## Contents

**From the Editor** ........................................................... 1

### Archaeology of Northeast Asia

- **Recent Excavations at the Shimaki Paleolithic Site, Hokkaido, Japan**  
  *Ian Buvit, Karisa Terry, Masami Izuho, and Koh Hamaguchi* ....................................... 1

- **First Known Paleolithic Cache in Mongolia**  
  *Sergei Gladyshev, Alexander Popov, Andrei Tabarev, John W. Olsen, and B. Gunchinsuren* .......... 3

- **An Early Lithic Assemblage from the Khaya IV Site, Western Beringia**  
  *Sergei B. Slobodin* ........................................................................ 6

- **The Western Transbaikal, Siberia: New Materials of the Middle Phase of the Upper Paleolithic**  
  *Irina I. Razgildeeva and Aleksander V. Konstantinov* .................................................. 8

- **The Definition of Raw-Material Centers during the Late Paleolithic, Neolithic, and Paleometal Ages of Sakhalin Island, Eastern Russia**  
  *A. A. Vasilevski and V. A. Grishchenko* ......................................................................... 11

- **New Data on the Upper Paleolithic of the Upper Yenisei Area (Siberia)**  
  *Valery S. Zubkov, Sergey A. Vasil’ev, Galina Y. Yamskikh, Elena V. Syromyatnikova, Anna V. Kosachek, and Svetlana A. Gavrilkina* .......................................................... 15

### Archaeology of North America

- **Paleoindian Occupation at the Paul Site, a Valley Locale in Yellowhouse Draw on the Southern High Plains, Texas**  
  *Paul N. Backhouse and Eileen Johnson* ........................................................................... 19

- **Bison Hunting at Jake Bluff: New Directions in Clovis Hunting Technology**  
  *Leland C. Bement and Brian J. Carter* ............................................................................. 22

- **An Early-Holocene Site in the Upper Susitna Basin, Central Alaska**  
  *John C. Blong* .................................................................................. 25

- **Ravenscroft: A Paleo-Arroyo and Late-Paleoindian Bison Kill in an Unusual Hillslope-Shoulder Position, Oklahoma Panhandle**  
  *Brian J. Carter, Leland C. Bement, and Kent J. Buehler* .................................................. 27

- **Recent Excavations at Teklanika West: A Late-Pleistocene Multicomponent Site in Denali National Park and Preserve, Central Alaska**  
  *Sam Coffman and Ben A. Potter* ...................................................................................... 29

- **Evidence for Changing Toolstone Source Use and Range Mobility during the Paleoindian Occupation of the Great Lakes/Northeast**  
  *Christopher Ellis* ............................................................................... 32

- **CA-SRI-26: A Terminal-Pleistocene Site on Santa Rosa Island, California**  
  *Jon M. Erlandson, Torben C. Rick, and Nicholas P. Jew* ................................................ 35
The Cochiti Clovis Point Base, Sandoval County, New Mexico
Gregory D. Everhart and Bruce B. Huckell ........................................ 37

Comparing Great Basin Paleoindian Raw Material Procurement Strategies: X-ray Fluorescence Data from Obsidian Fluted and Stemmed Points from Mud Lake and Lake Tonopah, Nevada
Lindsay A. Fenner, Geoffrey M. Smith, Samuel Coffman, and Gary D. Noyes .............. 39

Pleistocene Archaeology of the Tanana Flats, Eastern Beringia
Edmund P. Gaines, Kate S. Yeske, Scott J. Shira, William C. Johnson, and James F. Kunesh .... 42

Great Basin Stemmed Series Surface Assemblages at Pluvial Mud Lake, Nevada
Barbi Malinky Harmon ..................................................... 45

Clovis Activity in the Central Plains Uplands
Jack L. Hofman and Brendon P. Asher ........................................... 47

Folsom Obsidian Procurement and Use at the Boca Negra Wash Site, New Mexico
Bruce B. Huckell, M. Steven Shackley, Matthew J. O’Brien, and Christopher W. Merriman .... 49

Ultrathin Biface at the Adair-Steadman (41FS2) Folsom Campsite/Workshop on the Southern Plains
Stance Hurst and Eileen Johnson ................................................ 52

New Late-Pleistocene Lithic Artifacts from the Hiscock Site, Western New York State
Richard S. Laub .............................................................. 55

Late-Paleoindian versus Early-Archaic Occupation of Yellowstone Lake, Wyoming
Douglas H. MacDonald, Richard E. Hughes, and Jennifer W. Gish .......................... 58

Reinvestigation of the Cape Site, an “Early Man” Locality in Western Nebraska
David W. May, Matthew G. Hill, and David J. Rapson ................................... 60

Fluted Points from Pine County, Minnesota: The Neubauer Collection
Stephen L. Mulholland and Susan C. Mulholland ...................................... 62

The Third Lake Cache, St. Louis County, Minnesota
Susan C. Mulholland, Christopher L. Hill, and Stephen L. Mulholland ....................... 65

The Burgess-Mabrey Site: 40JK267, Jackson County, Tennessee
Mark R. Norton, John B. Broster, Dennis Burgess, and Larry Mabrey ..................... 67

New Fluted Artifact Finds at the Sheep Mountain Site (35HA3667), Harney County, Oregon
Patrick O’Grady, Michael F. Rondeau, and Scott P. Thomas .................................. 69

Clovis in Southeast Idaho’s Teton Valley
Bonnie L. Piblado and Benjamin Fowler .............................................. 71

The Mead Site, a Late-Pleistocene/Holocene Stratified Site in Central Alaska
Ben A. Potter, Phoebe J. Gilbert, Charles E. Holmes, and Barbara A. Crass .................... 73

Linda’s Point: Results from a New Terminal-Pleistocene Human Occupation at Healy Lake, Alaska
Robert A. Sattler, Thomas E. Gillispie, Norman A. Easton, and Michael Grooms ............ 75

An American (Projectile Point) in Paris
Frédéric Sellet, David J. Meltzer, Águeda Vilhena Vialou, and Denis Vialou .................. 78

Looking to the North: Results from the XRF Analysis of Pre-Archaic Projectile Points from Hanging Rock Shelter, Northwest Nevada
Geoffrey M. Smith, Stephen LaValley, and Craig Skinner .................................... 81

Geometric Morphometrics and the Effect of Raw-Material Quality on the Shape of Clovis Points
Heather Smith ............................................................ 83

New Evidence for the Paleoindian Occupation of the Narragansett Basin, Rhode Island and Massachusetts
Kevin P. Smith, Amy Smith, and Nina Hellebrekers ........................................ 86
New Finds and Related Obsidian Studies at the Sage Hen Gap Fluted-Point Site, Harney County, Oregon
Scott P. Thomas, Patrick W. O'Grady, and Michael F. Rondeau ...................................................... 89

A Submerged Suwannee Point Site from Lake George, St. Johns River, Florida
David K. Thulman ............................................................................................................................ 91

Archaeology of Latin America

The Paleoamerican Occupation of Cueva Bautista: Late-Pleistocene Human Evidence from the Bolivian Highlands
Juan Albarracin-Jordan and José M. Capriles .......................................................... 95

GISArchaeological Site Record and Remarks on Paleoindian Finds in the Rio Negro River Basin, Central Uruguay
Jorge Femenías, Hugo G. Nami, André Florines, and Arturo Toscano .............................. 98

Coast-inland Mobility during the Early Holocene in the Semiarid North of Chile: La Fundición Site
Donald Jackson, César Méndez, and Antonia Escudero .................................................. 102

A New Fishtail-Point Find from South Brazil
Lisiane da Silva Lopes and Hugo G. Nami ........................................................................... 104

Equus and Palaeolama Direct 14C Ages at Las Monedas Site, Semiarid North of Chile
César Méndez, Donald Jackson, and Roxana Seguel .................................................... 107

Techno-Morphological and Use-Wear Analysis on Lithic and Bone Tools from Campo Laborde Site (Pampean Region, Argentina)
Pablo G. Messineo and Nélida Pal ....................................................................................... 110

Exceptional Fell Projectile Points from Uruguay: More Data on Paleoindian Technology in the Southern Cone
Hugo G. Nami ......................................................................................................................... 113

Rescue of Mammutthus sp. Remains Associated with a Possible Artifact at Villa Hidalgo, Zacatecas, Mexico
Silvia Puga Pérez, Carlos A. Carrillo Rodríguez, and Ciprian F. Ardelean .................... 116

Paleoindian Occupation in the Central Mountains of Argentina: Was It a Failed Colonization?
Diego Rivero and Eduardo Berberián .................................................................................. 118

Early Hunter-Gatherers and Miners (ca. 12,000 CALBP) in the Arid Coast of Northern Chile
Diego Salazar, Donald Jackson, and Douglas Jackson ...................................................... 121

Two Directly Dated Early-Holocene Archaic Burials from Pains, State of Minas Gerais, Brazil
André Strauss, Edward Koole, Rodrigo Elias de Oliveira, Mariana Inglez, Tatiana Nunes, Pedro Da-Gloria, Alexandre Robazzini, Fernando Costa, and Walter Neves ........................................ 123

First Early Human Occupations in Caves and Rockshelters in Uruguay and Diverse Landscapes Utilized by Early South Americans
Rafael Suárez, David S. Leigh, and Mario Trindade .......................................................... 125

Geosciences

Lunette Distribution on the High Plains of Kansas—A Guide to Seeking Paleoindian Sites
Mark W. Bowen and William C. Johnson ............................................................................ 129

Soil Stratigraphy of the Lindenmeier Folsom Site
Vance T. Holliday .................................................................................................................. 131

Post–Last Glacial Maximum Dune Sequence for the “Parsonburg” Formation at Elliott’s Island, Maryland
Darrin Lowery, John Wah, and Torben Rick .......................................................................... 134
Deglaciation and the Archaeology of Trapper Creek, South-Central Alaska
   Brian T. Wygal and Ted Goebel. ............................................ 136

Paleobotany
Nonsiliceous Algae and Aquatic Pollen Spectra from the Portage River Channel, Northeast Minnesota
   James K. Huber. ............................................................. 141
12,000 Years of Environmental Change Archived on Morainal Ridges in Central Alaska
   William C. Johnson, Steven R. Bocarth, and Edmund P. Gaines. .......... 143

Paleontology
A Geometric Morphometric Study of North American Late-Pleistocene Equid Upper Premolars
   and Its Potential Significance for Equid Systematics
   Christian Raúl Barrón-Ortiz and Jessica Theodor. ........................ 147
Reexamining the Geological Context and Age of the Walhalla, North Dakota, Mammoth
   Ashley Breiland and Kenneth Lepper. .................................... 149
Mammal Extinction at the Pleistocene-Holocene Boundary in South America
   Alberto L. Cione, Eduardo P. Tonni, and Leopoldo Soibelzon. ............ 152
Environmental Stability During the Pleistocene-Holocene Transition in Northwestern Patagonia?
The Small Mammals of Cueva Huenul 1 as Evidence
   Fernando J. Fernández, Ulyses F. J. Pardiñas, Pablo Teta, and Ramiro Barberena. ............................... 154
The “Living Fossil” Peccary, *Catagonus wagneri* (Tayassuidae), and Its Climatic Significance
during the Pleistocene and Holocene
   Germán M. Gasparini, Esteban Soibelzon, Eduardo P. Tonni, and Martín Ubilla. .... 157
Using Morphometrics to Identify Shape Differences on Isolated Teeth in Pleistocene Tapir Species
   Matthew Lewis Gibson and Steven C. Wallace ................................ 159
A Review of the Nye Site, Wisconsin
   Marlin F. Hawley, Matthew G. Hill, Christopher C. Widga, and Darrell W. Kittleson ....... 161
Weevil (*Strangaliodes* sp., Curculionidae) Records for the Early Holocene in the Semiarid North of Chile
   Douglas Jackson. ............................................................. 163
Additional Records of Late Pleistocene Sciurids from the Hand Hills, Alberta
   Christopher N. Jass, David (Tim) Schowaller, Lisa Bohach, and Emily Frampton. ........ 166
Sexual Dimorphism in the Black-Footed Ferret (*Mustela nigripes*) Revealed by Geometric Morphometrics
   Leigha M. King and Steven C. Wallace ..................................... 168
Extinct Fauna from the Calama-Chiuchiu Basin, (North Arid, Chile): Taphonomic and Archaeological Relevance in the Late Pleistocene
   Patricio López M. and Oswaldo Rojas M. ................................ 170
Taxonomy and Evolution of the Plio-Pleistocene Proboscidian *Stegomastodon* in North America
   Spencer G. Lucas, Gary S. Morgan, Justin A. Spielmann, Michael R. Pusenka,
   and Ricardo Hernán Aguilar ...................................................... 173
Explorations in the Early Pleistocene of West Texas
   John Moretti and Eileen Johnson ............................................ 176
Species Response to the Theorized Clovis Comet Impact at Sheridan Cave, Ohio
   Brian G. Redmond and Kenneth B. Tankersley. ............................. 179
A New Occurrence of Toxodonts in the Pleistocene of México
   Rubén A. Rodríguez-de la Rosa, José Rubén Guzmán-Gutiérrez,
   and Carlos Ortega-Hurtado de Mendoza ..................................... 181
Dental Variation in Pleistocene Marsh Rabbits from Ichetucknee River, Florida
Dennis R. Ruez, Jr............................................................ 183

Evaluating the Co-occurrence of *Platygonus compressus* and *Mylolhyus nasutus* at Sheriden Cave, Wyandot County, Ohio
Kenneth B. Tankersley..................................................... 185

Compression Fractures in Dwarf Elephants from Malta Give an Insight into Their Small Size
George E. Theodorou, Bruce M. Rothschild, and Larry D. Martin................................. 187

Author Index .............................................................. 193

General Index............................................................... 195

Order Form for Back Issues of Current Research in the Pleistocene ..................... 207
From the Editor

After 28 years, we are saying “good bye” to *Current Research in the Pleistocene*. In your hands you hold its last volume. Costs of production have risen far above the revenue brought from sales, making it uneconomical for us to continue publication in its present form.

Many people have contributed to the editing of *CRP* over the years, and here we want to acknowledge their efforts. Jim Mead started the journal and served as editor from 1984 through 1992; in this role he was succeeded by Brad Lepper from 1993 through 2002, and Mike Waters in 2003. Their hard work and dedication all of those years ago made possible the last eight volumes, which I had the pleasure to assemble. During my time as editor I’ve collaborated with hundreds of authors and reviewers, as well as an editorial board that was always quick to respond to requests for reviews and a variety of problems and queries. David Meltzer was the first to join the editorial board back in 1989, and over the years the board grew to a group size of nearly 20. Past and present board members include Mel Aikens, Dan Amick, David Anderson, Chris Bell, Luis Borrero, Loren Davis, Dan Fisher, Ruth Gruhn, Gary Haynes, Bryan Hockett, Masami Izuho, John Johnson, Jason LaBelle, Terri LaCourse, Brad Lepper, Heidi Luchsinger, Carole Mandryk, Francisco Mena, Akira Ono, Stephen Ousley, Ulyses Pardiñas, Bonnie Pitblado, Tad Schurr, Paul Sciulli, Frédéric Selle, Linda Shane, Sergei Slobodin, Gentry Steele, Tom Stafford, and David Yesner. These scientists selflessly provided expert critiques and editorial assistance to me and past editors of the journal. Dan Fisher and Brad Lepper need to be expressly acknowledged: they have stuck with *CRP* for 18 years, Dan as editorial board member...
and Brad as editor and editorial board member. Thanks, Dan and Brad!

CRP never would have succeeded during the time that I’ve served as editor without three very important people: Laurie Lind and Jim and Charlene Chandler. Laurie unfailingly maintained order among hundreds of documents, images, and e-mail notes we received from authors annually, and she always did so with a cheery demeanor we all appreciated. Jim and Char’s superb page-editing skills repeatedly led to a smart-looking, professional journal, one appreciated by all its authors and readers. Both Laurie and the Chandlers deserve our collective congratulations and gratitude for a job well done all these years. I am especially indebted to them for their extreme patience with me, given that in eight years as editor, I did not meet a single deadline that we set for CRP production. Finally, thanks to Josh Lynch and Heather Smith, Ph.D. students at Texas A&M University, who this past year assisted us in production of this last volume.

CRP is ending, but the Center for the Study of the First Americans’ publishing efforts are not. We continue to produce the quarterly news magazine, The Mammoth Trumpet, and we maintain an established peer-reviewed book series with our partner, Texas A&M University Press. In the near future, we hope to resurrect CRP in a new format and under a new title, as an electronic quarterly journal that will not only maintain the short-article format but also include longer reviews and research reports. Currently we are developing proposals to academic journal publishers, one of whom we hope will be interested in providing us with the infrastructure needed to again deliver a peer-reviewed journal for the interdisciplinary field of first Americans studies. Please check our website (www.centerfirstamericans.org) during the next year for any news about this project, and don’t hesitate to send me an e-mail note at goebel@tamu.edu if you’d like an update.

So, for now, farewell.

Ted Goebel
Recent Excavations at the Shimaki Paleolithic Site, Hokkaido, Japan

Ian Buvit, Karisa Terry, Masami Izuho, and Koh Hamaguchi

Keywords: Paleolithic, Hokkaido, wedge-shaped cores

In August 2010, archaeologists from Tokyo Metropolitan University and Central Washington University reopened excavations at the Shimaki site on the second terrace of the Otofuke River, southeastern Hokkaido (43° 14′ N, 143° 18′ E). Previous excavations revealed a Paleolithic artifact concentration including a wedge-shaped core (Figure 1) associated with a fission track age of 21,700 ± 1800 CALYBP (Kato and Yamada 1988). The specimen exhibits the morphology of other northeast Asian post-last-glacial-maximum microblade cores from Siberia and northern Japan, but the facets on the face of the Shimaki artifact clearly preclude formal microblade detachment.

Earlier work at Shimaki was conducted by Tsuji and Kato in 1967 and 1969, by the Kamishihoro Board of Education in 1984, and by the University of Tsukuba in 1986–1988 (Kato and Yamada 1988). Stratigraphically, the artifact-bearing layer is within loamy floodplain sediments of the Otofuke River bracketed by the Sipfa-1 Tephra above (a.k.a. Tangara Pumice, <19,000 CALYBP) and the Sipfa-2 Tephra below (a.k.a. Uguisu Pumice, ca. 43,000 CALYBP). The 1984 excavations were the most productive, uncovering 6,566 mostly obsidian chipped-stone artifacts from the Paleolithic level (Kato and Yamada 1988). Several numerical ages, including the fission track and five obsidian hydration dates (BS.A1-26 19,000 ± 800 CALYBP; A1-137 18,200 ± 500 CALYBP; B1-43 18,200 ± 700 CALYBP; B1-2896 17,200 ± 800 CALYBP; B3-80 17,500 ± 900 CALYBP), indicate an occupation at or just after the last glacial maximum. A single conventional radiocarbon date of 25,500 ± 1200 RCYBP (GaK-3262) from 40 cm below the cultural level provides a lower age limit (Kosaka and Nogawa 1972).

Ian Buvit and Karisa Terry
Tokyo Metropolitan University, Faculty of Humanities and Social Sciences, Minami-Ohsawa 1-1, Hachioji-shi, Tokyo, Japan, 192-0397; Central Washington University, Department of Anthropology and Museum, 400 East University Way, Ellensburg, Washington, 98926; e-mails: ibuvit@gmail.com karisaterry@hotmail.com

Masami Izuho and Koh Hamaguchi, Tokyo Metropolitan University, Faculty of Humanities and Social Sciences, Minami-Ohsawa 1-1, Hachioji-shi, Tokyo, Japan, 192-0397; e-mails: izuhom@tmu.ac.jp koh_hama0225@yahoo.co.jp
Year 2010 excavations revealed Paleolithic artifacts associated with a hearth feature comprising an unlined ash and charcoal concentration (ca. 95 cm in diameter and 25 cm thick). Artifacts from all excavation units (N = 373) include 14 endscrapers, 5 sidescrapers, 12 flake cores, a burin, 4 retouched flakes, 210 flakes, 28 chips, 68 pebbles, and 32 pieces of ocher (see Figure 1 for examples). It is important to note that no microblades or other unequivocal microblade cores were discovered in 2010. Over 20 charcoal samples from the hearth feature and profiles are currently being processed at the University of Tokyo and should improve the geochronology of the site, especially the age of the archaeological material.

Figure 1. Paleolithic artifacts from the Shimaki site. A, wedge-shaped core; B, burin; C, flake core; D–G, scrapers.
This and future work at Shimaki will help place Hokkaido within the framework of northeast Asian Paleolithic prehistory and to potentially facilitate our understanding of the development of microblade technology in the region.

References Cited


First Known Paleolithic Cache in Mongolia

Sergei Gladyshev, Alexander Popov, Andrei Tabarev, John W. Olsen, and B. Gunchinsuren

Keywords: Mongolia, Paleolithic, cache, flakes

Paleolithic caches are a rare category of archaeological find, especially since relatively few are discovered and properly excavated by archaeologists. Most of the extant literature on Paleolithic caches focuses on the famous terminal-Pleistocene Paleoindian (Clovis, in particular) caches in North America and some earlier examples from western Europe, with additional sketchily reported finds from greater northeast Asia (e.g., the Russian Maritime Region, Chukotka, Yakutia, and Japan) (Kornfeld and Tabarev 2009). Some have speculated that caching behavior is more typical of North American cultures than those of northeast Asia (e.g., Bradley and Stanford 2004).

