1998
Horn Shelter	4 perforated coyote? canines	Folsom/Plainview	Redder and Fox 1998
Horn Shelter	1 shell pendant	Folsom/Plainview	Redder and Fox 1998
Lindenmeier	1 bone bead	Folsom	Wilmsen and Roberts 1978
Lubbock Lake	1 bone bead	Firstview	Johnson 1987
Powars II	2 shell beads	from Clovis to Hell Gap	Stafford et al. 2003
Powars II	1 bone bead	from Clovis to Hell Gap	Stafford et al. 2003
Wilson-Leonard	1 fossilized shark tooth	Wilson points	Collins 1998
Wilson-Leonard	1 *Prunum* shell bead	Wilson points	Collins 1998

Paleoindian human remains are extremely rare and are given much attention in the literature. Grave goods, therefore, are more likely to be described in greater detail. Thus, many recognized ornaments are reported from burials. Over half the ornaments listed in the inventory come from burial contexts. Determining whether this suggests that personal adornment was a Paleoindian mortuary practice or is due simply to sample bias is one goal of this project.

Clearly a larger and more comprehensive sample is needed to better understand Paleoindian ornamentation. For example, data are also being gathered on tools that may be used in ornament production (e.g., bone needles, drills, burins, abraders, and lapstones). Another goal is to correlate ornament styles with traditional culture complexes based on lithic artifacts (e.g., Clovis, Folsom, Hell Gap).

Researchers with information regarding finished or unfinished Paleoindian beads and pendants, needles, perforators, and ocher are asked to contact the author in order to update and expand the inventory. The database will be available to researchers upon request.

Thanks to Marcel Kornfeld for information given on Hell Gap beads, and to Vance Holliday for encouragement and use of his personal library.

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Errata

The following article was initially published in the 2004 edition of *Current Research in the Pleistocene,* vol. 21, pp. 53–55. Unfortunately, a final round of edits made by the authors was not incorporated into the published version of the paper. These changes include (a) reinterpretation of the Paleoindian occupation surface as "glaciomarine deltaic deposits" rather than subaerial glacial outwash, and (b) the addition of a new reference, Tary et al. (2001). The editors wish to apologize to the authors for not including these significant changes in the published version of their paper.

Micromorphological Investigations at the Hedden Site (4.10): A Buried Paleoindian Occupation along the Southern Maine Coast

Richard L. Josephs and Arthur E. Spiess

The Hedden site (4.10) is a buried Paleoindian occupation along the southern Maine coast, York County, Maine, that dates to ca. 10,500 RCYBP (Spiess and Mosher 1994; Spiess et al. 1995). The site was discovered in 1990 during an archaeological survey of the area conducted by personnel from the Maine Historic Preservation Commission. Over the past 13 years, numerous lithic artifacts, diagnostic of the Paleoindian period, have been collected at the site. The occupation surface is composed of glaciomarine deltaic deposits that were subsequently buried by a "linear eolian landform," most likely a longitudinal dune, which appears to have remained relatively stable since the late Pleistocene (McKeon 1989; Spiess et al. 1995; Tary et al. 2001). The dune-delta interface is not distinguished by the presence of a paleosol, indicating that environmental conditions were not conducive for pedogenesis and/or the paleosurface was rapidly buried. Modern spodosols are developed in the overlying eolian parent material (Spiess and Mosher 1994; Spiess et al. 1995).

Micromorphology was used to investigate geologic and anthropogenic pro-

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cesses affecting the site (Courty et al. 1989; French 2003; Goldberg 1992; Goldberg and Arpin 1999; Josephs 2000; Simpson et al. 1999). The primary focus of the investigation was the interface between the deltaic deposits and the overlying eolian sediments, i.e., the Paleoindian surface. A total of 24 sample boxes, yielding 48 thin sections, were collected from selected test unit profiles during the 2002 field season (Josephs and Bettis 2003). The thin sections were prepared by National Petrographic, Inc., Houston, Texas, and examined at the Department of Geology and Geological Engineering, University of North Dakota, with a Nikon Optiphot-Pol polarizing microscope. The procedure identified and described soil microstructure, basic mineral components, organic (plant remains) and anthropogenic (microdebitage) inclusions, and features resulting from soil-forming processes (pedofeatures). The descriptions follow the terminology of Bullock et al. (1985) and Stoops (2003).

Thin sections prepared from sample columns collected across the dune-delta boundary evince clear distinctions between the upper eolian material and the underlying deltaic sediments. The dune sediment is composed primarily of unoriented, moderately sorted, subrounded, medium sand-size, mono- and polymineralic grains with frequent (30–50 percent) void space. The deltaic deposits consist of unoriented, poorly sorted, subangular, predominantly sand-size, mono- and polymineralic grains. Void space is few (5–15 percent) due to the higher percentage of finer material. The decrease in void space is vertically gradational as you go from the dune material into the deltaic deposits. Very few (< 5 percent) plant residues were observed in either of the depositional units.

In micromorphological terms, the dune sands display a single-spaced enaulic related distribution pattern with a single grain to intergrain microaggregate structure (Bullock et al. 1985; Stoops 2003). The deltaic material has a single-spaced fine enaulic to porphyro-enaulic related distribution pattern with an intergrain microaggregate structure (Bullock et al. 1985; Stoops 2003). The micromorphology strongly supports the results of previous grain-size analyses performed at the site (Spiess et al. 1995).

Chert was the predominant lithic raw material used at the Hedden site (Spiess and Mosher 1994). Because the nearest chert source is more than 100 km distant, all chert found at the site is considered to be the result of human transport and subsequent lithic reduction (Spiess and Wilson 1989). Chert fragments were present in all 48 thin sections. Overall, chert fragments from samples collected at or near the occupation surface are larger and more angular than those observed in the overlying eolian deposit. The smaller size and smoother edges of the fragments in the dune material suggest transport-related mechanical weathering. A variety of chert was used in the manufacture of stone tools at the Hedden site (Spiess and Mosher 1994); however, no attempt was made to identify the chert fragments seen in thin section to a specific type (e.g., Munsungun, Coxsackie, etc.).

Due to the age and ephemeral nature of Paleoindian occupations, physical evidence of human presence is typically scarce. Quite possibly, the best evidence for such transitory occupations may well be found at the microscopic level. The results of this investigation are consistent with the previously published geomorphic, sedimentologic, and archaeologic findings (Spiess and

Mosher 1994; Spiess et al. 1995). Not only did micromorphology corroborate the results of the larger scale studies, it also promoted its use as a technique for identifying potential archaeological sites where physical remains are sparse to nonexistent.

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