In 2009, the Joint Mongolian-Russian-American Archaeological Expedition continued excavating the stratified Tolbor-15 site in the Khangai Mountains of northern Mongolia (Gladyshev and Tabarev 2009), along with carrying out reconnaissance for similar localities in the Selenga River watershed nearby.

A number of interesting sites with blade, flake, and microblade industries were found on high fluvial terraces, arguably the most intriguing of which is situated on the southeastern face of a hill about 40 m above the Ikh-Tolboriin-...
Gol River (49° 14’ 07″ N, 102° 56’ 04″ E) (Figure 1A). Intensive erosion has exposed the upper part of a concentration of lithic artifacts from buried soil horizon approximately 10–15 cm below the surface. Excavation unit 50-by-50 cm revealed that these lithics occurred in a dense 30-by-30-cm concentration, as if they had been enclosed in a bag or some other container. The feature was

Figure 1. The Tolbor Paleolithic cache. A, location of the cache; B, before excavation; C, after excavation; D, contents of the cache.
not found in the context of an established occupation site or quarry, and no other artifacts were found in the sediment enclosing the cache or on the surface for a radius of hundreds of meters.

The cache assemblage includes 57 flat flakes made on local gray chert. All are discoidal with no traces of intentional retouch on their edges, and all are ideal blanks for tools. Fifty-three (93%) of the flakes may be described as large, with at least one minimum dimension exceeding 5 cm, while 16 (28%) are even larger, with at least one dimension exceeding 10 cm. No debitage or exhausted cores are associated with this set of blanks, and no formal tools from exotic raw materials or artifacts with hypertrophic proportions were found, so this feature cannot be easily interpreted as ritual or ceremonial in character; rather, the characteristics of its contents and location suggest it is a raw material cache—a hoard of special blanks—the first Paleolithic cache described from Mongolia.

Taking into consideration the long chronology of flake technologies associated with Pleistocene industries in northern Mongolia (Gladyshev et al. 2010) and the fact that datable materials were not found in direct association, the Tolbor cache may be preliminarily dated on typological and stratigraphic grounds to between 25,000–15,000 CALYBP, which corresponds with the predominance of flake industries in contrast with the blade (40,000–25,000 CALYBP) and microblade (15,000–11,000 CALYBP) industries.

This research was supported by grants # 09-06-00006a from the Russian Foundation for Basic Research and # 10-01-00548 a/g from the Russian Foundation for Humanities, as well as the Je Tsongkhapa Endowment for Central and Inner Asian Archaeology at the University of Arizona.

References Cited


An Early Lithic Assemblage from the Khaya IV Site, Western Beringia

Sergei B. Slobodin

Keywords: Archaeology of Western Beringia, Kolyma region, Paleolithic Northeast Asia

The Khaya IV site is a long-term hunting camp located on the north slope of the Okhotsk-Kolyma Plateau, in the Upper Kolyma region, western Beringia. According to geological data, this region was free of ice during the Karga and Sartan (Anderson and Lozhkin 2002).

The site lies on a small tributary of the Maltan River named Bolshaya Khaya, and is situated on a rocky edge of an 11-m-high alluvial terrace (elevation 880 m). The cultural materials (stone artifacts) are enclosed in strongly cryoturbated, shallow (up to 30 cm thick) sandy loam deposits overlying the terrace base.

The artifact complex discovered from the site is homogeneous in typology, technology, and raw material. The latter is presented by siliceous platy cleavages from a nearby outcrop and chalcedony cobbles from the river bank. The artifacts include cores, blades, irregular microblades, burins, gravers, points, bifaces, scrapers, pendants, a chopper, and technical spalls (Figure 1).

The core types are presented by large and flat cores with a wide front for obtaining blade flakes; narrow cores, steeply beveled toward the frontal pressure-retouched platform; end cores on slabs; a flattened subprismatic core; flattened two-platform cores with retouched beveled pressure platforms; and a fragment of a core front with microblade removal negatives.

Bifaces have a flattened-lenticular cross section and are asymmetrically oval, semilunar, and asymmetrically triangular in shape. Points are bifacial leaf-shaped with rounded and pointed bases and sub-triangular with straight bases. Sidescrapers (including déjeté) are made on flakes, and endscrapers (including double-ended) on blades. Burins are dihedral, angle, and transverse, made on blade spalls. Ornaments are represented by a flat pendant with a hole, and beads.

The cultural association and age of these materials have not been precisely determined at the present, though it is clear that the Khaya IV tool complex is characteristic of Paleolithic complexes of northeast Asia, but differs from the Dyuktai (Mochanov 1977) and Ushki (layer 7) cultures (Vorobey 2009). This is corroborated by artifacts that reflect a transition from the subprismatic technique of obtaining blade blanks from broad core surfaces to end cores. Such a transition is recorded in early stages of the late Paleolithic of the Altai at the Kara-Bom site (Derevyanko et al. 2002) and in the middle of the late Paleolithic (25,000 to 18,000 RCYBP) in the Transbaikal region (Konstantinov 1994).
The primary flaking technique of the Bol'shaya Khaya IV site shows parallels with materials of the early Abakan site complex on the Amur (21,000–25,000 RCYBP) (Derevyanko et al. 1998), and with the lower layer of the Ustinovka I site in Primor’e dated to 22,000–14,000 RCYBP (Vasil’evskii and Gladyshev 1989), or even to 30,000 RCYBP (Kononenko 2001).

The Khaya IV complex expands the variety of western Beringia Paleolithic traditions. Since the complex of Khaya IV site includes virtually all categories of the stone toolkit and arts items, there is no reason to believe that this complex presents functional or ecologically rooted variation of any of the known cultures of Beringia. Absence of microcore and microblade at Khaya IV site is reason to group it with non-microblade complexes of Beringia, such as Ushki (layer 7), Nenana and Yana, although it differs from them (see Slobodin 2011). Another aspect common to them all is the presence of bifaces (at the Yana site they are not numerous, but presented). Discovering and identifying
a holistic complex of Khaya IV enhances the techno-typological analysis of mixed complexes or complexes with unclear context, both those existing and those not yet found in Beringia.

References Cited

Anderson, P. M., and A. V. Lozhkin, Ed. 2002 Late Quaternary Vegetation and Climate of Siberia and Russian Far East (Palynological and Radiocarbon Database). Magadan, NEISRI FEB RAS.


The Western Transbaikal, Siberia: New Materials of the Middle Phase of the Upper Paleolithic

**Irina I. Razgildeeva and Aleksander V. Konstantinov**

**Keywords:** Upper Paleolithic technology, lithic workshop, Siberia

Long-term archaeological research in the western Transbaikal region (Russia, Siberia) has focused on a series of the multilayered late Upper Paleolithic settlements spanning the final stage of the Sartan glaciation (Konstantinov 1994, 2001). The expressive remains of domestic complexes dating from 20,000 RCYBP have revealed a strong connection between the organization of inhabited space, distributions of artifacts, and specialized toolkits. Collections...
of stone artifacts have been found that contain wedge-shaped cores, microscrapers, knives, and microblades in combination with large cobble tools used as scrapers, choppers, etc. The repeated positioning of sites along floodplain terraces, short duration of occupations of dwellings, and specificity of tool assemblages point to specialized seasonal hunting habitations. Sites with full spectra of stone-tool manufacturing (i.e., workshops) are quite rare. The origins of this late Upper Paleolithic complex is unknown; our recent research therefore has focused on characterizing the middle phase of the Transbaikal Upper Paleolithic, ca. 25,000–20,000 RCYBP.

In 2007–2010 we researched a new Paleolithic site situated in the second alluvial terrace of the Menza River (85 m from the edge of the terrace, 7.35 m above the modern river level), called Ust’-Menza-14 (or Lagernaia) (Figure 1). Paleolithic cultural layers occurred at a depth of 3 m. Lithic artifacts recovered include scrapers on massive split cobbles, large cortical spalls, and numerous flakes. The occurrence of large boulders suggests the possible presence of dwelling features.

As of 2010, an area reaching 33 m² had been excavated. The exposed stratigraphic profile reached 5.6 m. From the top downward, stratigraphic layers are as follows: layers I-II, talus dating to the Holocene; layer III, talus dating to the Noril’sk stade (10,300–10,800 RCYBP); layer IV, pedocomplex dating to late Sartan interstadials (i.e., Kokorevo and Taimyr, 10,800–12,700 RCYBP); layer V, periglacial floodplain alluvium, dating to full Sartan glaciation (ca. 13,000–20,000 RCYBP); layer VI, normal floodplain alluvium dating to late Karga interglaciation (ca. 20,000–25,000 RCYBP); layer VII, river bed facies, also presumed to date to late Karga times. The cultural layer is connected with the lithological layer V, at the base of periglacial alluvium of the second floodplain terrace, at a depth of 2.9–3.4 m. The cultural layer is poorly preserved. Its surface is undulating, and ice-wedge features cut through the surface of the layer. Artifacts appear redeposited into ancient gully features, tracked by a band of fine white sand. The assemblage appears to have been water-sorted, with small pieces having been washed away. Artifacts are discolored by iron oxides, suggesting a marshy, wet substrate in antiquity. Surfaces of all artifacts are strongly eroded, but technological patterns permit us to consider them as a single, uniform complex.

The stone assemblage is characterized by large products—mostly cobble scrapers and rejected scraper preforms, as well as numerous cortical spalls and core-reduction flakes. The excavated area also contained rounded boulders and cobbles that appear to have been used as hammers and anvils. The site appears to have functioned as a workshop, and stone raw materials are chiefly of local metamorphosed sandstones and slates, microquartzites, quartzites, microslates, and poor-quality jasper). Bipolar reduction was the chief form of core splitting. Worked edges of tools were prepared by hard-hammer percussion. In addition, the assemblage has a series of scrapers and flakes on orthoclase rhyolites, which are not represented in the local alluvium. A small number of micro-flakes (n = 39) made of multicolored jasper, chalcedony, and volcanic glass also occur. An unusual artifact includes an angular fragment from a dark brown siliceous pebble of skarn containing 75% magnetite,
Figure 1. A, map of Ust'-Menza area; B, stratigraphic profile of Ust'-Menza-14; C, plan of excavation of Ust'-Menza-14.
4 cm long, 3 cm wide, and less than 1 cm thick. Skarns of this type occur further up the Menza River. The lithic assemblage totals 1,107 pieces, and among them are 24 scrapers on flakes, 10 scrapers on fragments, 9 possible knives, 4 combination scraper-knives, 2 chisel tools, and 2 retouched flakes. Forty hammerstones and numerous more fragments have been recovered, as well as 10 pebble-retouchers made on microsandstones and microslates. Faunal remains are poorly preserved.

Site mapping led to the distinction of an area roughly 4 m² in extent, in the area of the excavation corner closest to the Menza River, which contained a massive boulder-anvil (0.96 x 0.6 m in size) with a concavo-convex surface covered with barbs. From under it were recovered three hammerstones and a scraper, and around it were additional scrapers, hammerstones, chipped and split pebbles, cortical spalls, and flakes.

The analysis of Ust’-Menza-14 and its contents is not yet finished; however, already we have recorded differences between it and the other later Upper Paleolithic sites of the Ust’-Menza archaeological area. Ust’-Menza-14 contains, for the first time, a unique workshop site where the bipolar technique of splitting locally procured raw materials occurred. On the basis of the assemblage’s stratigraphic position and character of its archaeological materials, we assign the horizon to the initial stage of a Sartan glaciation and the middle Upper Paleolithic archaeological period (i.e., Karasev 2002:61).

References Cited
Karasev V. V. 2002 The Cenozoic of Transbaikal. Chita [in Russian].

The Definition of Raw-Material Centers during the Late Paleolithic, Neolithic, and Paleometal Ages of Sakhalin Island, Eastern Russia
A. A. Vasilevski and V. A. Grishchenko

Keywords: Sakhalin island, jasper center, raw material

The raw-material (RM) basis of lithic industries during the Stone (20,000–3000 RCYBP) and Paleometal (until the 6th century A.D.) ages in Sakhalin.

A. A. Vasilevski, Doctor of science, vice-rector of Sakhalin State University. Yzhno-Sakhalinck, Lenina str, 290, Sakhalin State University, Russia; e-mail: vasilevski@bk.ru
V. A. Grishchenko, Ph.D, Head of Educational archaeology museum of Sakhalin State University. Yzhno-Sakhalinck, Lenina str, 290, Sakhalin State University, Russia; e-mail: v.grishchenko@mail.ru
included local and exotic components. Local RM included various hornfels, tuff, siliceous argillite, andesite, basalt, gabbro, chalcedony, quartzite, etc. Generally, by local we understand the lithic RM that was collected by people locally within a distance of 50–100 km, or on a journey of 2–4 days on foot from residential sites during their hunting or fishing trips. Most tools, as a rule, were produced on such local RM. Nevertheless, major additions to late-Paleolithic industries, and to even a greater degree early-Neolithic industry, were exotic silicates used to make blades, especially microblades.

A significant phenomenon of the late-Pleistocene/early-Holocene archeology of the Japanese archipelago, Sakhalin, Kuril Islands, and Kamchatka was transporting obsidian from outcrops in Hokkaido and Kamchatka along the so-called “obsidian way,” as much as 1000 km one way. Numerous publications (Kimura 1992, 1998; Vasilevski 1996; Phillips and Speakman 2009; Glascock et al., 2000; Kuzmin et al. 2002] are devoted to this. We note that the farther to the north a site is situated, the less obsidian is found in it. So it seems quite natural that we unearthed a few artifacts made of Hokkaido obsidian in sites in the north of Sakhalin.

Jasper characterized by sealing-wax color is widely distributed throughout the East Sakhalin Mountains and in the Tym and Nabil river valleys. In the region, several groups of Stone Age sites were discovered between 2001 and 2009 (Berseneva 2007; Mozhaev 2009, 2010; Vasilevski 2006) (Figure 1). The Paleolithic and Initial Neolithic lithic RM sites are situated at altitudes ranging from 250 to 400 m, close to river deposits and to numerous surface outcrops and rocks of jasper. These outcrops are the largest known resource of RM in the island. Massive spalls, sometimes weighing more than 30 kg, detached from natural stationary cores—lonely rocks—were frequently used as blanks, as well as big pebbles from river sides. Thus the makers reduced failures in production by avoiding cracks in the structures of cores. Much of the RM from the upper parts of original layers or rocks has been spoiled by forest fires, water, and frost, so jasper toolmakers preferred already realized blanks—pebbles and boulders (Figure 1B). Most artifacts from the sites include debitage, blanks, anvils and half-prepared and spoiled cores, fragments of blades, side spalls, platform-rejuvenation spalls, flakes, chips, and unsuccessful products. Used tools are rare, but their presence indicates the place was inhabited by people for some time, not just for procuring RM. Sites dating to the middle and late Neolithic and the Paleometal age (4th millennium B.C.–5th century A.D.) are dominated by tools and flakes made of jasper the color of sealing wax.

We distinguish four areas of local lithic RM distribution in the island region for the period 20,000–1500 RCYBP, as shown in Figure 1. The northern area (area 1), including most of northern and central Sakhalin, was the source of local flints and small amounts of jasper used about 20,000–7500 RCYBP. Area 2 corresponds to the Middle Sakhalin jasper area, which was the source of toolstone used throughout the period. These two areas became united after flake industries replaced microblade industries in the middle Neolithic, about 7500–7000 RCYBC. Area 3 is the area of southern Sakhalin, where although toolmakers used jasper from the north and obsidian from the south, local
materials were the basis of the industry. This conclusion is based on the results of our excavations of such sites as Ogonky 5 and 8, Olympia 4–5 (late and final

Figure 1. A, The raw-materials areas (I–IV) of Sakhalin and Eastern Hokkaido and the late-Paleolithic/early-Neolithic sites mentioned in the article; B, the jasper core from the late-Paleolithic site Vosyi 5; C, the bazalt core from late-Paleolithic site Ogonky 5; D, the obsidian core from late-Paleolithic site Starorusskoe 5.
Paleolithic), Slavnaya 4, and Starodubskoye 3 (Neolithic), etc. At the same time, some sites characterized by microblade assemblages and dating to 12,000–8000 RCYBP, such as Slavnaya 5, Ogonky 7, Sokol 1, and Starorusskoye 3 and 5 (Figure 1), all late Paleolithic and initial Neolithic, are characterized by a prevalence of obsidian tools. The latter facts confirm the significance of obsidian exchange and possible migrations of obsidian toolmakers from Hokkaido during some periods in the final Pleistocene and early Holocene. Area 4, situated in northern and eastern Hokkaido, is characterized by industries founded on local RM, primarily obsidian. As for the Kurils, obsidians from both Kamchatka and Hokkaido were used (Phillips and Speakman 2009), as was local basalt and jasper.

Despite the significance of obsidian for microblade production, local RM remained a basic necessity even during peaks of obsidian exchange during the period 12,000–8,000 RCYBP. During some periods the jasper outcrops of middle Sakhalin were even more significant than Hokkaido obsidian resources. This has to be assessed to develop a comprehensive understanding of the Stone Age industries of Sakhalin Island.

References Cited


New Data on the Upper Paleolithic of the Upper Yenisei Area (Siberia)

Valery S. Zubkov, Sergey A. Vasil’ev, Galina Y. Yamskikh, Elena V. Syromyatnikova, Anna V. Kozachek, and Svetlana A. Gavrilkina

Keywords: Yenisei, Upper Paleolithic, lithic workshops

The paper briefly summarizes the preliminary results of the first phase of a research project carried out in the upper Abakan valley (upper Yenisei basin, southern Siberia) in 2010. The main theme of the research is outlined as follows. Up to now our knowledge about the development of Paleolithic cultures in the vast area of the Yenisei River basin is mostly based on data from sites located within the narrow limits of the Yenisei valley itself, owing to the fact that the main research efforts have been associated with large-scale salvage archaeology campaigns in areas to be flooded by the river’s reservoirs. Archaeologically, the large areas lying beyond the main valley floor are essentially blank. Moreover, searching for sites in the area not heavily affected by reservoirs and construction works seems to be promising from the viewpoint of detecting well-preserved buried sites.

The valley of the main left tributary of the upper Yenisei, the Abakan River, was chosen as an area to be investigated because of good preservation of Quaternary terraces and minimal recent human activities. Owing to the efforts of the senior author, several stratified Stone Age sites have been discovered since 2001 in the previously unexplored area (Zubkov 2008). The sites associated with the upper strata of the first terrace 5–7 m high (i.e., above the modern river level) are Sigurtup I, Matros I, Semenovsky Ruchey I, and Kuibyshevo I; for the second terrace 8–12 m high, Bolshie Arbaty I; for the third terrace (15–20 m high), Kuibyshevo III); for periglacial sediments forming elevations 27–29 m high, Mozharov Uval. Upper components of most of the sites produced remains of the Iron and Bronze Age as well as Neolithic cultures, while lower components could be assigned to the final Pleistocene or...
The importance of the site is threefold. First, it differs in the stratigraphic position from all known sites in the Yenisei basin and even beyond it. The culture-bearing layer represented by the dispersed lithics is embedded in thin covering loams above eluvium. This stratigraphy is more similar to that of Upper Paleolithic sites in the Russian Far East (Pacific areas) than in Siberia sensu stricto. Second, the functional peculiarity of the site is worth mentioning. Despite the long history of archaeological research and several hundred Upper Paleolithic sites now known from the Yenisei region, Kuibyshevo II is the first lithic workshop located near sources of raw material commonly used early Holocene. The sites yielded bones of wild sheep, red deer, roe deer, moose, auroch or bison, and fish. More specifically, the lowermost component of Matros I produced reindeer bones; layer 2 at Bolshie Arbaty I produced sheep and fish; and layer 3 yielded moose and sheep.

The main focus of fieldwork has been at Kuibyshevo II, located in a small intermountain depression along the right bank of the Dzhebash River, a tributary of the Abakan (Figure 1). In a series of trial trenches on the flat surface of the erosional terrace 70 to 75 m above the river, the remains of a cultural layer associated with upper loams have been exposed. The depth of sediments is about 1.15 m. Under the modern soil is a brown loam, underlain by a brownish yellow loam with artifacts at a depth of 0.35–0.55 m. Redeposited artifacts also have been found in slope sediments at levels 55–60 and 90 m above the river, the last suggesting that another locality may have existed that is now destroyed. Near the site in the base of the terraces outcrops of quartzite blocks have been discovered.

Figure 1. Kuibyshevo II site location and stratigraphy.

The importance of the site is threefold. First, it differs in the stratigraphic position from all known sites in the Yenisei basin and even beyond it. The culture-bearing layer represented by the dispersed lithics is embedded in thin covering loams above eluvium. This stratigraphy is more similar to that of Upper Paleolithic sites in the Russian Far East (Pacific areas) than in Siberia sensu stricto. Second, the functional peculiarity of the site is worth mentioning. Despite the long history of archaeological research and several hundred Upper Paleolithic sites now known from the Yenisei region, Kuibyshevo II is the first lithic workshop located near sources of raw material commonly used
by prehistoric humans of the region. Third, the composition of the site’s lithic assemblage is unique. Kuibyshevo II yielded three toolkits previously reported from different site clusters and traditionally considered incompatible. The core of the industry represents the Afontova-type lithic industry prevalent in the region during the final Pleistocene (Vasil’ev 1996), with heavy single- and double-platform cores, microblade wedge-shaped microcores, and numerous sidescrapers and endscrapers made on flakes. At the same time the site yielded a series of endscrapers on retouched blades and elongated burins, morphologically identical to “classic” specimens of the Kokorevo-type industry found in sites located several hundred kilometers north of Kuibyshevo II (Kokorevo I, Novoselovo VI and VII; for detailed discussion see Vasil’ev 1992). Moreover, the assemblage includes a series of foliate bifaces reported only from the sites of the Derbina cluster located further north of Kokorevo (Akimova et al. 2004). Thus the assemblage could be considered as a starting point for reexamining the complicated problem of the nature of lithic assemblage variability in the late Upper Paleolithic of Yenisei.

Future work should be oriented toward dating Kuibyshevo II. The dearth of organic matter prevented our using customary radiocarbon dating; therefore only RTL- and OSL-dating methods could help us establish the chronological position of the site. We plan to continue exploring this cursorily investigated area in our search for other Paleolithic occupations.

This research has been supported by the Russian Foundation for Basic Research, The RFBR-Khakasiya Program, Grant #10-06 98011. We thank the editorial board of CRP for correcting the English version of the paper.

References Cited


——— 1996 Pozdnii Paleolit Verkhnego Eniseia [The Late Paleolithic of the Upper Yenisei]. Peterburgskoe Vostokovedenie, St.Petersburg.

Paleoindian Occupation at the Paul Site, a Valley Locale in Yellowhouse Draw on the Southern High Plains, Texas

Paul N. Backhouse and Eileen Johnson

Keywords: Hunter-gatherers, Paleoindian, Southern High Plains

The Paul site (41LU136) is a multicomponent, hunter-gatherer location with occupations that span the late Quaternary. It is a large valley site (4.37 acres) within Yellowhouse Draw just above the confluence with Blackwater Draw that then forms Yellowhouse Canyon and the North Fork of the Double Mountain Fork of the Brazos River. The site is well stratified, mirroring the regional valley fill stratigraphy (Holliday 1995) and, in particular, that of the Yellowhouse system sequence defined upstream at Lubbock Lake (Holliday 1985; Holliday and Allen 1987). A comprehensive program of subsurface investigations (Backhouse et al. 2010; Johnson 2010) has identified at least 16 occupational episodes within the 5 major units and yielded 26 radiocarbon dates. Deeply buried Paleoindian-age material is well represented, encompassing at least six occupation zones, and the in situ recovery context is significant regionally.

The Paleoindian strata (1 and 2 in the regional system; Holliday 1995) were below the water table, and access was through systematic trenching using a trackhoe, safety trench boxes, and pumps. Trackhoe scoops were in ca. 10-cm levels within an identified stratum, and the sediments from each provenienced scoop were water processed for recovery of cultural and biological materials. Fourteen of the 26 radiocarbon dates came from stratum 2.

Occupation zones were based on spatial distribution and topography (upper and lower valley margins, axis). Stratum 1, the deepest unit and representing terminal-Pleistocene deposits (Holliday 1985; Johnson 1987), contained at least two occupation zones in different Clovis-age substrata. Flaked lithic
debitage (Ogallala Formation chert and quartzite) composed the lower zone, while the upper zone contained a flaked lithic biface, debitage (Edwards Formation, Tecovas, Alibates cherts, Ogallala Formation cherts, and quartzites), and caliche hearthstones. The biface (Edwards Formation chert) was snapped laterally (not a fresh break) and appears to be a basal segment that may have been hafted. This breakage pattern was consistent with projectile weapon breakage patterns derived from experimental research (Odell and Cowan 1988). The biface segment, however, lacked any evidence of fluting on either side and was much smaller than what is typical for Clovis blade technologies (Collins 1999). The extremely small size and angularity data indicated that the hearthstones were bits coming from the fracturing and fragmentation occurring on larger hearthstones. The dark gray coloration was characteristic of thermal alteration as a result of intense heating (Lintz 1989; Backhouse et al. 2005). While in stratigraphic context, the small size suggested post-depositional site formation processes most likely are responsible for the current location. The translocation (within-site displacement) of hearthstones over short distances can occur as a function of a number of site-formation processes (Backhouse et al. 2005; Petraglia 2002; Stevenson 1991), in this case, probable erosion and downslope displacement of hearth feature(s) originally located on the valley margins.

Stratum 2, representing early-Holocene deposits (Holliday 1985; Johnson 1987) contained at least four occupation zones within three substrata. The two zones in the lowermost deposits (substratum 2A; diatomite) were both composed of flaked lithic debitage primarily from Edwards Formation chert and Ogallala Formation quartzites. Lower 2A was undated, but dates above upper 2A indicated that the zones would date older than ~10,700 RCYBP, indicating Folsom age and in line with dates associated with 2A at Lubbock Lake and in the region (Holliday 1995; Johnson 1987). One occupation zone occurred in the substratum above 2A deposits (2p; peat), composed of flaked lithic debitage (Alibates chert and Ogallala Formation quartzite). It dated to ~10,700 RCYBP and indicated a third Folsom-age occupation. The uppermost deposits (2B; paludal muds) had one occupation zone composed of flake lithic debitage (Edwards Formation chert and Ogallala Formation cherts and quartzites) and hearthstone bits. Their medium light gray coloration is characteristic of thermal alteration through intense heating. Their occurrence indicated the presence of at least one hearth in the site area during 2B times. Associated dates ranged from ~9700 to ~9000 RCYBP, indicating a late-Paleoindian (Firstview) age for the zone.

Overall, the empirical technological characteristics recorded for the strata 1 and 2 flaked lithic assemblages are similar to each other. Tool sharpening and rejuvenation are the primarily activities. These tertiary reduction activities primarily are occurring with tools made from Edwards Formation chert and Ogallala Formation cherts and quartzites. The inferred presence of hearths is significant in that thermal technology is poorly understood at this time with few Paleoindian hearths known for the Southern High Plains (Backhouse 2010). Nevertheless, the hearthstone bits suggest that hot-rock technology is a component of Paleoindian indigenous fire technologies. Taken together,
these activities indicate repeated occupation with a series of Paleoindian campsites within the Paul site.

Research at the Paul site was funded by the Museum of Texas Tech University and the City of Lubbock, conducted under Texas Historical Commission Antiquities permit #2625. The Paul Site Collection is a state-associated collection housed at the Museum of Texas Tech University, held-in-trust for the people and State of Texas. This manuscript represents part of the ongoing Lubbock Lake Landmark regional research into grasslands hunter-gatherers and adaptation to ecological change on the Southern Plains.

References Cited


Excavation at the Jake Bluff site in northwest Oklahoma, USA, suggests Clovis mammoth hunters developed new techniques to procure bison as mammoths and other large game were extirpated from the North American plains.

The Clovis adaptation in North America is often portrayed as including the hunting and scavenging of mammoths and other large mammals (Haynes 2002) although a more generalist subsistence practice of broad spectrum foraging and hunting of smaller game is also included (Cannon and Meltzer 2004). This adaptation, including the production of the distinctive Clovis projectile point, stops within a century of the start of the Younger Dryas (YD) climatic episode ca. 12,900 CALBP (Waters and Stafford 2007) and with the extirpation of mammoths and other large mammals. The largest remaining animal is the bison, and cultural adaptation on the North American Plains during the YD includes the development of new hunting tactics targeting bison. Although the development of large-scale bison hunting tactics is often attributed to members of the post-Clovis Folsom culture (Frison 2004), new evidence shows that Clovis hunters developed a bison hunting technique that would dominate the Southern Plains archaeological record for 8000 years—the arroyo trap (Frison 1978, 2004).

The recent analysis of materials excavated from the Jake Bluff site, an arroyo along the North Canadian River in northwestern Oklahoma, reveals that Clovis hunters maneuvered at least 22 bison of a predominantly cow/calf herd into a natural dead-end trap (Bement and Carter 2010). Sheer sandstone sidewalls and a steep knick point or erosional head prevented the animals from escaping (Figure 1). Four Clovis-style projectile points were recovered from the arroyo floor amidst the bones of the butchered animals. Secondary butchering locations dominated by fore and hind legs were found on the sidewall benches, indicating select parts were removed from the carcasses and handed to persons outside the arroyo for continued processing.

Jake Bluff has been radiocarbon dated to the end of the Clovis period (Waters and Stafford 2007). Two additional bone dates bring the total number of assays to five (Bement and Carter 2010:918). Four of the five assays are statistically the same at 95% confidence level ($T = 6.866136$, $\chi^2(.05) = 7.81$, $\delta f = 3$; Reimer et al. 2004). Because the fifth date was outside the 95% confidence level, it was omitted from the average. An average of these four dates provides an age range of 12,825–12,850 CALBP with a midpoint at 12,838 CALBP. Jake Bluff postdates all Southern Plains mammoth kills and suggests
that Clovis hunters were developing new bison hunting techniques as mammoth numbers diminished in the area early in the Younger Dryas.

Other known Clovis bison kills include Blackwater Locality No. 1 in New Mexico, Aubrey in Texas, and at Murray Springs in Arizona (Ferring 2001; Haynes and Huckell 2007; Hester 1972). The reconstructed bison kills at these sites follow tactics similar to those employed at mammoth kills. The animals were ambushed at water holes (Huckell and Haynes 2007).

The hunters at Jake Bluff employed a different kind of landform, the gully. The development of the arroyo trap may have been facilitated by the opening of short gullies and arroyos at the onset of the YD (Holliday 1995). Coring along the North Canadian River floodplain margin identified numerous arroyos, including the one containing Jake Bluff and one with the oldest age of 13,000 CALYBP. A third arroyo contained the three Folsom-age bison kills at the Cooper site (Bement 1999). The extent that bison hunting permeated Folsom culture may be suggested by the presence of a painted bison skull below the bones of the second use of the arroyo. Such evidence of intensification and the importance of bison in all aspects of the culture are similarly manifest in other bison hunting cultures through time (Frison 2004).
Jake Bluff indicates Clovis people survived perturbations in faunal and floral resources at the start of the YD. Whether the changes were caused by acute factors (as suggested by proponents of the comet hypothesis [Firestone et al. 2007]) or by a progression of postglacial warming events, Clovis people adapted to the changing conditions around them. Among the adaptations was the development of the arroyo bison trap technique, a technique practiced by plains hunters for millennia.

References Cited


Ferring, C. R. 2001 *The Archaeology and Paleoenology of the Aubrey Clovis Site (41DN479) Denton County, Texas.* Center for Environmental Archaeology, Department of Geography, University of North Texas, Denton.


Central Alaska has a diverse late-Pleistocene and Holocene archaeological record. Lithic assemblages vary spatially and temporally, highlighted by the decision to use bifacial versus inset-microblade projectile technology (Goebel and Buvit 2011; West 1996b). Current explanations for this variability propose that technological choices were conditioned by seasonal variation in subsistence activities and technological organization on different landscapes (Potter 2008; Wygal 2009). The uplands of the central Alaska Range play an important role in assessing these hypotheses, as few prehistoric sites have been fully documented in this region (but see West 1996a; Wygal 2009).

Our research is focused on identifying hunter-gatherer adaptations to upland landscapes from the earliest colonization throughout the Holocene. In summer 2010 we conducted archaeological reconnaissance survey in the upper Susitna basin. We located four unrecorded surface lithic scatters and conducted test excavations at two of them; the most intriguing of these sites is Susitna Dune 1 (HEA-454).

Susitna Dune 1 is located in the upper Susitna basin at 63° 112′ 15.87423″ latitude, 147° 322′ 57.58083″ longitude, at 797 m above sea level. The site is located on a sand dune capped by aeolian sedimentary deposits (Figure 1), overlooking the upper Susitna basin to the north and east, approximately 1.2 km northeast of the Denali Highway. We excavated one 1-m² test unit and identified 3 cultural components. Components 2 and 3, located in the upper-most 25 cm of the profile, are undated (Figure 1). Component 1, buried 90 cm below the ground surface (Figure 1), contained four gray chert flakes and the articulated, but highly degraded, upper maxilla and teeth of a large Cervidae, probably wapiti (Cervus canadensis) or caribou (Rangifer tarandus). The small component-1 lithic assemblage indicates that secondary reduction and tool maintenance occurred at the site. We obtained an AMS ¹⁴C date of 9620 ± 50 RCYBP (BETA-284748) from dispersed charcoal in component I.

Susitna Dune 1 plays an important role in understanding the colonization of south-central Alaska and early-Holocene upland adaptations. Along with Jay Creek Ridge (9500 RCYBP) (Dixon 1993:86), Susitna Dune 1 provides the earliest evidence of prehistoric upland use in the Susitna basin, indicating that the uplands played an important role in hunter-gatherer adaptations early in the occupation of central Alaska. In summer 2011 we will conduct further testing at Susitna Dune 1 to gain a more representative lithic and faunal assemblage and to obtain ¹⁴C dates on all three cultural components.
Figure 1. HEA-454 test unit 1 south wall profile.

References Cited


Ravenscroft: A Paleo-Arroyo and Late-Paleoindian Bison Kill in an Unusual Hillslope-Shoulder Position, Oklahoma Panhandle

Brian J. Carter, Leland C. Bement, and Kent J. Buehler

Keywords: Paleo-arroyo, bison kill, soil-landscape

The ravages of soil erosion and deposition occurring over thousands of years create unique challenges for prospecting, finding, and revealing archaeological sites in Oklahoma. Many sites are deeply buried by alluvium, loess, or other unconsolidated debris and require significant excavation, sometimes removing up to several meters of soil and sediments (Bement and Buehler 1994; Bement and Carter 2010; Bement et al. 2007; Carter 1990; Carter and Bement 2003; Holmes 1973; Hurst et al. 2010; Retalick 1966). Deeply buried sites often occur in low-lying areas such as floodplains, stream terraces, footslopes, and toeslopes. Conversely, upland site preservation along summit, shoulder, or even backslope hillslope positions is poor. Upland sites are represented by scant surface scatters, extensive scatters on deflated surfaces, or small remnants of debris with dubious depositional environment and site context classifications.

The Ravenscroft arroyo bison kill site (Bement et al. 2008), however, occupies a hillslope-shoulder position similar to that documented at the Olsen-Chubbuck site in eastern Colorado (Wheat 1972). The gully deposits explored so far are over 1 m thick and extend laterally from 7 to 8 m. The Ravenscroft site is located in the High Plains Breaks along the left flank of a first-order tributary of Bull Creek in western Beaver County, Oklahoma (Figure 1). Two field seasons excavated a total area of 21 m². Sediments were excavated from the soil surface

![Figure 1. Soil-sediment profile (North 54, East 49 to 53 grid plane coordinates) through the middle of the Ravenscroft site, identifying three arroyo fill units (I, II, and III) and soil horizon designation for each unit (A, Bk, BCkb1, Btkb2, Bkb2, or Cb2).]
through the paleo-arroyo sediments. Three separate arroyo fills (Units I, II, and II) are identified from a soil profile (Figure 1) located between the two grid excavated areas. The partially butchered remains of an estimated ten bison occur on the paleo-arroyo floor of the upper most arroyo fill (Unit IIIIBk1; Figure 1). Along with the bison remains, artifacts from fabricating and sharpening knives were found in this ancient gully, but so far no projectile points. A radiocarbon assay on a bison petrous places the kill event at 9090 ± 30 RCYBP (UCIAMS 78134). Portions of the upper paleo-arroyo deposits are gone, having been truncated by hillslope erosion. A native warm-season short- and mid-grass prairie now stabilizes the ground surface and protects the paleo-arroyo deposits from rapid erosion. During this recent stabilization period, soil that contains a mollie A horizon and calcic Bk horizon has formed into the upper part of the surface-exposed paleo-arroyo sediments (IIIA; Figure 1).

The particle-size content of the fill material ranges from a coarse sandy loam to a sandy clay loam. The arroyo-fill modal particle size is a sandy loam and fines upward for each unit. A prominent buried soil, the Btkb2 horizon, is formed into the top of Unit I (IBtkb2) and identifies a stable period during arroyo development and prior to the bison kill. The modal yellowish red (5YR4/6) and strong brown (7.5YR5/6) colors of the lower fills (Units I and II, respectively) indicate that these fill materials are eroded from adjacent Permian and Quaternary sediments. These lower “colorful” units strongly contrast with the dark brown color of the Unit III fill. Material source for this upper arroyo fill originated from the erosion of the surface soil A horizon marking the final stages in this paleo-arroyo development. The paleo-arroyo development at Ravenscroft site must have progressed from an initial incision into the hillslope of predominately Permian and Quaternary sediments, and ended with a series of headcuts tapping surface soil A horizons and calcium carbonate-rich sediments. This eroded A horizon material now makes up the bulk of Unit I and provides a foundation for the dark brown coloration. Subsequent to paleo-arroyo development several meters of stream incision have left the Ravenscroft site “high and dry.” Current base level for modern gullies occurs 4 to 6 m below the estimated base level that once existed for the paleo-arroyo that is the Ravenscroft site. Initial continuous push-tube cores to 1 to 2 m depth are credited with revealing the extent and geoarchaeological relevance of the site. Undisturbed continuous shallow cores are recommended for the initial exploration of upland archaeological sites.

The hill-slope shoulder position of the Ravenscroft arroyo and the bison kill it contains illustrates the difficulty predicting the location of paleo-arroyos on the High Plains. The inverted topography where once low arroyos are now buried within shallow upland hillslope deposits high in the drainage also reminds us of the extent of landscape change over the last 9,000 years.

References Cited


Recent Excavations at Teklanika West: A Late-Pleistocene Multicomponent Site in Denali National Park and Preserve, Central Alaska

Sam Coffman and Ben A. Potter

Keywords: Younger Dryas, bison, uplands

Recent excavations at Teklanika West have yielded new data on site chronology and human occupation history. The site is located on a loess-mantled granitic bedrock bluff overlooking the glacial-fed Teklanika River, and lies within the Denali National Park and Preserve. Early investigations were largely surface collections (Morgan 1965; Treganza 1964; West 1965); these data were integral in defining the influential Denali Complex (West 1967, 1975, 1996). West interpreted the site to contain an undated single large Denali occupation, characterized by a microblade-rich assemblage with no associated fauna. A brief reinvestigation by Goebel (1992, 1996) yielded artifacts within a profile and stratigraphically associated radiocarbon dates indicating multiple occupa-
Tentative component delineations are based on bone-collagen dating of taxa associated with lithics, stratigraphic association, vertical profile backplots, and material type distributions. The lowest two components (C1 and C2) appear spatially separated, below the paleosol. Component 1 is associated with a *Bison* sp. date of 10,920 ± 50 RCYBP and contains two broken bifacial preforms and a sidescraper. This component thus dates to the initial Younger Dryas period (Mangerud et al. 1974; Meltzer and Holliday 2010), a period with very few components in eastern Beringia, perhaps during the transition between Nenana and Denali complexes.

Component 2 is associated with a *Bison* sp. date of 8820 ± 40 RCYBP and contains three strongly convex lanceolate projectile point bases, two end scrapers, two broken bifacial preforms, and a few microblades. Component 3 is associated with the paleosol, dating to 6770 ± 50 RCYBP, and contains two bipointed lanceolate projectile points, microblades, three boulder spall scrapers, and highly fragmented faunal remains. Two other later-Holocene components contain caribou and dall sheep remains.

These data demonstrate the presence of multiple components, including one dating to the late Pleistocene. The relative lack of a microblade industry at the site might relate to the small sample size at present, but the presence of
microblades in small samples in components 2, 3, and 4 are consistent with regional continuity of this technology (Potter 2008). No Nenana Complex diagnostic materials were found in any of the components (Goebel et al. 1991). Bison were brought to the site during and after the Younger Dryas, and coupled with the bison found at the intermediate Dry Creek Component 2 (~10,000 RCYBP) (Powers et al. 1983), this suggests that bison were a reliable resource in the northern foothills of the Alaska Range during and after the Younger Dryas. This exploitation strategy differs significantly from the later Holocene components, associated with modern upland ungulates (sheep and caribou).

Current interpretations of two distinct cultural traditions (Nenana and Denali complexes) separated by the Younger Dryas are more difficult to sustain given older microblade technology at Swan Point (Holmes 2001) and younger Chindadn points in Cultural Zone 3 at Swan Point (Holmes 2008). It is unclear at present how Teklanika West data fit into the broader cultural chronology of the region, but early interpretations of a single microblade-rich Denali Complex occupation at the site are shown to be incorrect. Analyses are ongoing at Teklanika West, but the initial data help elucidate lifeways of early populations in upland regions of central Alaska.

Funding for this project came from Denali National Park and Preserve and University of Alaska Fairbanks. Additional financial support was provided by the Otto Geist Fund of the University of Alaska Museum of the North and by the Murie Science and Learning Center Discover Denali Fellowship program. We thank Jeremy Karchut (Chugach National Forest) and Amy Craver and Lucy Tyrrell (Denali National Park) for their support and assistance of this project, and especially the volunteers who helped excavate the site.

References Cited


Holmes, C. E. 2001 Tanana River Valley Archaeology Circa 14,000 to 9000 B.P. Arctic Anthropology 38(2):154–70.


Evidence for Changing Toolstone Source Use and Range Mobility during the Paleoindian Occupation of the Great Lakes/Northeast

Christopher Ellis

Keywords: Mobility, colonization, toolstones

Information on 80 Northeast–Great Lakes Paleoindian sites with concave-based points was compiled to more rigorously test the oft-suggested idea that range mobility declined through time (Burke 2006:84; Ellis and Deller 1997:12). This decline could be due to range reduction after an initial colonizing movement as the landscape filled up with people. The main raw material source employed was used as the measure of range mobility, assuming that material had to be directly procured (see Meltzer 1988). The sample was subdivided into two temporal groupings. One consisted of larger, more parallel-sided “Clovis-like” points. These all date to > 10,500 RCYBP based on the dates from sites like Debert (MacDonald 1968) and Shawnee-Minisink (Waters and Stafford 2007) and represent the earliest evidence of significant human occupation. Other forms are assigned to later occupations. They include fluted-point types such as Barnes, Crowfield, and Michaud-Neponset (Deller and Ellis 1988; Spiess et al. 1998). They also include clearly related early unfluted forms such as Holcombe or Nicholas points. These later styles seem to date from about 10,500–10,000 RCYBP (Spiess et al. 1998).

The distances from source to site more often exceed 200 km earlier in time ($\chi^2 = 12.643; \delta f = 1; p = .000$; Figure 1). Earlier sites also occur significantly farther on average from sources than do later ones (179 versus 128 km; $t$ [for unequal variances] = 2.114; $\delta f = 75.727; p = .038$). The directions from site to
source are predominantly north-south ($\chi^2 = 4.629, \delta f = 1, p = .031$) indicating the distances involved represent range mobility and probably seasonal movements rather than long-distance trips to procure raw materials that we would expect to be directionally variable. The contrast between samples from the Clovis-like sites and those from later-style sites suggests distinctly different ways of life. Given that the two are distributed widely over the same geographic areas, this information is consistent with the idea they are temporally different (Loebel 2005).

There are also suggestions of other temporal contrasts, such as how sites cluster by distance. There are significantly more earlier sites in the 0- to 50-km distance group associated with or close to stone sources ($\chi^2 = 5.556, \delta f = 1, p = .018$), reinforcing suggestions that these locations played a special role amongst those occupations (Anderson 1990:185-196). Often these sites are “quarry-related base camps” (Gardner 1977:258), that are right at the sources (e.g., Welling [Prufer and Wright 1970]; West Athens Hill [Funk 2004]). Amongst concave-based styles I do not know of later sites with substantial evidence

Figure 1. Comparison of Distance to Main Toolstone Source Between Sites with Clovis-like and later styles. The major material in the samples used here consists of at least 25% of an assemblage, and in all but four cases it includes at least 40% of the assemblage with many exceeding 80%. Since diagnostics at some sites indicate they were used in both periods, observations exceed $n = 80$ in some analyses. Note the stronger association of Clovis-like sites with stone source areas. The seemingly greater association of sites 150–200 km with later styles is not significant, but it is a product of sampling error and actually overemphasizes the average distance from toolstone source for those later styles (Ellis 2008).
of occupation sites at outcrops. However, the causes of such an association remain obscure.

References Cited


CA-SRI-26: A Terminal-Pleistocene Site on Santa Rosa Island, California

Jon M. Erlandson, Torben C. Rick, and Nicholas P. Jew

➤ Keywords Channel Islands, Paleocoastal period, maritime adaptations

Located east of the mouth of Arlington Canyon, CA-SRI-26 was identified by Orr (1951:223, 1968) as potentially the oldest of several “Pleistocene” shell middens he described on the northwest coast of Santa Rosa Island. Erlandson (1994) relocated these sites in the early 1990s, collecting 14C samples and showing that all contained early-Holocene components dated between ~9300 and 7800 CALYBP. The youngest of these was a patchy red abalone midden at CA-SRI-26 buried in a paleosol ~1–1.5 m below the surface (Erlandson 1994:191). In deeply incised gullies nearby, multiple paleosols were visible deeper in late-Pleistocene alluvium of the Upper Tecolote Formation, but no archaeological materials were found in these older soils at the time.

In July 2010, Erlandson carefully reexamined these gullies at CA-SRI-26 and found a low-density deposit of chipped-stone artifacts, animal bones, and occasional marine shells eroding from a ~40- to 50-cm-thick paleosol situated ~2–2.5 m below the surface and about 1 m below the early-Holocene red abalone midden. This Paleocoastal component has produced a small assemblage of artifacts and faunal remains from stratified contexts, including a California mussel (Mytilus californianus) shell fragment AMS dated to 10,545 ± 30 RCYBP (UCI-80937), with a calibrated age range of 11,340–11,220 CALYBP. The contents and stratigraphy of this component are very similar to a terminal-Pleistocene site (CA-SRI-512) located <1 km to the northeast (Erlandson et al. 2011), supporting the veracity of this 14C date. So far, our investigation of the Paleocoastal component at CA-SRI-26 has been limited to a single small test pit, but the preliminary results are significant and are summarized here.

CA-SRI-26 is located on the high bluffs several hundred meters northeast of CA-SRI-173, where the deeply buried bones of the ~13,000-year-old Arlington Man were found in 1959 (Johnson et al. 2002; Orr 1962; Rick et al. 2005), and a rocky sill in the canyon bottom brings freshwater to the surface year-round. Today the coastline is located ~100 m north of CA-SRI-26, but 11,500 CALYBP sea levels along the southern California Coast were ~50 m below present (Masters and Aiello 2007) and the site may have been as much as 5–7 km from the outer coast. Rising postglacial seas may have formed an embayment at the mouth of Arlington Canyon, however, backed by a broad, marshy canyon bottom (Erlandson et al. 2011).

Jon M. Erlandson and Nicholas P. Jew, Museum of Natural and Cultural History, University of Oregon, Eugene, OR 97403-1224; Department of Anthropology, University of Oregon, Eugene, OR 97403-1218; e-mails: jerland@uoregon.edu njew@uoregon.edu

Torben C. Rick, Archaeobiology Program, Department of Anthropology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20013-7012; e-mail: RickT@si.edu
A small test pit excavated (with 4 10-cm levels of 20 liters each; total volume = 80 liters) in the intact site remnants produced >100 chipped-stone artifacts and almost 200 bone fragments from birds (n = 106), fish (n = 54), sea mammal (n = 6), rodent (n = 15), and undifferentiated vertebrates (n = 9). Most of the bones are heavily fragmented and not further identifiable, but at least one bird bone was identified as goose (c.f., Branta spp.). Also recovered were several fragments of California mussel shell.

The artifacts from CA-SRI-26 provide another window into maritime Paleoindian technologies on the Northern Channel Islands. Neither Arlington Springs (CA-SRI-173) nor a terminal Pleistocene component at Daisy Cave (CA-SMI-261) produced diagnostic artifacts, but recent work at Cardwell Bluffs (CA-SMI-678, 679) and CA-SRI-512 has shown that Paleocoastal island peoples were armed with stemmed points and chipped-stone crescents similar to those of the Western Pluvial Lakes Tradition (WPLT; Beck and Jones 2010; Erlandson et al. 2011). Although smaller, the CA-SRI-26 assemblage is similar to those from Cardwell Bluffs and CA-SRI-512. Several fragments or preforms of Channel Island Barbed (CIB) points (see Justice 2002) were found at the site, along with a complete stemmed and serrated Amol point found on an eroded surface. Also recovered were two chipped-stone crescent fragments—one in situ and another eroded from the gully wall.

Our preliminary investigations suggest that Paleocoastal peoples camped at CA-SRI-26 ~11,300 CALBP. They chose a high bluff adjacent to the largest drainage on the island, a place where freshwater was readily available along with a commanding view of the coastal lowlands and near-shore waters along the northern shore of Santarosae. While occupying the site, they hunted birds and sea mammals, fished in coastal waters, and collected shellfish from rocky shore habitats. These early seafaring peoples were armed with finely made stemmed points and crescents similar to those found in WPLT sites scattered across America’s Far West. Although CA-SRI-26 was located some distance from the coast, its Paleocoastal occupants clearly had a maritime economy and hunting technology. Future excavations should shed more light on the contents of the site and the lives of its occupants.

Our research was supported by a National Science Foundation grant (BCS 0917677) to Erlandson and Rick, Channel Islands National Park (CINP), and our home institutions. At CINP we are grateful to Mark Senning for logistical support. We also thank an anonymous reviewer, Ted Goebel, and the editorial staff for assistance in the review and publication of this paper.

References Cited


On 15 January 2010, U.S. Army Corps of Engineers (Corps), Albuquerque District, archaeologists John D. Schelberg, Lance Lundquist, and Gregory D. Everhart were conducting a pedestrian survey at Cochiti Lake, Sandoval County, New Mexico (Figure 1). During the survey, Everhart discovered the base of a Clovis projectile point. The Corps’ Cochiti Lake dam and reservoir is located on the Rio Grande west of Santa Fe in north-central New Mexico. Cochiti Lake is located within the Pueblo de Cochiti Reservation on lands leased by the Pueblo to the Corps. Bruce B. Huckell visited the site 27 January 2010 to examine its geological context.

The site is positioned on the east side of the Rio Grande channel atop a terrace developed on an alluvial deposit of middle-early Pleistocene age (Qta1 of Dethier and Sawyer 2007) near the mouth of White Rock Canyon, and west of the 120-m-high La Bajada (basalt) escarpment. The site is 1,688 m in elevation; the nearby Rio Grande channel is 1,609 m a.s.l. The point fragment was found near the top of the sloping edge of a road borrow ditch that was excavated in the 1970s, which may have exposed the point. A small trench dug along the ditch revealed that this high terrace has a >50-cm-thick strongly developed soil profile consisting of an A/B horizon overlying two clay-rich Bt

Gregory D. Everhart, Environmental Resources Section, U.S. Army Corps of Engineers, Albuquerque District, 4101 Jefferson Plaza, NE, Albuquerque, NM 87109; e-mail: gregory.d.everhart@usace.army.mil

Bruce B. Huckell, Maxwell Museum of Anthropology and Department of Anthropology, University of New Mexico, Albuquerque, NM 87131; e-mail: bhuckell@unm.edu
horizons. Below the lower Bt is a K horizon with Stage III calcium-carbonate morphology. The strength of soil profile development, consistent with at least a mid-Pleistocene age, suggests that this surface was stable long before Clovis occupation. Today this upland terrace is a Plains–Mesa Grassland with dispersed junipers (Dick-Peddie 1993:104–06).

The point is a relatively large basal fragment, broken by a transverse snap fracture that originated from a small cavity in the material (Figure 1A). It exhibits large single flutes on both faces that cut one or more previously detached basal thinning flake scars; the base is slightly concave, and both it and the lateral margins are well ground (Figure 1B and 1C). The point is made of a fine-grained, white orthoquartzite. While the specific source for this material is unknown, it may be derived from the Morrison formation (LeTourneau 2000:446–47). Occasional Clovis and Folsom artifacts from other central New Mexico sites are made from this same quartzite. Maximum length of the fragment is 19.0 mm, and the shorter side is 17.7 mm. Maximum width at the fracture is 31.6 mm; width at the base is 28.1 mm. Maximum thickness is 7.1 mm, and the basal concavity is 1.9 mm deep. The point fragment was reutilized subsequent to the break as evidenced by a well-rounded edge prominent on the transverse fracture nearest the side with the small cavity. The wear suggests that the vertically broken edge was used with a transverse (scraping or planing) motion. A point basal fragment from the Murray Springs, Arizona, Clovis site shows exactly the same pattern of reuse (Huckell 2007:199–200; Fig. 8.7c).

The point base was found at the northern margin of an extensive artifact scatter of primarily Archaic lithic tools and debitage, all of locally available fine-grained dacite. The Archaic scatter is densest approximately 150 m south of the Clovis point base. Artifacts on the surface within 50 m of the point base, however, include three red chert flakes and a chalcedony flake that suggest the possibility of a separate, possibly Clovis, component to the site. This will have to be assessed by future research. This is the first positively identified Clovis point found in Sandoval County (T. Fallis, pers.comm. Archaeological
Thank you to the U.S. Army Corps of Engineers, Albuquerque District, archaeologists John Schelberg, Jonathan Van Hoose, and Ariane Pinson. Gary Smith, Department of Earth and Planetary Sciences, University of New Mexico, directed us to relevant geological literature.

References Cited


Comparing Great Basin Paleoindian Raw Material Procurement Strategies: X-ray Fluorescence Data from Obsidian Fluted and Stemmed Points from Mud Lake and Lake Tonopah, Nevada

Lindsay A. Fenner, Geoffrey M. Smith, Samuel Coffman, and Gary D. Noyes

Keywords: Source Provenance Analysis, Paleoindians, Great Basin

The relationship between fluted and stemmed projectile points in the Great Basin remains poorly understood. For example, we do not know if fluted points...
We used the criteria outlined by Warren and Phagan (1988) to distinguish fluted points from basally thinned, unfluted concave base points and only included the former in this study. Furthermore, if the two point styles do indeed represent different time periods, owing to a paucity of comparative studies our understanding of if and how fluted- and stemmed-point users’ lifeways differed remains limited. Additional comparisons between fluted and stemmed point assemblages are needed to help resolve these issues.

Toward that goal, we compared existing (Coffman 2008; Haarklau et al. 2005) and previously unpublished results of X-ray fluorescence (XRF) analyses of 19 fluted points\(^1\) and 86 stemmed points collected from sites around Mud Lake and Lake Tonopah, Nevada.\(^2\) Following Eerkens et al. (2007), we compared obsidian source diversity using a statistical technique known as bootstrapping to avoid potential issues related to sample size. If source diversity differs significantly between the two samples, then it may provide evidence that fluted and stemmed points were used by different groups possessing different toolstone procurement strategies, perhaps at different times. Alternatively, if source diversity does not differ significantly, then it may indicate that the two point types simply represented different components of the same toolkit or that they were used by groups possessing similar toolstone procurement strategies.

Summarized in Table 1 are the unpublished and previously published XRF results. A wide variety of geochemical types from California and Nevada are represented in both samples with a possible difference in distribution evenness present (e.g., Crow Spring fluted frequency); however, when adjusted for sample size, source diversity does not differ significantly between them ($p = .267$, two-tailed).

Although our samples are admittedly small and comprise a single raw material type, these results suggest that the individuals that produced the distinctive fluted and stemmed point technologies used the same obsidian sources—a finding that is at odds with Fagan’s (1996) results of a comparative study of fluted and stemmed points from the Dietz site in Oregon in which he found notable differences in obsidian use between the two point types.

We would like to thank the Great Basin Paleoindian Research Unit, University of Nevada, Reno and the Northwest Research Obsidian Studies Laboratory for supporting the XRF analysis of additional Paleoindian points from Mud Lake. Special thanks are due to Gary Noyes for bringing the rich cultural resources of Mud Lake to the attention of the archaeological community and sharing his extensive knowledge of the Tonopah area.

References Cited


---

\(^1\) We used the criteria outlined by Warren and Phagan (1988) to distinguish fluted points from basally thinned, unfluted concave base points and only included the former in this study.

\(^2\) Many of the points from Mud Lake and Lake Tonopah were collected by Gary Noyes under the auspices of the Nevada State Museum. Those artifacts have well-documented proveniences and were mapped prior to collection using the compass-and-distance method from a central site datum that was standard practice in archaeological fieldwork prior to the emergence of GPS technology.
Table 1. Summary of the geochemical types of obsidian represented in fluted and stemmed point samples from sites near Mud Lake and Lake Tonopah, Nevada.

<table>
<thead>
<tr>
<th>Geochemical types</th>
<th>New data</th>
<th>Previous data*</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stemed</td>
<td>Fluted</td>
<td>Stemed</td>
</tr>
<tr>
<td>Bodie Hills, CA</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Casa Diablo (Lookout Mountain), CA</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Casa Diablo (Sawmill Ridge), CA</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Coso, (West Sugarloaf), CA</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Coso (Sugarloaf Mountain), CA</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Crow Spring, NV</td>
<td>2</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Garfield Hills, NV</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Goldfield Hills, NV</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Mono Glass Mountain, CA</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Montezuma Range, NV</td>
<td>7</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Mount Hicks, NV</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Mount Majuba, NV</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Obsidian Butte, Variety 2, NV</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Obsidian Butte, Variety 3, NV</td>
<td>3</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Obsidian Butte, Variety 4, NV</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Obsidian Butte, Variety 5, NV</td>
<td>4</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Queen, CA</td>
<td>7</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Saline Ridge, CA</td>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Silver Peak, NV</td>
<td>1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Tempiute Mountain, NV</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>35</td>
<td>51</td>
<td>18</td>
</tr>
<tr>
<td><strong>Geochemical type diversity</strong></td>
<td>9.5</td>
<td>8.02</td>
<td></td>
</tr>
</tbody>
</table>

*Previously published results were compiled from Coffman (2008) and Haarklu et al. (2005).


Pleistocene Archaeology of the Tanana Flats, Eastern Beringia

Edmund P. Gaines, Kate S. Yeske, Scott J. Shirar, William C. Johnson, and James F. Kunesh

Keywords: Archaeology, Beringia, colonization

The Tanana Flats (Figure 1), central Alaska, marks a geographic crossroads and natural corridor between Pleistocene archaeological sites in the Nenana and Tanana valleys (Goebel and Bigelow 1996; Goebel et al. 1996; Hoffecker et al. 1996; Holmes 1996, 2006; Pearson 1999; Powers and Hoffecker 1989; Potter 2009; Potter et al. 2008, 2010). Through a combination of AMS 14C dating and inter-site stratigraphic correlations, 10 sites recently identified in the flats have been dated to the terminal Pleistocene (Gaines et al. 2010; 2011). Ongoing investigations underscore the importance of this region in understanding the early peopling of eastern Beringia and the New World.

Six sites are situated on an alluvial terrace (Péwé et al. 1966) that exhibits a general stratigraphic sequence of basal gravels, overlain by up to 4 m of Pleistocene aeolian sand, which is capped by 1–1.5 m of loess. Testing at FAI-02043 identified at least two components, the earliest of which occurs in the upper portion of the sands at 95–110 cm below the surface (bs). The recovered assemblage consists of lithics and fauna including hare (Lepus sp.), goose (Subfamily Anserinae) and bison (Bison sp.) associated with a charcoal age of 11,600 ± 50 RCYBP (Beta-283430). The later component consists of lithic debitage in the lowest portions of the loess at 80–90 cm bs and produced a charcoal date of 10,730 ± 50 RCYBP (Beta-281235). FAI-02019 yielded flakestone from the basal portion of the loess at 60–70 cm bs with a charcoal date of 11,050 ± 70 RCYBP (Beta-277776). FAI-02077 produced debitage, microblades, and a biface from the lower loess near the sand contact at 35 cm bs with a charcoal date of 10,130 ± 50 RCYBP (Beta-283435).
Other sites on the landform—FAI-02050, FAI-02051, and FAI-02066—remain undated; however, artifacts deeply buried in the lower sands suggest terminal Pleistocene ages.

Four sites—FAI-02009, FAI-02020, FAI-02024, and FAI-02032—occur in a vegetated dune field east of the Wood River (Péwé et al. 1966). Dune stratigraphy consists of 7+ m of Pleistocene sand capped by 1–2 m of Holocene loess. These sites contain buried artifacts at or below the sand/loess contact at depths of 70–130 cm bs. Comparisons with nearby well-dated dune and aeolian sand sequences in the Tanana Valley (Potter et al. 2008; 2010) provide reasonable terminal-Pleistocene/early-Holocene age estimates. Pending luminescence (OSL & IRSL) age analyses are expected to support these approximations.

Early sites in the Nenana and Tanana valleys have been used as the basis for hypotheses concerning the early habitation of eastern Beringia and colonizing of the New World (Goebel et al. 1991; Hamilton and Goebel 1999; Potter 2009; Yesner 2001). Research presented herein is the result of reconnaissance survey and limited testing. Further investigations in the Tanana Flats will undoubtedly provide a crucial link between the two river valleys and produce important new information regarding the Pleistocene occupation of Beringia and the New World.

This research was made possible only by the determined efforts of the 2009 and 2010 field crew members, who braved difficult conditions and remained ever diligent in their search for elusive early archaeological remains. Funding was provided by Army Environmental Command (AECOM) as part of Section 106 compliance surveys.
References Cited


Great Basin Stemmed Series Surface Assemblages at Pluvial Mud Lake, Nevada

Barbi Malinky Harmon

Keywords: Paleoindian, Great Basin

In 2007, Kautz Environmental Consultants, Inc., conducted an archaeological inventory on the floor of Ralston Valley in central Nevada in support of a proposed solar development. During the inventory, five sites containing Great Basin Stemmed Series flaked stone tool assemblages were encountered and documented, representing occupations of Ralston Valley dating to the latest Pleistocene or early Holocene (Beck and Jones 1997). Each of these assemblages contains between one and five Stemmed Series point fragments in association with other implements such as bifaces, modified flakes, scrapers and small scatters of debitage. Toolstone in the assemblages is dominated by obsidian and basalt, and the Stemmed Series points are identified as unshouldered base fragments. Four of the five assemblages are single component, containing only Stemmed Series point fragments, while one site also contained a Middle Archaic Elko Series projectile point. In addition to the five assemblages identified, two isolated artifacts were also documented, including one Parman-like base fragment and one concave sidescraper nearly identical to those identified at the Sadmat Locality in western Nevada (Graf 2001:76, Fig. 4.22; Warren and Ranere 1968:10, Fig. 2).

The surveyed block straddles several ancient lake shorelines associated with extinct pluvial Mud Lake, and the assemblages were identified in direct association with these shorelines (Figure 1). These ancient lake features were identified by Nellis Air Force Base as part of a series of studies of Ralston Valley. While their elevations are documented, these beach strands have not yet been dated. Mud Lake had a maximum surface area of 427 km² and a maximum depth of 26 m (Mifflin and Wheat 1979). The lake was likely a semipermanent pluvial lake containing no fishes (Hubbs and Miller 1948:49), and is assigned an age equivalent to that of Lake Lahontan. The assemblage discussed here is merely the latest in a series of both stemmed and fluted point assemblages identified from Mud Lake, the most famous of which is the Noyes Collection (Coffman and Noyes 2008).

All the documented isolated artifacts and sites containing Stemmed Series points cluster within a tight range of elevations at the northernmost margin of the lake. All are situated between 1,604.5 m and 1,607.3 m, constituting a range in elevation of only 2.8 m. These locations fall directly between the identified highstand of Mud Lake at 1,609 m, and the next-lowest identified ancient beach strand at 1,603 m. Occupations at all these sites are undoubtedly directly related to the existence of pluvial Mud Lake. These sites may date

Barbi Malinky Harmon, Principal Investigator, Kautz Environmental Consultants, Inc., 1140 Financial Blvd, Suite 100, Reno, NV 89502; email: malinky@kecnv.com
to the period immediately following the recession from the highstand of the lake, or may be associated with a later temporary refilling of the basin in Ralston Valley. Absolute dating of the identified shorelines is necessary to fully understand not only the history of Mud Lake, but also how it is related to the prehistory of Ralston Valley. Future investigations may also focus on obsidian source and hydration rim data to further aid in understanding the timing and nature of the prehistoric occupations around Mud Lake.

References Cited


Coffman, S., and G. Noyes 2008 Morphometric Variation in Great Basin Fluted and Unfluted...
Concave-Based Projectile Points from Pleistocene Lake Tonopah and Mud Lake, Nevada. *Current Research in the Pleistocene* 25:68–70.


**Clovis Activity in the Central Plains Uplands**

*Jack L. Hofman and Brendon P. Asher*

➤ **Keywords:** Clovis settlement, site documentation, upland Plains

Many Clovis artifacts from Kansas and Nebraska have been recovered from active stream deposits (Hofman and Hesse 2002; Holen 2001), but two Clovis sites in northern Kansas provide important exceptions. Diskau (Schmits 1987) is located between the Big Blue and Republican rivers, and Eckles (Holen 2001, 2010) is 130 km northwest of Diskau on a high terrace of White Rock Creek, tributary to the Republican River. Four additional Clovis sites are here documented in upland settings between the Big Blue and Republican rivers, providing further evidence of Clovis activity in the Central Plains uplands.

The Larson site (14RP11) yielded a Clovis point found with two broken bifaces during terracing of a central Republic County field. The site is on the southeast slope of a prominent divide and a short distance from a marsh or spring. The bifaces were subsequently lost, but the Clovis point (Hofman and Hesse 2002: Figure 1e) is nearly complete with probable impact damage on the tip and one blade edge. The material is translucent chalcedony, probably a White River Group silicate (WRGS), though not necessarily from the northeast Colorado Flattop Butte source. Much of the Clovis assemblage from Eckles (Hoard et al. 1992, 1993; Holen 2001, 2010) is WRGS and this material is also present in the Diskau Clovis assemblage (Schmits 1987).

The Bredthauer site (14RP327) is a multicomponent upland site in central Republic County a few kilometers south of Larson and in a similar terrace...
setting near a spring. Key artifacts from this location include three Clovis points, one complete with a reworked tip and blade and two large basal fragments. Also from this site are blades and unifacial tools of probable Paleoindian origin. The points are manufactured from Smoky Hill Jasper (SHJ), which is well represented in the Diskau collection (Schmit 1987). A large unifacially retouched flake, two blades, and endscraper all of SHJ may reflect Clovis activity at this site.

The Graham site (14RP10), located in northeastern Republic County, is on a north sloping ridge toe near a spring on a tributary of the Little Blue and has evidence for multiple Paleoindian occupations. A Folsom point base made from SHJ and a reworked Clovis point of gray Permian chert are recorded from this site. This Clovis point has a reworked tip and is heavily patinated. The Fisher-Filipi site (14RP8) is on Mill Creek where an impact-damaged Clovis point of SHJ was found eroding from a basal clay stratum.

Collectively, these finds provide supportive evidence for fairly intensive use

Figure 1. Clovis sites and selected points from Republic County, Kansas and vicinity including Eckles (14JW4) and Diskau (14RY303). A, B, Clovis points from the Bredthauer site (14RP327).
of upland settings by Clovis people in this portion of the Central Plains. The abundance of seeps, springs, and marshes along upland tributaries in the area probably attracted animals and Clovis people to this region.

For their help in various ways we thank Robert Hoard, Virginia Wulfkuhle, Steve Holen, Al Johnson, Mike Fosha, Richard Gould, Mary Adair, Edward Larson, William Graham, Annette Bredthauer, Todd Filipi, Frank Fisher, Larry and Pat Walter, and Deb Aaron.

References Cited


Folsom Obsidian Procurement and Use at the Boca Negra Wash Site, New Mexico

Bruce B. Huckell, M. Steven Shackley, Matthew J. O’Brien, and Christopher W. Merriman

Keywords: Folsom, obsidian sourcing, technological organization

Since its discovery in 1997, the Boca Negra Wash Folsom site has been the subject of four seasons of investigation. It is one of three excavated Folsom sites in the Middle Rio Grande Basin, and has produced a large assemblage of artifacts, a significant proportion of which is made of obsidian. The site consists of two loci, A and B, adjacent to a playa (Holliday et al. 2006: Figure 3; Huckell and Kilby 2000; Huckell et al. 2002, 2003); 95 1-m² units were
excavated at Locus A and 104 at Locus B. Locus A produced 480 artifacts, 70 of which were obsidian, and Locus B yielded 1335 artifacts, 421 of them obsidian. This material composes 16.9% of the debitage at Locus A and 33% at Locus B. Obsidian accounts for 18.8% of tools at Locus A and 34.3% at Locus B. Folsom use of obsidian in the Middle Rio Grande Valley has been long appreciated (Amick 1994; Judge 1973; LeTourneau 2000; LeTourneau et al. 1996). LeTourneau and Baker 2002 (Table 3.3) reported that obsidian composed 15.9% of their sample of 822 Folsom points, preforms, and channel flakes from the Basin and Range Province of New Mexico. The obsidian was from two general source areas: the Jemez Mountains, which contain at least four geochemically distinct sources (Cerro Toledo, El Rechuelos, Valle Grande, and Bear Springs Peak), and two Mount Taylor volcanic field sources, Grants Ridge and Horace Mesa (also see Shackley 2005).

Sixteen artifacts from Boca Negra Wash have been characterized by X-ray fluorescence at the Berkeley Geoarchaeological XRF Laboratory (Table 1), the largest sample yet analyzed from a single Folsom site. All are from the Jemez Mountains, with 15 of the 16 (93.8%) assigned to the Valles Rhyolite (VGM, Valle Grande member) and one to the Cerro Toledo Rhyolite (CTR) (Shackley 2005: 64-74). LeTourneau (2000:96–100) reported XRF results on 33 Folsom artifacts from 19 Southwestern/Southern Plains sites showing that VGM obsidian was dominant (26 of 33, or 78.8%); CTR was a minor contributor (3 of 33, or 9.1%).

Table 1. Boca Negra Wash Folsom site obsidian artifacts characterized by XRF.

<table>
<thead>
<tr>
<th>Artifact number</th>
<th>Artifact type</th>
<th>Locus</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Biface frag</td>
<td>A</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>28</td>
<td>Flake frag</td>
<td>A</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>32</td>
<td>Flake frag</td>
<td>A</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>56</td>
<td>Flake</td>
<td>A</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>130</td>
<td>Folsom preform base</td>
<td>B</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>316</td>
<td>Folsom point midsection</td>
<td>A</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>433</td>
<td>Folsom preform base</td>
<td>B</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>522</td>
<td>Channel flake</td>
<td>B</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>909</td>
<td>Flake tool frag</td>
<td>B</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>1490</td>
<td>Biface frag</td>
<td>B</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>1582</td>
<td>Channel flake</td>
<td>B</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>1753</td>
<td>Folsom point base</td>
<td>B</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>2000</td>
<td>Folsom point basal corner</td>
<td>B</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>2021</td>
<td>Folsom point tip</td>
<td>B</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>2059</td>
<td>Pseudo-fluted point frag</td>
<td>B</td>
<td>Valles Rhyolite</td>
</tr>
<tr>
<td>2284</td>
<td>Folsom point basal corner</td>
<td>B</td>
<td>Cerro Toledo</td>
</tr>
</tbody>
</table>

The predominance of VGM obsidian at Boca Negra Wash is significant because it is uniquely derived from Cerro del Medio, a resurgent dome complex within the Valles Caldera approximately 75 km north of the site. Obsidian from this source has not been transported fluvially outside the Jemez caldera to any significant extent or in pieces larger than approximately 40 mm (LeTourneau and Shackley 2009; Shackley 2005, 2010). Thus, to obtain pieces of suitable size for the manufacture of projectile points, bifaces, or other tools,
Knappers had to travel to the caldera, where pieces up to 30–40 cm in maximum dimension and of high knapping quality are available (LeTourneau and Steffen 2002; Shackley 2005). CTR obsidian was clearly also used; its primary outcrops are to the northeast and southeast of the Valle Grande itself, but it occurs in Rio Grande Valley alluvium in a secondary source context.

What can be said of how Folsom knappers at the Boca Negra Wash were transporting and using obsidian? The site lies approximately 75 km south of the caldera and some 1,340 m lower. In our estimation, the obsidian was probably directly procured by members of the Folsom group that occupied Boca Negra Wash, based on the relatively large percentage of the assemblage it composes and on its occurrence as finished tools, tools broken in manufacture, and debitage. Indirect procurement (exchange) cannot be completely ruled out (Meltzer 1989), but given that Pedernal chert is present in similar abundance (28% of the materials in Locus A, 16.5% in Locus B) and is available from primary outcrops 20–25 km north of the Valles Caldera, direct procurement seems the most logical explanation (Shackley 2005: 117–133). We infer that the obsidian was transported in already reduced form—potentially including finished projectile points—because only 3 of 504 obsidian artifacts (0.6%) exhibit cortex. Quarry products such as large flakes or small bifacial preforms are likely candidates for these partially reduced forms. Locus B yielded 92 pieces of debitage that retained striking platforms; 67 (72.8%) are faceted, another 21 (22.8%) are plain, and the remaining 4 (4.3%) are cortical. The much smaller sample from Locus A included 9 plain and 3 faceted striking platforms. The dominance of faceted platforms suggests that biface production was an important aspect of obsidian use here. Moreover, it appears that the pieces being transported were not large. Although the obsidiandebitage from the site is fragmented, it consists of small pieces. At Locus B mean debitage piece size is 8.4 mm (± 3.9 mm) long, 6.4 mm (± 3.8 mm) wide, and 1.3 mm (± 0.09 mm) thick. It seems that obsidian was used primarily for weapons tips and informal flake tools. The 15 recovered obsidian tools include Folsom points and point preforms (7), bifaces (3), gravers (1), unifacially retouched (3) and utilized (1) flake tools.

The apparent predominance of VGM obsidian at Boca Negra Wash is of critical importance in reconstructing Folsom lithic material procurement and transport. Data from both debitage and tools from this single-component site also provide insights into the forms in which obsidian was transported and the role it played in technological organization.

References Cited


Ultrathin Biface at the Adair-Steadman (41FS2) Folsom Campsite/Workshop on the Southern Plains

Stance Hurst and Eileen Johnson

➤ Keywords: Folsom, ultrathin bifaces, Southern Plains

Adair-Steadman (41FS2), located on the western Rolling Plains of Texas, was a persistently used place for hunter-gatherer groups to camp and manufacture stone tools from the nearby abundant outcrop of gravels that included large tabular nodules of Edwards Formation chert. Notably, Folsom-age hunter-gatherer groups used the chert outcrop for manufacturing an array of tools including bifaces for projectile points. The sequence of Folsom point manufacture was reconstructed from the large number of manufacturing failures at the site (Tunnell 1977; Tunnell and Johnson 2000).
An end segment of an ultrathin biface (TTU-A7-45272) was identified during analysis of the Adair-Steadman assemblage. The ultrathin biface, made from Edwards Formation chert, is 58.56 mm long and 73.8 mm wide, with a maximum thickness of 6.81 mm. The thickest part of the biface segment is near the tip; center thickness is 6.1 mm. The minimum width/thickness ratio for this ultrathin fragment ranges between 10.8 and 12.1; inasmuch as this segment is not the widest portion of the biface, the ratio for the unbroken ultrathin biface would have been significantly greater. Large expanding flakes terminating near midline were removed to thin the center and create a bi-planar cross section.

Other ultrathins on the Southern Plains have been documented at 41LU8 (Johnson 2010), Blackwater Draw Locality No. 1 (Boldurian and Cotter 1999:81–82), Gault (Dickens 2005:69), Pavo Real (Collins et al. 2003), Ryan (Hartwell 1995:172–74), Shifting Sands and nearby Wyche Ranch (Hofman et al. 1990; Rose 2011), and as an isolated find (Wyckoff 1996). All currently known documented ultrathins were manufactured from Edwards Formation chert. Their widespread distribution on the Southern Plains suggests they were part of the transportable toolkit. The Westfahl biface was found the farthest from the Edwards Formation, 420km away (Wyckoff 1996). On the Southern High Plains, the 41LU8, Blackwater Draw Locality No. 1, and Ryan ultrathins are located 150–200 km distant, and the Shifting Sands and Wyche Ranch ultrathins were located ca. 100km (Hofman et al. 1990) away. Like Adair-Steadman, the Pavo Real and Gault ultrathins were associated with a workshop located at an Edwards Formation chert outcrop.

The presence of ultrathins at Ryan and Gault suggests ultrathin bifaces also were part of Clovis and Plainview technologies. On the Northwestern Plains, Muniz (2005) documented ultrathins as part of Cody toolkits. Ultrathin technology may not be diagnostic of just the Folsom period and may have been an important specialized tool used throughout Paleoindian times.

The Southern Plains ultrathins complete enough for identification were ovate in shape and bi-planar to biconcave in cross section, with width/thickness ratios of 7.6–19.0. The lowest width/thickness ratio was measured on an ultrathin segment from Pavo Real that likely was an early-stage ultrathin biface (Collins et al. 2003:102). The largest width/thickness ratio was from the ultrathin at Blackwater Draw Locality No. 1 (Boldurian and Cotter 1999:82). The measurements and technological characteristics of ultrathins on the Southern Plains fall within the range of variation for ultrathins defined on the Northern Plains (Root et al. 1999).

Manufacturing ultrathin bifaces likely required a high level of skill similar to fluting Folsom points (Root et al. 1999:141). Workshops such as Adair-Steadman contain a high number of manufacturing failures resulting from start-up problems at the source location. The production of ultrathin bifaces may follow a pattern similar to that for Folsom point production. Folsom points often were manufactured at considerable distances from raw material sources. This pattern suggests a flexible technology in which bifacial cores or flake blanks were used to replenish the supply of Folsom points rather than transport a large number of finished Folsom points (Hofman 1992). Similarly,
larger bifacial cores or earlier-stage ultrathin bifaces may have been reduced into ultrathin bifaces when the supply of ultrathins became depleted. At Shifting Sands, ultrathin biface segments may have been recycled into Folsom points and other tool types (Rose, personal communication, 2011) in a similar fashion as found on the Northern Plains (Root et al. 1999).

Folsom lithic technology appears to be centered upon carrying intermediary tool blanks that were themselves used as tools before being converted into projectile points and ultrathins (Hofman 1992). Ultrathin bifaces likely were an important part of the toolkit used for butchering bison (Jodry 1999:204–09) and served as cores if other tool types had become depleted (e.g., Surovell et al. 2003). The impromptu place of manufacture for ultrathin bifaces, similar to that for projectile points, suggests hunter-gatherers during the Folsom period used a highly flexible toolkit to provision themselves with stone tools as needed without being tethered to lithic source locations (Sellet 2004). Future investigations will need to explore the incidence of ultrathins in other Paleoindian toolkits and whether ultrathins are diagnostic of only the Folsom period.

Adair-Steadman research is funded by the Museum of Texas Tech University. Thanks are due to Richard Rose (Midland) for granting access to the Shifting Sands Collections, sharing information, and discussing ideas. This manuscript represents part of the ongoing Lubbock Lake Landmark regional research into grasslands hunter-gatherers and adaptation to ecological change on the Southern Plains.

References Cited


Dickens, W. A. 2005 Biface Reduction and Blade Manufacture at the Gault Site (41BL323): A Clovis Occupation in Bell County, Texas. Unpublished Ph.D. dissertation, Department of Anthropology, Texas A&M University, College Station.


New Late-Pleistocene Lithic Artifacts from the Hiscock Site, Western New York State

Richard S. Laub

➤ Keywords: Hiscock site, lithics, fluted biface

Hiscock is a late-Quaternary locality in northern Genesee County, New York (Laub et al. 1988). I describe here Pleistocene lithics excavated at this site subsequent to an earlier report on this topic (Laub 2006).

The proximal portion of a fluted biface (Buffalo Museum of Science catalogue no. C30363; Figure 1A–C) is from an unconformity between the pre-cultural Cobble Layer and the overlying Holocene Woody Layer (Laub 2003; Figure 1D) near the margin of the basin. The fracture surface is flat, and perpendicular to the worked surfaces of the artifact. This surface (Figure 1C) bears two small conchoidal scars with several distinctly smaller ones at the center of one edge, and a narrow rim along the opposite edge. The two lateral and basal edges of the artifact have been ground, suggesting that it had been completely formed before breakage (Lepper 1988, 2002). The specimen, the seventh from this site (see Ellis et al. 2003 and Laub 2006 for the others), was in the same stratigraphic context as C24956, the first fluted biface found at Hiscock, and approximately 7 m distant.

The basal corner of a fluted biface (BMS C30364; Fig. 1 E, F) is from the...
Figure 1. A-C, BMS C30363, base of a fluted biface, in lateral (A, B) and distal (C) views. D, Generalized stratigraphic column for the Hiscock site. 1, stratigraphic position of C30363; 2, stratigraphic position of C30364; 3, stratigraphic position of C30365. E-F, BMS C30364, basal corner of a fluted biface in obverse and reverse views. G-I, BMS C30365, a possible graver, in “dorsal,” “lateral,” and “ventral” views, respectively. Note the prominent narrow projection facing upward. Dotted lines indicate rounded rather than sharp boundaries. All scale bars = 1 cm. Artifact illustrations by William L. Parsons.
pebbly Fibrous Gravelly Clay (Laub 2003), and lay closer to the axis of the basin than the previous specimen. It includes part of the flute scar. Both the lateral and basal edges have been ground. It is not clear if this represents an eighth fluted biface, or if it separated from one of the others known from this site.

A third specimen (BMS C30365; Fig. 1G–I) is a blocky piece of chert from the fine Fibrous Gravelly Clay (Laub 2003) with a small patch of weathering rind. It lay 7 m from the previous specimen, and closer to the basin margin. This specimen bears a prominent narrow projection, suggestive of a graver point, which is based on the broadest surface of the piece and rises steeply to a flat surface that is parallel to the first. The projection is defined by two laterally bounding concavities, one of which is single while the other consists of several smaller concavities. These depressions lack the concentric ripples of typical conchoidal fractures. There is a distinct flat area just above the terminus of the projection. The absence of fine flaking around the prominence leaves a cultural origin questionable.

The fluted biface base and basal corner show no obvious evidence of reworking. They and the putative graver appear to be made of Onondaga chert, the principal lithic source in the vicinity.

The author thanks the following people for their assistance. Leonid I. Shmookler (Ecology and Environment, Lancaster, New York), James M. Adovasio and Allison Byrnes (Mercyhurst Archaeological Institute, Mercyhurst College, Erie, Pennsylvania), John D. Holland (Holland Lithic Laboratory, Buffalo Museum of Science, Buffalo, New York), John D. Holland Jr. (Buffalo, New York), and Bradley T. Lepper (Ohio Historical Society, Columbus) provided helpful and insightful comments. William L. Parsons and Michael R. Grenier (Buffalo Museum of Science) respectively created the artifact drawings and did the graphic layout of the figure. Excavation of the Hiscock site has been carried out by hundreds of volunteers, too numerous to mention, but fully deserving of deep gratitude. The project is supported by individual and corporate contributors through the Buffalo Museum of Science.

References Cited


Late-Paleoindian versus Early-Archaic Occupation of Yellowstone Lake, Wyoming

Douglas H. MacDonald, Richard E. Hughes, and Jannifer W. Gish

Keywords: Altithermal, lithic technology, Yellowstone

Archaeological data from sites in the Greater Yellowstone Ecosystem (GYE) of Wyoming and Montana indicate that some portions of the region were attractive to early- and middle-Holocene hunter-gatherers. In this paper, we provide new data on a high-elevation early Plains Archaic site, Fishing Bridge Point (48YE381), that suggest land-use patterns contrasting with those of the late-Paleoindian period.

Fishing Bridge Point is located along the northwest shore of Yellowstone Lake, Wyoming, at an elevation of 7,785 ft. amsl, on the S2 lake shoreline dated to the early Holocene (Pierce et al. 2007). This site contained an early-Archaic burn feature within a buried soil on the incipient beach of the lake shore (MacDonald and Livers 2010). Wood charcoal from the feature returned an AMS 14C date of 5910 ± 50 RCYBP (Beta-265310), with a 2-σ calibration of 6860–6640 CALYBP. It is the first early-Archaic feature ever to be excavated in Yellowstone National Park.

Comparing lithic raw-material data from Fishing Bridge Point with earlier late-Paleoindian occupations at the Osprey Beach site (Johnson et al. 2004; Shortt 2003) at Yellowstone Lake suggests dynamic shifts in settlement patterns during the early Holocene. Located only 20 km south of Fishing Bridge Point, Osprey Beach contained significant amounts of chert (46%) from at least six sources and volcanics from another 11 sources (54% of total). In stark contrast, early-Archaic Fishing Bridge Point occupations yielded nearly exclusively obsidian (90%), with 95% of that sourced to Obsidian Cliff. Cashman dacite from southwest Montana was the only other non–Obsidian Cliff source, while 4–6 sources of chert and other materials account for less than 10 percent of the material at the site. Total lithic assemblages analyzed from the two sites are not significantly different (n = 127 from Osprey Beach; n = 90 from Fishing Bridge).

These data suggest that hunter-gatherers at Yellowstone Lake switched from a wide-ranging settlement and/or trade pattern in the late-Paleoindian period (represented by 17 lithic sources) to a constricted, tethered settlement/trade pattern in the early Archaic (using only 6–8 lithic sources, including mostly

Fossil pollen collected from the early-Archaic levels at Fishing Bridge Point (Gish 2010) indicates the presence of a shrub-grassland at Yellowstone Lake at the time of occupation (elevation 7,750 ft. amsl). Our pollen data corroborate soils data from nearby Dead Indian Pass in the Absaroka Mountains, which indicate substantial grasslands in the pass (elevation 7,900 ft. amsl) approximately 6000 RCYBP (Reider et al. 1988). Apparently, some portions of the high-elevation GYE drew grass-hungry ungulates and human predators during the early-Archaic period.

Lithic and pollen data from the Fishing Bridge Point site at Yellowstone Lake support those from other regional sites, confirming that the Altithermal was a significant climatic event for early- and middle-Holocene hunter-gatherers. After 9000 RCYBP, hunter-gatherers living in the northern Plains and Rocky Mountains moved into areas with reliable and permanent water sources, including river watersheds and lakes, especially those at higher (cooler) elevations such as Yellowstone Lake, Wyoming.

References Cited


Reinvestigation of the Cape Site, an “Early Man” Locality in Western Nebraska

David W. May, Matthew G. Hill, and David J. Rapson

Keywords: Geoarchaeology, Paleoindian, Great Plains

The discovery of artifacts associated with the remains of extinct animals at Folsom and Blackwater Draw, New Mexico, in the 1920s and 1930s put archaeologists and vertebrate paleontologists on high alert for similar sites elsewhere on the Great Plains. The Cape site, Morrill County, western Nebraska (Figure 1), was one of numerous suspected “Early Man” sites (Sellards 1952:5) investigated during this period (Barbour and Schultz 1936), several of which figured centrally in establishing the early culture history for the region (Barbour and Schultz 1932a, 1932b). Despite being relatively well published (Bell and Van Royen 1934a, 1934b, 1936), the Cape site was largely ignored in these discussions, presumably because the stratigraphy proved difficult to interpret and no diagnostic artifacts were recovered.

In May of 2010 we relocated the Cape site using the map and site description provided in Bell and Van Royen (1936). It is situated along the northeast bank

David W. May, Department of Geography, University of Northern Iowa, Cedar Falls, IA 50614-0406; email: dave.may@uni.edu
Matthew G. Hill and David J. Rapson, Department of Anthropology, Iowa State University, Ames, IA 50011-1050; emails: mghill@iastate.edu drapson@uwyo.edu
of the lower East Fork of Greenwood Creek, adjacent to a spring. In the original description, the site extends almost to the confluence with the West Fork. Today, the upper two stratigraphic units (B and C) identified by Bell and Van Royen (1936, Figure 2, p. 407) are exposed, as is their “old soil” located at the contact between these stratigraphic units. We found a scatter of bison bone fragments 5–20 cm below the surface of unit B (their “partially cemented sandy silt”), and in the “old soil.” Although unit A (more than 3.6 m below the terrace) was not located in this section during the current study, it was identified in a natural cut-bank exposure on the northwest side of the West Fork just upstream of the confluence of the two forks. Here, we found a pocket of charcoal that looked like a burned branch in situ in stratified sand 4.5 m below the modern terrace surface. The charcoal was identified as willow (Tony Zalucha, personal communication, 2010). The AMS conventional radiocarbon age of the charcoal was $6570 \pm 40$ RCYBP (Beta-280092) or $7560–7420$ CALYBP (at 2σ, using IntCal04). This date firmly establishes that the Cape site is not an Early Man site, but represents instead a deposit of probable Archaic age.

We thank Pete Lapaseotos, land owner, for granting us permission to work on his ranch, and Stewart Glass for providing information about springs in the valley. The Department of Geography, University of Northern Iowa, funded the AMS radiocarbon assay.

References Cited


——— 1936 Some Considerations Regarding the Possible Age of an Ancient Site in Western Nebraska. In *Chapters in Nebraska Archaeology*, edited by E. H. Bell, pp. 405–19. University of Nebraska Press, Lincoln.

Fluted Points from Pine County, Minnesota: 
The Neubauer Collection

Stephen L. Mulholland and Susan C. Mulholland

Keywords: Clovis, Folsom, Gainey, Holcombe

At present, Pine County has the highest number of reported fluted projectile points in Minnesota with 17 recorded and another one reported but unconfirmed. The majority (16) are in a private collection owned by Joseph Neubauer. Joe collected artifacts from the Snake River drainage in the general area of Pine City for over 80 years, with only a short break for World War II. Another reported point (Higginbottom 1996:46) has not been seen by the authors; a second was reportedly taken to New England as part of a private collection (Neubauer personal communication 2010).

Initial documentation of the Neubauer points included photographs, drawings, and descriptions, but not site locations (Shane n.d.). Recently Joe has allowed additional documentation, including locations of point recovery (Mulholland and Mulholland 2011). Site locations are along the Snake River valley and tributaries in southeastern Pine County. Recoveries are from plowed fields and other surface contexts on private lands. Other collectors also have artifacts from many of the localities. Only initial observations on the early-Paleoindian occupations are offered.

Material types largely indicate a regional origin. Four are Hixton silicified sandstone, whose source is about 275 km to the southeast (Carr and Boszhardt 2010). Three are Prairie du Chien (PDC) chert, found about 105 km to the south at the closest (Klawiter 2001). Two quartz points could be local or from Little Falls, about 135 km west (Mulholland and Mulholland 2010). One each of Knife Lake siltstone (KLS), Biwabik silica, and brecciated Kakabeka chert could be from local till sources deposited by northern glaciers (Mulholland and Klawiter 2009). Only four are as yet unidentified cherts, although two could be PDC and one could be Cochrane chert.

Although classification is difficult with isolated points, the 16 points are tentatively identified to four types: Clovis, Folsom, Gainey, and Holcombe. Clovis and Gainey are differentiated by flute width, depth of basal concavity, and depth of flaking scars as indications of direct and indirect percussion (Morrow and Morrow 2001). Folsom is much easier to identify, even in the Midwest (Morrow and Morrow 1999). Holcombe points are identified by the presence of narrow basal thinning flakes on one or both faces (Justice 1987:24).

Five projectile points are identified as Clovis (Figure 1A), including two of Hixton and one each of PDC chert, quartz, and KLS. Four have flutes on both faces while one is fluted on one side with a prepared nipple on the other. All five have shallow concave bases and relatively narrow flutes.
Five projectile points are identified as Folsom (Figure 1B); materials include two of PDC chert, one of Hixton, one possible Cochrane chert, and one unidentified chert. All are fluted on both faces with a broad, distinctive flute. Small pressure flakes are present on the bases. Three of the points are broken.

Three projectile points are identified as Gainey (Figure 1C), including one of Hixton, one of an unidentified chert (possibly PDC), and one of quartz. The Hixton point is heavily resharpened but with a wide flute on both sides and a deeply concave base. The quartz point also has deeply concave base and flutes on both sides. The third artifact is an asymmetrical knife formed from a projectile point; at least one face has a very wide flute.

Three projectile points identified as Holcombe (Figure 1D) include Biwabik silica, brecciated Kakabeka chert, and an unidentified chert (possibly PDC). One point has a flute on one side and basal thinning flakes on the
other; the other two have basal thinning flakes on each side. All are heavily
resharpened; one lacks the tip.

The greatest concentration of recorded fluted projectile points in Minne-
sota has been the Neubauer collection in Pine County; the 10 (of 11) points
recorded in the mid 1990s (Higginbottom 1996:36–45) are expanded in the
present study to 16 (of 18). In addition, several (five) broken point bases with
possible flutes or basal thinning flakes require further study to determine
affiliation. The Snake River valley in the vicinity of Pine City is in the opening
for an ice-free area early in the deglaciation of central Minnesota (Mulholland
et al. 1997). This geographic situation may explain the concentration of early-
Paleoindian projectile points and suggests that east-central Minnesota, as well
as southwestern and southeastern areas, could be inhabited early in the late
Pleistocene.

Grateful acknowledgment is given to Joseph Neubauer, Sr. for providing access to his collection.
Special thanks to Anthony Romano for identification of the brecciated Kakabeka chert point and
calling the prevalence of fluted points in the Pine City area to our attention. David Peterson and Larry
Furo significantly assisted in the documentation project. Access to the unpublished Shane papers at
the Science Museum of Minnesota was provided by Ed Fleming. Dan Wendt suggested the Cochrane
chert identification.

References Cited


Higginbottom, D. K. 1996 An Inventory of Fluted Projectile Points from Minnesota. Paper and
draft report presented at the 54th Annual Plains Anthropological Conference, Iowa City.

Justice, N. D. 1987 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States.*
Indiana University Press, Bloomington.


International Monographs in Prehistory, Archaeological Series 12, Ann Arbor.

Morrow, J. E., and T. A. Morrow 2001 Exploring the Clovis-Gainey-Folsom Continuum: Techno-
logical and Morphological Variation in Midwestern Fluted Points. In *Folsom Technology and Lifeways*,
edited by J. E. Clark and M. B. Collins, pp. 141–57. Special Publication No. 4 of Lithic Technology,
University of Tulsa, Tulsa.

Mulholland, S. L., and B. N. Klawiter 2009 The Lithic Resources of Northeastern Minnesota. The
*Minnesota Archaeologist* 68:51–70.

Mulholland, S. C., and S. L. Mulholland 2011 The Fluted Points of Pine City: Recexamination of
the Neubauer Collection. Paper presented at the Council for Minnesota Archaeology symposium,
Inver Grove Heights.

——— 2010 Two Quartz Fluted Points from Pine County, Minnesota. *Current Research in the
Pleistocene* 27:140–42.

Mulholland, S. C., S. L. Mulholland, G. R. Peters, J. K. Huber, and H. D. Mooers 1997 Paleo-
400.

Shane, O. C., III n.d. Unpublished descriptions of Minnesota fluted points, documents stored in
the Science Museum of Minnesota, St. Paul.
The Third Lake Cache, St. Louis County, Minnesota

Susan C. Mulholland, Christopher L. Hill, and Stephen L. Mulholland

Keywords: Jasper taconite, Kakabeka chert, Minnesota

In 1982, a lithic assemblage containing bifaces and debitage was discovered between Third Lake and the Cloquet River east of Independence in St. Louis County, Minnesota. This region contains Independence till (combined Rainy lobe and St. Croix phase, Superior lobe); outwash (Alborn phase, St. Louis sublobe) is in the Cloquet River valley, and Highland moraine deposits (Automba phase, Superior lobe) are immediately to the south (Hill 2007; Lehr and Hobbs 1992). The artifacts were exposed in a shallow subsurface context by loggers bulldozing a haul road for a logging operation. The loggers collected some artifacts and notified the Minnesota Power land owners; limited field investigations conducted by personnel from the University of Minnesota Duluth (UMD) Archaeometry Laboratory included one author (CLH). In 1998, the portion of the collection in the possession of David Johnson, Jr., was photographed by one author (SLM). The cache has not been reported in detail, although it is briefly cited as the Third “River” site (Harrison et al. 1995:15, 21; Mulholland and Klawiter 2009:61).

Reportedly, only the “most interesting” artifacts were originally collected; "numerous smaller pieces" were discarded into the nearby woods. At present, only the Johnson, Jr., collection (38 artifacts) has been photographed in detail; 14 artifacts from the later investigation, presently in UMD curation, were briefly reviewed. Efforts are underway to locate the materials still in the possession of the original collectors for a more detailed study; the present review indicates two findings.

The lithic assemblage consists of two types of raw material, jasper taconite and Kakabeka Falls chert. Both materials are commonly found in this region of northeastern Minnesota and adjacent Ontario near Lake Superior (Mulholland and Klawiter 2009). However, the quality represented in this assemblage is quite remarkable. Both types are especially high-grade materials, with extremely high silica content and no noticeable flaws or imperfections. Overall, the amount and quality of both lithic types greatly exceeds that seen by one author (SLM) in any other collection from northeastern Minnesota. In general, jasper taconite pieces often exhibit flaws, particularly those recovered from till sources.

The range of artifact sizes and stages of manufacture is also interesting. No
finished tools were observed in the Johnson collection, and no projectile points were mentioned from the assemblage as a whole. The larger artifacts range from rough bifacially flaked items to more finished blanks and pre-  
forms. The smaller artifacts discarded by the original collectors probably included a variety  
of debitage, although small tools such as scrapers may not have been recognized. A larger piece, possibly a core, was photographed at the time of discovery but was not seen in the 1998 study.

Large jasper taconite bifaces in northeastern Minnesota tend to be Paleo-Indian rather than Archaic or later. Large Kakabeka chert bifaces are anomalous, not being common in any tradition. In addition, Paleoindian assemblages are characterized by high (over 90%) amounts of single or closely related material types (Bakken and Mather 1999; Mulholland 2002:94). The number of large bifaces from two high-quality lithic types strongly suggests a Paleoindian affiliation for this assemblage.

The site can be considered in terms of caching behavior. Seven late-Paleoindian caches from the western Great Lakes were classified into two categories (Carr and Boszhardt 2003:232). Ceremonial caches have broken points (heat fractured) of lithic materials from sources a long distance from the cache. Functional caches have mostly intact bifaces and are in closer proximity to the source of the materials. The bifaces are also less finished and, although attributed to specific complexes, do not include definitive projectile points. The Third Lake assemblage is most similar to functional caches, although caches can also represent other activities (Chandler 2001).

The Third Lake assemblage requires additional analysis to determine if the technology warrants attribution to the Paleoindian period. Review of more artifacts would strengthen the study; the photographs and materials in hand include only 52 pieces. Reported discard of small artifacts created a bias in the sample toward larger bifaces. However, this cache is important; few have been reported in Minnesota (Largent 2007), and the extremely high quality of the lithic materials is unique in northeastern Minnesota. Additional research will add to the knowledge of Paleoindian caching behavior in this region.

Grateful acknowledgment is given to David Johnson, Jr. for providing access to his collection. Thomas Houghtaling and Matt Radzak from Minnesota Power provided information on the original timber sale and logging company. Special thanks are given to Dr. Mark Muniz for calling the Kriesel cache article to our attention.

References Cited


The Burgess-Mabrey Site: 40JK267, Jackson County, Tennessee

Mark R. Norton, John B. Broster, Dennis Burgess, and Larry Mabrey

Keywords: Clovis, Cumberland, Southeast

The Burgess-Mabrey site (40JK267) is located on the Cumberland River in Jackson County, Tennessee, in the eastern Central Basin physiographic province at the contact with the Eastern Highland Rim physiographic province. The site is situated on a terrace above the relic channel of the river and adjacent to a tributary. High-quality Fort Payne and Bigby-Cannon chert cobbles and nodules are associated with the Mississippian and Ordovician limestone formations located here.

Prior to the completion of the Cordell Hull dam in 1973, this terrace was in agricultural use. It was during the 1960s that Mr. Mabrey began finding stone tools here while cultivating the terrace. Since the completion of the dam this landform is seasonally inundated by Cordell Hull Lake and is now managed by the U. S. Army Corps of Engineers.

Avocational archaeologists Dennis Burgess and Larry Mabrey informed the Division of Archaeology of this site upon recognizing the significant numbers of Paleoindian projectile points and tools within this artifact assemblage. Paleoindian projectile points including Cumberland, Clovis, Beaver Lake, and Quad have been recorded (Figure 1). Other Paleoindian artifacts include fluted biface preforms, blade cores, blades, unifacial blade tools, and overshot flakes.

The relatively low number of formal unifacial blade tools here leads us to
conclude this site may represent short-term Paleoamerican encampments associated with chert procurement. A similar artifact assemblage although larger in scale was recognized at the Sinclair site (40WY111), a Clovis quarry in Wayne County, Tennessee (Broster and Norton 2009). These short-term encampments differ from larger base camps, or staging areas (Anderson 1990:187–196) such as the Carson-Conn-Short site (40BN190), in Benton County, Tennessee, by having fewer numbers and varieties of unifacial blade tools (Broster and Norton 1993). We think the lower unifacial tool counts may indicate that fewer numbers of individuals were involved in trips to procure chert, which possibly were coupled with other tasks such as hunting forays. The primary focus of activity at these quarry locations is selecting raw material and reducing cobbles or nodules. The majority of the newly acquired bifaces and blades were packed and transported back to base camp for final tooling. Given the extent of the chert resources in the region, we think Burgess-Mabrey represents one of many short-term Paleoamerican camps associated with procuring chert. Test excavations are planned for the upper portion of this terrace, which is above the summer pool level of the lake, and within the site boundaries as described from the 1960s.

References Cited


New Fluted Artifact Finds at the Sheep Mountain Site (35HA3667), Harney County, Oregon

Patrick O’Grady, Michael F. Rondeau, and Scott P. Thomas

Keywords: Fluting technology, obsidian studies, Oregon

The initial discovery of two fluted points at the Sheep Mountain site in the northern Great Basin of southeastern Oregon (O’Grady et al. 2009; Rondeau 2007, 2008) prompted University of Oregon field school excavations there over the last three years. The majority of formed tools are stemmed points, but the fluted artifact inventory increases as field work continues. Most are surface recoveries. The four artifacts here reported include a fluted-point fragment, two fluted bifaces, and a biface that has been shaped in a manner consistent with fluted-point lithic reduction techniques. Sheep Mountain is a 5.5-acre site occupying a shallow basin overlooking Wagontire Valley. Sedimentary deposits range in depth from 2 to 6 m, and Mazama O tephra (Foit 2008) provides a site-wide buried time marker.

A large fluted biface fragment (BSQ-10-1 [Figure 1A]) was collected at nearby Big Stick Quarry. Located 3 km east of the Sheep Mountain site, its distinctly gray-banded obsidian has been shown by geochemical sourcing and visual characteristics to be a prominent variety at the site. Surveys in 2010 led to the recovery of this artifact. Geochemical sourcing confirmed its Big Stick origin, with a hydration band measurement of 5.6 µm (Skinner and Thatcher 2010b).
The large biface is 82.56 mm long, 111.21 mm across, 18.0 mm wide, and weighs 198 grams. Rondeau (2010a), observing that flute removal on both faces led to a bi-concave basal cross section, attributes the transverse break to an internal flaw. Platform grinding and microflake removal adjusted the direction of flute removal, and pressure flakes on both faces are truncated by the flutes.

Specimen 3667-09-6-B-5-2 (Figure 1B) is a fluted base fragment that has been reshaped into a unifacial scraper. The artifact was recovered from level 5 of Excavation Unit 2 at Sheep Mountain, underlying Mazama O tephra. It is 47.07 mm long, 57.75 mm wide, 12.78 mm thick, and weighs 36.2 grams. It is fluted on one face, and several pressure flakes are truncated by the flute. The opposite face has percussion scar remnants that establish the beveled fluting platform for removal of the flute flake (Rondeau 2010b). It is made of Buck Springs obsidian. Hydration cuts in both the fluting flake scar and the distal scraping edge produced measurements of 8.9 µm. It is the first fluted artifact to be found in a buried context at Sheep Mountain. Two stemmed points and the ear of a possible Black Rock Concave Base point (Rondeau 2010a:12) were recovered below the Mazama tephra within 5 m of this fluted base. Specimen 3667-CL-1, a complete fluted point (O’Grady et al. 2009; Rondeau 2007), was surface collected less than 10 m away.

Specimen 3667-10T-2 (Figure 1C) is an end-thinned biface fragment collected from the surface of the Sheep Mountain site, with evidence of failed flute preparation in the form of two pronounced basal scars (Rondeau 2010a:12). Other characteristics are consistent with fluted-point preparation, including pressure edge retouch beveling on both faces of the proximal margin, overface flake scars, and a center ridge exhibiting ridge set-up scars on either side. Breakage occurred as the result of a twisting fracture. The biface is made of obsidian from the Glass Buttes 6 source, with a hydration measurement of 7.6 µm (Skinner and Thatcher 2010b).

Specimen 3667-CL-3 (Figure 1D) is a fluted-point base made of Tank Creek obsidian with a hydration rim measurement of 7.6 µm (Skinner and Thatcher 2010a). It was a surface find on the east side of the site, in the same general vicinity as the previously recovered fluted points. It is 19.35 mm long, 34.43 mm wide, 6.52 mm thick, and weighs 3.2 grams. Damage to the point is attributed to a transverse bending fracture (Rondeau 2010a), and the base is missing one ear. Edge grinding is not evident on the base, and the lateral margins are too damaged to reveal such evidence. Single flute scars are present on both faces, and the basal cross section is bi-concave. Pressure and percussion flake scars on one side have been truncated by the flute.

Three seasons of field investigations and two previous surveys led to the recovery of six artifacts that bear evidence of fluting or technological approaches associated with the practice. Such finds, and results from previous archaeological and geomorphological explorations provide guidelines for continuing work at the site.

References Cited

Clovis in Southeast Idaho’s Teton Valley

Bonnie L. Pitblado and Benjamin Fowler

➤ Keywords: Clovis, southeast Idaho, New World settlement

In summer 2010, Utah State University (USU) archaeologists recorded three Clovis sites in the Teton Valley, southeastern Idaho (Figure 1). The sites are located within 4 km of each other on the western margin of the Teton Valley at elevations ca. 1830 m asl, and they occupy the same low terrace of the Teton River in what are now plowed fields. We have temporarily designated them the LH1, TH1, and LP1 Clovis sites.

The LH1 site came to our attention in spring 2010, thanks to a private citizen who found an artifact while picking potatoes decades ago on her family’s farm near Driggs, ID. The tool, a Clovis preform, had been transferred intact in a clod of dirt onto the inspection conveyor belt along with the potatoes she was sorting. The preform’s raw material is a butterscotch-colored volcanic rock unusual for the area. Its pristine condition and provenience suggest it may once have been part of a cache.

The LH1 preform led us to the Teton Valley in July 2010 where, with the help of the artifact’s owner, we documented its locality in general terms. However, the property had changed hands, and the new owners were unavailable to grant access to the precise spot where the preform emerged from the ground. Thus, for the moment, we must view it as an isolated occurrence that may or may not have been part of a cache or other Clovis site.

During our reconnaissance, two more Teton Valley landowners alerted us to the LP1 and TH1 sites and granted us permission to survey and record them.

Bonnie L. Pitblado and Benjamin Fowler, Anthropology Program, Utah State University, Logan, UT 84322; e-mails: bonnie.pitblado@usu.edu b.fowler@aggiemail.usu.edu
The LP1 site produced four Clovis bifaces in various stages of manufacture, including an obsidian preform. The TH1 site yielded two complete Clovis points (one of burnt chert found in two pieces at different times, and one of unfinished obsidian), an unfinished obsidian Clovis point midsection, an early-stage Clovis biface, mastodon long-bone fragments, and numerous flakes. All the TH1 site material had been churned up during a year of deep plowing in a 100-by-100-m area.

Future work at these Teton Valley Clovis sites will include survey of the LH1 site and tests to determine if intact buried material remains at any of them. The sites support Kornfeld et al.’s (2010:73) contention that the Rocky Mountains “teem” with Clovis finds, although the TH1 site’s apparent mastodon kill/processing focus expands a sparse database of megafaunal-human associated sites in the Rockies. The sites’ locations may speak to the directionality of Clovis settlement of the New World, whether west to east, east to west, or via some other trajectory (e.g., Anderson and Gillam 2000, Beck and Jones 2010, Pitblado 2011) (Figure 1).

Thanks so much to the three private landowners lucky enough to find Clovis artifacts on their property and generous enough to share their finds and insights with USU archaeologists. Additional thanks to the citizens of the Teton Valley who attended USU’s July 2010 “Artifact Road Show” in Victor, ID and showed great interest in our Paleoindian pursuits—and in many cases significantly furthered them. We are grateful to the USU students and others who helped document the Teton

Figure 1. Map showing the location of Teton Valley Clovis sites (inset) and other well-known Clovis and peopling-related sites in the western United States. Note that the Teton Valley could have been readily accessed by Clovis people moving west from the Plains or east using the Snake River Plain as a travel corridor. Note also the well-documented Clovis cache sites located north, south and west, respectively, of the Teton Clovis localities.
Valley Clovis sites and who organized and staffed the Victor “Road Show”: Holly Andrew, Wes Andrew, Alex Hildreth, Jason Patten, Ashley Smith, and Andrew Straup. We thank Molly Cannon and Holly Andrew for their help drafting Figure 1 and as always, Richard and Joyce Shipley for their ongoing support of USU’s efforts to understand Paleoamerican occupation of southeastern Idaho and northern Utah.

References Cited


The Mead Site, a Late-Pleistocene/Holocene Stratified Site in Central Alaska

Ben A. Potter, Phoebe J. Gilbert, Charles E. Holmes, and Barbara A. Crass

Keywords: Paleoeconomy, site structure, late Pleistocene, eastern Beringia

Excavations at Broken Mammoth and Swan Point in central Alaska have revealed late-Pleistocene records that share some similarities, but reveal significant differences in assemblage variability (Holmes 2001; Yesner 2001; see review in Hoffecker and Elias 2007). The Mead site has often been linked with both of these sites in various contexts, but it has received relatively limited testing. We present here initial analyses on the earliest two components (Cultural Zones [CZ] 3 and 4) derived from 2009 excavations, totaling 54 m².

Mead is located on a 10-m-high bedrock upland overlooking Shaw Creek flats, in the mid Tanana River basin. Stratigraphy and radiocarbon dating indicate five occupations (Figure 1). There is moderate cryoturbation in the upper 50 cm of loess (OAB), but little evidence of post-depositional disturbance in the lower paleosols associated with CZ3 and CZ4.

Cultural Zone 3 includes 2 hearths with contemporaneous dates (12,300–11,700 CALBP), 238 flakes, a microblade, 2 large modified flakes, and an ivory fragment. Faunal remains include avian, rodent, and bison. The overall simi-
larities of the faunal assemblage associated with hearth features and expedient lithic artifacts suggests similarities with Broken Mammoth (Krasinski 2005) and Gerstle River hearths 9 and 13 (Potter 2005, 2007).

Cultural Zone 4 cultural materials, stratigraphically dated to ~13,500–13,100 CALYBP, include 323 flakes and a lithic tool, a modified flake with burin damage. Preliminary faunal identification indicates waterfowl, wapiti, and bison, and ivory fragments. A number of activity areas have been identified, including: (1) a very dense cluster of locally available quartz flakes, similar to concentrations found at Broken Mammoth; (2) a cluster of bone fragments, primarily large ungulates with few lithics.

The faunal assemblages of CZ3 and CZ4 are relatively similar. They are highly fragmented; no elements are complete, and few are identifiable. No articulation was present. The remains are relatively dispersed; some concentrations are associated with features, and others are not. These patterns resemble later-stage Gerstle River processing (i.e., dominated by secondary processing and marrow extraction (Potter 2007)). These data suggest diverse subsistence economies (exploitation of large ungulates as well as small mammals and waterfowl). CZ4 is characterized by diffuse lithic and bone scatters punctuated by spatially limited activity areas, suggestive of intermittent short-
term occupations. CZ3 data match expectations for spike camps where game was processed on site (Potter 2007).

Both CZ3 and CZ4 contain obsidian, which, added to the obsidian at Broken Mammoth CZ4 and Swan Point CZ4 (Holmes 2001), suggests that long-distance trading and/or high levels of mobility were present in these earliest populations. In terms of lithic variability, the initial Mead CZ4 data correspond more closely to largely expedient assemblage at Broken Mammoth than to the older microblade- and burin-dominated assemblage at Swan Point.

Funding was provided by UAF and Denali—The Alaska Gas Pipeline, LLC.

References Cited


Holmes, C. E. 2001 Tanana River Valley Archaeology Circa 14,000 to 9000 BP. Arctic Anthropology 38(2):154–70.


Linda’s Point: Results from a New Terminal-Pleistocene Human Occupation at Healy Lake, Alaska

Robert A. Sattler, Thomas E. Gillispie, Norman A. Easton, and Michael Grooms

Keywords: Healy Lake Chindadn, Younger Dryas, Beringian archaeology

The Tanana Valley contains the largest concentration of late-Pleistocene archaeological sites in eastern Beringia (Potter 2008). Among these is the
Healy Lake Village site, the first in Alaska to produce artifacts associated with dates greater than 13,000 CALYBP, and the type-site for the Chindadn Complex (Cook 1969, 1996). Cook regards Chindadn as a single component, loosely constrained between 9200 and 13,300 CALYBP. Discordant dates and uncertain relationships between excavation levels cloud this interpretation (Erlandson et al. 1991). Recent research at Linda’s Point, an adjacent site of similar age, is now providing an opportunity to reexamine Healy Lake Chindadn.

Linda’s Point lies 1.7 km southeast of the Village site. Whereas the Village site occupies a low peninsula projecting into the lake, Linda’s Point rests on three narrow terracettes ascending a hill rising directly from the shoreline. Sediments consist of 65–80 cm of sandy loess, underlain by 10–15 cm of sand above frost-shattered bedrock. Ventifacts on bedrock indicate an erosional unconformity created by katabatic winds during the Delta and Donnelly glacial intervals (Reger et al. 2008). The modern soil is a cryocrept, and thin paleosols occur at depths of 35–60 cm.

In 2010, we excavated 51 systematic tests (50 by 50 cm) spaced at 10-m intervals, of which 18 produced buried cultural material. Vertical distribution of lithics provided evidence of three components, consistent with the Village sequence. The upper component (0–25 cm) is similar to Cook’s late-Holocene Athabascan assemblage; the middle component (25–40 cm) resembles his mid-Holocene Transitional assemblage; and the lower component (≥40 cm) appears stratigraphically equivalent to the Chindadn complex.

Four tests produced artifacts at ≥40 cm, including three 1-by-1-m units. Unit 17 yielded a hearth at 40–48 cm below surface, characterized by fire-reddened loess and a lens of wood charcoal with soot-blackened pebbles. Associated with the hearth are a red jasper flake and a calcined bone fragment. The hearth is isolated from the overlying components by 15 cm of sterile loess, and extends laterally beyond our one-meter sampling unit. A split sample of wood charcoal from the hearth gave radiocarbon dates of 11,050 ± 60 (Beta-293543) and 11,150 ± 60 RCYBP (Beta-293544). One-sigma calibrated ages are 13,110–12,980 and 13,090–12,880 CALYBP, respectively (Reimer et al. 2004). We believe most cultural materials recovered from ≥40 cm below surface are correlative to these dates, based upon presence of green chert artifacts found in three units. A biface of this chert found in Test 46 at 40–50 cm below surface is a Chindadn-like preform. Tools made of a similar material occur in the Chindadn levels of the Village site.

The Chindadn-age component at Linda’s Point may be contemporary with major shifts in human population and tool kits in eastern Beringia. Potter (2008) hypothesizes that human population may have peaked at 13,000–14,000 CALYBP, an interval of technological diversity, followed by a precipitous population decline at 12,000–13,000 CALYBP, a period when microblade technology predominated. The age range of the Linda’s Point hearth spans this 13,000 CALYBP threshold. It also corresponds to a period of Northern Hemisphere temperature instability marking the transition from the warmer Allerød to the cooler Younger Dryas, dated 12,800–13,200 CALYBP (Steffensen et al. 2008). Several other terminal-Pleistocene occupations in the Tanana drainage radiocarbon date to within 2σ of this critical era, including Upward...
Sun River (C1), Walker Road (C1), and Dry Creek (C1) (Potter 2008; Potter et al. 2011).

A recent pollen proxy record from Lost Lake, in the upper Tanana lowlands, gives evidence of biome fluctuation at the 13,000 CALYBP threshold (Tinner et al. 2006). There, Salix abundance rose sharply at 13,500–14,500 CALYBP, declined concurrent with a Betula increase, and then stabilized c.13,000–13,200 CALYBP. Dated Salix charcoal from hearths at Swan Point (14,000 CALYBP; Holmes 2011) and Upward Sun River (13,200 CALYBP; Potter 2008) bracket the decline. Temporal concordance among these events may reflect causal linkages.

Opposing such linkage is a proxy study that concludes no Younger Dryas event occurred in central Alaska (Kokorowski et al. 2008). This implies no climatic fluctuation occurred at the 13,000 CALYBP boundary sufficient to drive human population and technological events. We find this result questionable since the eastern Beringian records, ranked as chronologically reliable by the study’s authors, split evenly between those records that show a Younger Dryas signal and those that do not. Additionally, the central Alaskan proxies used have only a multi-century scale temporal resolution, too coarse to model a climate oscillation that lasted c. 800 years (Steffensen et al. 2008: Figure 2). Set against this background, ongoing research at Linda’s Point promises to expand to our understanding of the Chindadn complex and its paleoenvironmental context.

We thank the Linda’s Point landowners (Josephine Beaver, Sam and Susan Freese), the Healy Lake Traditional Council, the Bureau of Indian Affairs and Tanana Chiefs Conference for making this research possible. We are also grateful to our 2010 field crew: Nick Jarman, Amy Krull, John Grieve, Evie Combs, and Raquel Derry. Support is appreciated from JoAnn and Corey Polston, Fred and Paul Kirsteatter, Jr. and E. James Dixon. Special thanks go to John P. Cook for sharing his original field data.

References Cited


Reger, R. D., D. S. P. Stevens, and D. N. Solie 2008 Surficial Geology of the Alaska Highway
An American (Projectile Point) in Paris

Frédéric Sellet, David J. Meltzer, Águeda Vilhena Vialou, and Denis Vialou

➤ Keywords: Folsom type site, history of Paleoindian archaeology, Musée de l’Homme

Formal excavations at the Folsom type site were conducted from 1926 to 1928, and because of its importance the site proved to be a magnet for tourists (archaeological and otherwise) in later years. Subsequent visitors to the site occasionally found artifacts, primarily projectile points. Not all these specimens made their way into museum collections; some are in private hands, and of the 28 projectile points recorded as having been found at the Folsom site, 6 are missing (Meltzer 2006:255–56). In some cases, photographs of the missing specimens are available (e.g., Howard 1935: Plate 33; Wormington 1957: Figure 7); in other instances, the points are only known from brief mention in correspondence (Meltzer 2006: Table 8.2). It would appear that one of those missing points, or perhaps one not known to have gone missing, has been living in Paris since the 1930s.

Recently, one of us (FS) was examining a portion of the collections at the Musée de l’Homme, and came across a Folsom point that is part of the Colonel L. Vésigné collection. This Folsom point, made of Flattop chert, is 51.7 mm long.
long and 24.8 mm wide (Figure 1). The point displays obvious impact damage, and has one ear broken off, perhaps the result of end shock. The point is ground along its lower edges and has a small ‘notch’ in the basal concavity, which appears to be a break that occurred after the point was no longer in its haft.

This specimen, along with nine other fluted points, was in a photograph accompanying a brief note—“Les pointes de Folsom”—published by Vésignié in 1937. The 10 specimens were identified as Folsom points, which was common in the 1930s (Meltzer 2006:251), though all but one are Clovis and Cumberland points from five different Eastern and Midwestern states.

There are two obvious questions raised by the lone Folsom specimen: Is it indeed from the Folsom type site? And, if so, how did it end up in Paris?

In regard to the first question, Vésignié’s figure caption explicitly identifies the source of the point as Folsom, New Mexico. He describes the photograph as illustrating “a small series of points of the Folsom type, all found in various areas of the United States, with the exception of one, unfortunately slightly damaged, which comes from Folsom itself” (Vésignié 1937:326, emphasis added). Only one other fluted point in the photograph—a Cumberland with a missing base—appears “slightly damaged,” but as such is far less worthy of comment than the impact-fractured Folsom point with its missing ear. The Cumberland point was also explicitly identified as coming from Kentucky.

If the Vésignié Folsom point is from the type site, how did it get to Paris? There is no archival record of an exchange of artifacts between the Musée de l’Homme and either the then-Colorado Museum of Natural History (now Denver Museum of Nature and Science) or the American Museum of Natural
History, which excavated at Folsom in 1926–1927 and 1928, respectively. As best can be determined, all the projectile points from the excavations by these institutions are accounted for (Meltzer 2006:251–52, Table 8.2).

Of the six Folsom points found by later visitors and known to be missing, five were discovered before 1937. Of those, only two are complete. One of the complete specimens, known from photographs in Howard (1935) and Wormington (1957), is not the Vésignié point. Therefore, the only remaining candidate for a trans-Atlantic crossing was a point found by Fred Howarth, the Raton, New Mexico, banker who first helped call attention to the site and was a regular visitor there during the excavations and afterward (Meltzer 2006). In the summer of 1933, he found a “good arrowhead” at the site which he described as “not the typical Folsom point but exactly the same type as the one found by [Barnum] Brown a year or two ago. But is a much better specimen, being whole, just a little tiny chip from one corner.” (Howarth to Cook, July 25, 1933, HJC/AGFO; specimen Sn 19 in Meltzer 2006:Table 8.2).

Howarth’s description of the condition of the point is certainly consistent with the Vésignié point. As telling, perhaps, is Howarth’s observation that it is the “same type” as the point found by Brown; if “type” refers to lithic raw material, as it appears to in this context, it is noteworthy that Brown’s point was also made of Flattop chert—one of only three at the site made of this toolstone (Meltzer 2006: Table 8.5).

Regardless of whether Vésignié’s point is that Howarth point, or another not known to be missing from the site, the trail from the Folsom site to the Musée de l’Homme in Paris cannot be traced. The only known comment on the disposition of the point was Howarth’s to Harold Cook:

> I have said nothing to the Colorado [Museum of Natural History] people about it as yet but I suppose that I should send it to them as all the data that is possibly available should be kept together where it can be studied by experts. However in this connection I will wait for your opinion on it before I say anything about it to anyone.” (Howarth to Cook, July 25, 1933, HJC/AGFO).

Regardless of how this point, or some other got to France, it is known that it was part of a large collection of North American artifacts that Vésignié, the former president of the Société Préhistorique Française, amassed and donated, which unfortunately was never fully catalogued (Smith 1961:428). All that is known of how this Folsom fluted point got into Vésignié’s hands is his statement that the specimen “has been kindly given to me by our colleague Kelley, with a series of photos and documents, for which I would like to thank him greatly” (Vésignié 1937:326). Harper Kelley, an American archaeologist in Paris, was at the Musée de L’Homme from 1917 on and was responsible for building up the institution’s collections. Although he presumably had good connections with his country of birth, how a Folsom point from the type site got from Howarth (or some unknown person) to Kelley is not known.

References Cited

Looking to the North: Results from the XRF Analysis of Pre-Archaic Projectile Points from Hanging Rock Shelter, Northwest Nevada

Geoffrey M. Smith, Stephen LaValley, and Craig Skinner

Keywords: Source provenance analysis, Paleoindians, Great Basin

Hanging Rock Shelter (HRS), located in northwest Nevada, was excavated by Thomas Layton in 1967–1968 (Layton 1970). Although undated, the recovery of over 40 stemmed and concave-base projectile points from the site’s basal stratum led Layton to conclude that HRS was initially occupied between 10,000 and 12,000 CALYBP. This approximation is wholly consistent with both current estimates of the antiquity of stemmed and concave-base points in the Great Basin (Beck and Jones 1997) and the basal stratum from nearby Last Supper Cave, which was occupied as early as ~12,060 CALYBP and contained a similar number of pre-Archaic points (Smith 2008).

The stemmed and concave-base points from HRS represent one of the few sizeable assemblages of Pre-Archaic points from northwest Nevada not yet submitted for X-ray fluorescence source provenance analysis. As part of an ongoing effort to better understand pre-Archaic toolstone procurement patterns in that region, we submitted 31 obsidian stemmed points from HRS for geochemical characterization. Eleven known and one unknown geochemical types were identified. Sources of these obsidians are located in northwest Nevada, northeastern California, and south-central Oregon, and most of the points (90.3%; n = 28) are made on materials that originated within 78 km of HRS. Two geochemical types (Venator and Whitewater Draw) located more than 240 km distant are present but represented by isolated specimens (Table 1).

Our results are consistent with those derived from similar assemblages in the region including Last Supper Cave (Smith 2008), the Parman localities (Smith 2007), and the Black Rock Desert (Amick 1997; Camp 2009). Most of
Table 1. Geochemical types represented in the sample of obsidian pre-Archaic projectile points from Hanging Rock Shelter.

<table>
<thead>
<tr>
<th>Geochemical type</th>
<th>N</th>
<th>Percentage</th>
<th>Distance to nearest source (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Badger Creek, NV</td>
<td>1</td>
<td>3.2</td>
<td>27</td>
</tr>
<tr>
<td>Bordwell Springs/Pinto Peak/Fox Mountain, NV</td>
<td>7</td>
<td>22.6</td>
<td>23</td>
</tr>
<tr>
<td>Buck Mountain, CA</td>
<td>2</td>
<td>6.5</td>
<td>70</td>
</tr>
<tr>
<td>Buffalo Hills, NV</td>
<td>1</td>
<td>3.2</td>
<td>78</td>
</tr>
<tr>
<td>Cowhead Lake, CA</td>
<td>2</td>
<td>6.5</td>
<td>64</td>
</tr>
<tr>
<td>Coyote Spring, NV</td>
<td>2</td>
<td>6.5</td>
<td>7</td>
</tr>
<tr>
<td>Hawks Valley, NV/OR</td>
<td>1</td>
<td>3.2</td>
<td>51</td>
</tr>
<tr>
<td>Massacre Lake/Guano Valley, NV/OR</td>
<td>11</td>
<td>35.5</td>
<td>17</td>
</tr>
<tr>
<td>Surveyor Spring, NV/OR</td>
<td>1</td>
<td>3.2</td>
<td>68</td>
</tr>
<tr>
<td>Venator, OR</td>
<td>1</td>
<td>3.2</td>
<td>244</td>
</tr>
<tr>
<td>Whitewater Ridge, OR</td>
<td>1</td>
<td>3.2</td>
<td>267</td>
</tr>
<tr>
<td>Unknown</td>
<td>1</td>
<td>3.2</td>
<td>Unknown</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

the material was procured locally—a finding that is not surprising given the abundance of high-quality obsidian in northwest Nevada. No sources of obsidian from south of the Black Rock Desert are represented in the HRS sample, which is consistent with the results of a recent synthesis of source provenance work in the area that suggests there was little long-distance north-south movement of toolstone in the western Great Basin (Smith 2010). As such, we do not think that Pre-Archaic groups in northwest Nevada had strong socio-economic ties to the western Great Basin and instead likely possessed a greater affinity with pre-Archaic populations to the north. This possibility is supported by marked similarities in toolstone procurement and mobility strategies (Smith 2011), perishable textile technologies (Connolly and Barker 2004), and rock-art styles (Woody 1996) in northwest Nevada and south-central Oregon.

Funding for this project was provided by the Great Basin Paleoindian Research Unit, Department of Anthropology, University of Nevada, Reno. Craig Skinner conducted the XRF analysis of artifacts from Hanging Rock Shelter. Thanks to the staff of the Nevada State Museum for making the artifacts available for study and Tom Layton for establishing much of what we know about the prehistory of the High Rock Country of northwest Nevada.

References Cited


Geometric Morphometrics and the Effect of Raw-Material Quality on the Shape of Clovis Points

Heather Smith

**Keywords:** Fluted points, geometric morphometrics, raw-material quality

Determining the relative proportions of various raw materials in stone-tool assemblages has traditionally focused on distinguishing between high- and low-quality raw materials and their use in making formal versus expedient tools (Andrefsky 1994; Jones 1979; Kilby 2008; Kuhn 1991). The effect on artifact shape of so-called “high-quality” raw materials, however, has not been directly addressed. It is well known that Clovis assemblages are characteristically made of fine-grained, high-quality raw materials, and that cached Clovis artifacts are also made of a variety of high-quality toolstones (Goodyear 1979; Kelly and Todd 1988; Kilby 2008).

To determine if the shape of projectile point was determined by the type of high-quality raw material used, a landmark-based approach to geometric morphometrics was used. First, Cartesian coordinates were plotted around the perimeter of each artifact following Smith (2010). Then coordinate data were imported into the tps Relative Warps program (tpsRelw) (v. 1.46; Rohlf 2008), which generated partial warp scores, relative warp scores, and centroid size for each artifact. Relative warp scores serve as principal components, following Bookstein (1991). The first four scores, constituting 94.75% of shape variability for the dataset, were used in statistical analysis.

Hierarchical multivariate cluster analysis using Ward’s method was done on
three assemblages of projectile points: Fenn cache, Lehner site, and Drake cache (Figure 1). Data on raw materials were drawn from Frison and Bradley (1999:10–19, 40–45, 96), Haury et al. (1959:18), and Kilby (2008:86–87).

Artifacts from the Fenn cache were tested to determine whether points made from Utah agate clustered closer together than points made from Green River chert, obsidian, quartz, red jasper, and chert possibly from the Amsden Formation in Wyoming (Kilby 2008). If the type of raw material affected point shape, then we would expect tools made from Utah agate to be most closely similar in shape to each other and consequently generate the shortest Euclidian distances. The resulting Euclidean distance matrix and corresponding dendrogram (Figure 1A) shows that the two projectile points within the Fenn cache most similar in shape are those made from Green River chert (120) and red jasper (148). Points made of Green River chert (121) and red jasper (149) also formed the next-closest affinity. The third-closest relationship was between projectile points made from quartz (155) and Utah agate (142). Furthermore, the pair of points within the Fenn cache least similar in shape made from Utah agate (138) and Green River chert (120).

Figure 1. Results of the multivariate cluster analysis conducted within the fluted-point assemblages from the Fenn cache, Lehner site, and Drake cache.
shape were both made from Utah agate (138 and 130). Projectile points made from the same toolstone did not cluster together, and the type of raw material thus had no effect on the variability of shape of projectile points in the Fenn cache.

If shape was affected by the type of toolstone in the Lehner assemblage, then chert, quartz, chalcedony, and jasper should form specific groups in the cluster diagram (Figure 1B). However, the two projectile points most similar in shape were made of two different materials, quartz (520707) and chalcedony (526704), and the second-most similar in shape were points made from chert (526629) and chalcedony (526652). Conversely, the two points with the greatest Euclidean distances (least similar in shape) were the only two points made from the same material, quartz (526708 and 520707). Thus, the points from the Lehner site do not cluster according to the type of raw material.

If the type of raw material constrained the shape of fluted points in the Drake cache, then the two projectile points not made from Alibates dolomite should fall outside the multivariate cluster of Alibates points (Figure 1C). The greatest similarity of shape within the Drake point assemblage was found in four points of Alibates dolomite; however, the third-most similar were a chalcedony point and an Alibates dolomite point. Moreover, the point made from Edwards chert did not become an outlier to the Drake cluster. Two points, both made from Alibates dolomite, were even less similar in shape to the majority of the Drake cache points than the point made of Edwards chert. The type of raw material is therefore not a factor that determines shape within the Drake cache.

Multivariate cluster analyses made on the assemblages of the Fenn, Drake, and Lehner sites determined that the shape of projectile points was not determined by the kind of high-quality raw material used. Artifact shape can therefore be better attributed to cultural factors influencing tool manufacture such as normative templates of tool style or the skill level of the knapper.

This analysis could not have been conducted without the help and guidance of Ted Goebel, Michael Waters, David Carlson, and Tom DeWitt. I am most appreciative of Dennis Stanford and Pegi Jodry for allowing me to analyze fluted points from the Drake cache and Lehner Site, as well as Michael Waters and Ted Goebel for allowing me to analyze the Fenn cache. I am also grateful to David Kilby for his helpful feedback.

References Cited


New Evidence for the Paleoindian Occupation of the Narragansett Basin, Rhode Island and Massachusetts

Kevin P. Smith, Amy Smith, and Nina Hellebrekers

Keywords: Paleoindian, New England, lithics

The Paleoindian occupation of the Narragansett Basin in Rhode Island and adjacent Massachusetts is poorly understood. The Wapanucket 8 site produced a small suite of early-Paleoindian diagnostics from mixed contexts (Bradley and Boudreau 2006a; Robbins and Agogino 1964), and several fluted points have been identified in Massachusetts collections (Bradley and Boudreau 2006b, 2008). But only three diagnostic Paleoindian points were known from Rhode Island before 2002 (Rhode Island Historical Preservation and Historical Commission 2002).

The Haffenreffer Museum of Anthropology curates nearly 40,000 stone tools from Rhode Island and Massachusetts purchased from local collectors in the early 20th century by Rudolf F. Haffenreffer, Jr., and donated to Brown University in 1955 (Robinson 1986, Gregg 1994). In a recent reevaluation of this major collection, we identified 13 diagnostic Paleoindian points, 9 Paleoindian tools, and 4 fluted-point preforms from the Narragansett Basin. Three additional Paleoindian projectile points and a trianguloid scraper-graver from Massachusetts are also most likely from the Narragansett Basin. Typological assessment of these previously undocumented objects (following Bradley et al. 2008) indicates significant early- and late-Paleoindian activity in the region.

The early-Paleoindian diagnostics include two complete Bull Brook/West
Athens Hill points from southwestern RI manufactured on Onondaga and black Normanskill/Mount Merino cherts (Funk 2004); a yellow jasper channel flake and a black Normanskill chert endscraper-graver, both from Diamond Hill, RI; an endscraper on a fractured gray chert fluted-point base from Attleboro, MA; a green Normanskill chert combination end/sidescraper with graver spurs from the Palmer River in Barrington, RI; and a rhyolite composite scraper-graver from North Rehoboth, MA.

During the Younger Dryas, currently inundated portions of Narragansett Bay were deep valleys carrying rivers that flowed into embayments located 25–30 km south of the present shoreline and 35–37 m below current sea level (McMullen et al. 2007, 2008, 2009). The scattered distribution of early-Paleoindian materials in the Haffenreffer Museum collections suggests extensive foraging within the upland headwaters of these now-drowned valley systems. Relying on lithic raw materials originating in formations 150–250 km distant is consistent with high mobility and has regional parallels in assemblages from Bull Brook (Robinson et al. 2009) and Wapanucket 8 (Bradley and Boudreau 2006a).

In contrast, late-Paleoindian specimens in the Museum collection cluster in two geographically separate parts of the basin. One cluster—on the morainal divide between the Narragansett and Boston Basins near Attleboro, MA—includes four Cormier-Nicholas points, two bifaces similar to Hi-Lo points (Ellis 2004), and a finely serrated quartz lanceolate point with pronounced basal thinning. The second cluster—from an area bounded by the confluences of the paleo-channels of the Providence, Pawtuxet, and Taunton Rivers—includes four Cormier-Nicholas points from South Swansea, MA, and Barrington, RI, as well as an assemblage of five late-Paleoindian projectile points, three trianguloid endscrapers (one fluted, another on a jasper channel flake), one composite scraper-graver, and two fluted performs from Riverside, RI. The Riverside assemblage suggests particularly intensive activity at the now-drowned confluence of the Pawtuxet and Providence Rivers.

These two clusters, each roughly 15 km in diameter, are separated by a zone of nearly equal distance from which no late-Paleoindian materials are known, despite comparable attention by early collectors. Recently, three additional Cormier-Nicholas points were reported from previously undocumented locations in Massachusetts (Bradley and Boudreau 2006b). All were found within the geographic boundaries of the two clusters defined here, suggesting that their coherence reflects more than the collecting preferences of the individuals who made Haffenreffer’s collections.

Tentatively, we suggest that these clusters represent focal areas for increasingly redundant and/or enduring patterns of settlement and/or resource use in the uplands and headwaters of the basin’s drowned late-Pleistocene river systems. This intensive, focused pattern contrasts with the extensive, scattered distribution of early-Paleoindian diagnostics from the same region. Significantly, nearly all late-Paleoindian tools in the Haffenreffer collection are made from fine-grained igneous rocks available within 75–100 km of the locations where they were found, reinforcing a sense of groups settling into the region rather than moving through it. One Cormier-Nicholas point, however, ap-
pears to be manufactured from Mount Jasper or Jefferson (New Hampshire) rhyolite (Pollock et al. 2008), suggesting the existence of some long-distance interactions.

These new data significantly expand the number of Paleoindian tools known from the Narragansett Basin; suggest shifts from extensive land-use patterns during the Little Dryas to intensive, regionally focused strategies afterwards; and document shifts in raw material preferences at the end of the Pleistocene. These initial findings provide foundations for future research and reaffirm the value of curated collections for contemporary research.

References Cited


Gregg, D. S. 1994 Archaeological Collections, in Passionate Hobby: Rudolf Frederick Haffenreffer and the King Philip Museum, edited by Shepard Krech III. Haffenreffer Museum of Anthropology, Bristol, RI.


New Finds and Related Obsidian Studies at the Sage Hen Gap Fluted-Point Site, Harney County, Oregon

Scott P. Thomas, Patrick W. O’Grady, and Michael F. Rondeau

Keywords: Fluted points, obsidian, Great Basin

Sage Hen Gap (35HA3548) is a fluted-point site on the northern perimeter of the Harney Basin in southeastern Oregon. The site was initially recorded in 1984, and five fluted-point discoveries were reported by O’Grady et al. (2008) (3548-CL1 through 5). Six additional fluted points recovered since that time are reported here (3548-CL6 through 11). All are obsidian and surface finds.

Rondeau (2008) reports that specimen 3548-CL6 exhibits classic fluted-point attributes (Figure 1A). Specimens 3548-CL7–CL9 were found in 2009 (Figure 1B–D). While 3548-CL8 has single flute scars on both sides, two of the three specimens (3548-CL7 and 3548-CL9) have multiple flute scars on one face and single flute scars on the other (Rondeau 2010a). Rondeau considers the multiple flute scars a possible deviation from “classic” fluted-point attributes.

---

Figure 1. Six fluted specimens from Sage Hen Gap.

Scott P. Thomas, Burns District Bureau of Land Management, 28910 Highway 20 West, Hines, OR, 97738; e-mail: scott_thomas@blm.gov

Patrick O’Grady, University of Oregon Museum of Natural and Cultural History, 1224 University of Oregon, Eugene, OR, 97403-1224; e-mail: pogrady@uoregon.edu

Michael F. Rondeau, Rondeau Archeological, 251 Rockmont Circle, Sacramento, CA, 95835; e-mail: mikerondo@yahoo.com
tributes, but concludes all three specimens share other attributes (edge grinding, flute scratches, and size) that support Western Clovis designation. 3548-CL10 (Figure 1E) is a medial fragment of a point with biconcave cross section, a single flute scar on each face, and flute scratching on one flute surface (Rondeau, 2010b). Its size and other technological attributes align it with Western Clovis. Specimen 3548-CL11 (Figure 1F) is a triangular-shaped medial fragment with a single flute scar on one face. Step fractures on the opposite face reflect repeated impact damage (Rondeau 2010b). This fragment has a biconcave cross section and discontinuous edge grinding on the remaining lateral margin. Although the piece is fragmentary, its attributes confirm its similarity to Western Clovis points.

A summary of obsidian XRF sourcing and obsidian-hydration analyses of the fluted points is shown in Table 1 (Skinner and Thatcher 2007, 2008a, 2008b, 2010a, 2010b, 2010c). The Buck Spring source is available on site, while the Rimrock Spring and Big Stick sources are 15 and 30 km from Sage Hen Gap, respectively. As is commonly known, different obsidian sources can hydrate at different rates. Rimrock Spring and Big Stick sources consistently hydrate at a much slower rate than Buck Spring, hence their thinner hydration rinds.

The mean obsidian-hydration-rind measurements for fluted points made of Buck Spring obsidian is 10.1 µm. Although the individual hydration-rind measurements for the fluted points vary widely, the population of Buck Spring (n = 181, mean = 9.8 µm) obsidian hydration measurements from the site has a very low (0.09) coefficient of variation (CV). Such a low CV suggests the obsidian was discarded at the site during one event or multiple events closely spaced in time. A tentative hydration rate (8µm^2/1000 years) for Buck Spring obsidian has been calculated using pairs of absolute dates (^{14}C and tephra) with associated hydration-rind measurements from other sites in the Harney Basin (Thomas and O’Grady 2006). If this rate is applied to the mean hydra-

Table 1. XRF sourcing and obsidian hydration data for fluted points from Sage Hen Gap, (35HA3548).

<table>
<thead>
<tr>
<th>Specimen no.</th>
<th>Obsidian source</th>
<th>Obsidian hydration rind thickness (µm)</th>
<th>Estimated hydration rate(µm^2/1000 years)</th>
<th>Estimated age (CALYBP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3548-CL1</td>
<td>Buck Spring</td>
<td>9.7</td>
<td>8.00</td>
<td>11,800</td>
</tr>
<tr>
<td>3548-CL2</td>
<td>Big Stick</td>
<td>7.3</td>
<td>unknown</td>
<td>no estimate</td>
</tr>
<tr>
<td>3548-CL3</td>
<td>Buck Spring</td>
<td>10.8</td>
<td>8.00</td>
<td>14,600</td>
</tr>
<tr>
<td>3548-CL4</td>
<td>Buck Spring</td>
<td>9.2</td>
<td>8.00</td>
<td>10,600</td>
</tr>
<tr>
<td>3548-CL5</td>
<td>Rimrock Spring</td>
<td>6.1</td>
<td>unknown</td>
<td>no estimate</td>
</tr>
<tr>
<td>3548-CL6</td>
<td>Buck Spring</td>
<td>8.2</td>
<td>8.00</td>
<td>8,400</td>
</tr>
<tr>
<td>3548-CL7</td>
<td>Buck Springs</td>
<td>10.4</td>
<td>8.00</td>
<td>13,500</td>
</tr>
<tr>
<td>(CL-09-01)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3548-CL8</td>
<td>Rimrock Spring</td>
<td>5.8</td>
<td>unknown</td>
<td>no estimate</td>
</tr>
<tr>
<td>(CL-09-2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3548-CL9</td>
<td>Rimrock Spring</td>
<td>5.9</td>
<td>unknown</td>
<td>no estimate</td>
</tr>
<tr>
<td>(CL-09-3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3548-CL10</td>
<td>Big Stick</td>
<td>5.2*</td>
<td>unknown</td>
<td>no estimate</td>
</tr>
<tr>
<td>(CL-09-3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3548-CL11</td>
<td>Buck Spring</td>
<td>11.8</td>
<td>8.00</td>
<td>17,400</td>
</tr>
<tr>
<td>summary</td>
<td>Buck Spring</td>
<td>N = 6</td>
<td>8.00</td>
<td>12,500</td>
</tr>
<tr>
<td>specimens</td>
<td></td>
<td>Mean = 10.01 µm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*This hydration rind has a diffuse hydration boundary and has been weathered.
tion-rind thickness of the Sage Hen Gap fluted points made of Buck Spring obsidian, a date of 12,500 CALYBP is derived. Tentative hydration rates for Rimrock Spring and Big Stick have not been calculated because the appropriate $^{14}$C/hydration rind thickness data pairs have not been obtained. None of the specimens has been associated with $^{14}$C dates, and work continues at Sage Hen Gap and other sites in the region to find fluted points in stratigraphic and datable contexts. Nevertheless, it is clear that these fluted points with the size and technological attributes of Western Clovis yield some of the largest hydration rinds for any obsidian source in this region.

References Cited


——— 2010a NWROSL Results 2010:15. Manuscript on File at Burns BLM District Office.


——— 2010c NWROSL Results 2010:151. Manuscript on File at Burns BLM District Office.


A Submerged Suwannee Point Site from Lake George, St. Johns River, Florida

David K. Thulman

Keywords: Paleoindian, Florida, Suwannee

The Lake George Point site (PU1470) is a newly identified Suwannee site submerged in Lake George in the St. Johns River in northeast Florida. Until recently recorded Paleoindian points were rare in this region of the state.

David K. Thulman, Anthropology Department, The George Washington University, 2110 G St. NW, Washington, DC 20052; email: dthulman@gwu.edu
(Dunbar 1991), and only one Paleoindian site had been recorded (Edwards 1954). In 2000 a local collector reported several Suwannee points (Figure 1) from Lake George. Over several years he collected more than 40 whole points and snapped bases from the site by probing the lake bottom, along with many unifacial tools and Pleistocene faunal remains. His entire collection from the region around Lake George and nearby Crescent Lake includes 88 Paleoindian hafted bifaces (Thulman 2006a; images and data on these points are available on the PIDBA website), all but 10 of which were found in the lakes or along their shorelines. Suwannee-age material has never been dated but is presumed to be post-Clovis in age (ca. 10,500–10,200 RCYBP; Daniel and Wisenbaker 1987).

The site is located on the end of a submerged sand spit (~1 m in depth) that extends approximately 150 m from the northeast shore of the lake. Lake George is a broad (10 km by 18 km) shallow (average depth ~3–4 m) lake intersected by the St. Johns River. Several springs discharge into the western side of the lake. During the late Pleistocene the lake would have been a dry, flat broad plain, and the site would have provided its occupants with an advantageous vantage point (Thulman 2009).

Most of the points are made of Ocala chert, whose nearest known sources are 65 km to the west, near Silver Springs, Marion County. The complete points are all resharpened. Other than the points, it was not possible to identify with confidence which tools had come from the site. However, a cursory review showed they are dominated by unifaces similar to tools found at the Suwannee/Bolen site of Harney Flats in Hillsborough County (Daniel and Wisenbaker 1987) and another collection of Paleoindian/early Archaic tools from the Santa Fe River in Alachua County (Thulman 2006b).

In 2009, an underwater survey was made of the site to determine whether any of the Paleoindian occupation remained. The depth of the site ranged

Figure 1. Four complete Suwannee points from the Lake George Point site.
from approximately 1m to 2 m (although parts of the site may remain undisturbed in deeper water), and the survey was conducted by divers along several transects and at random loci. Although not deep, the water was dark, which made surveying difficult. We found no diagnostic Paleoindian artifacts, although many unstained remains of Pleistocene fauna were recovered, including horse, giant tortoise, mammoth, and mastodon. Holocene species were also recovered, but most of that material was stained, indicating that the Pleistocene deposits are segregated from the modern surface. Previous coring by the USGS in this area of the lake found deep deposits of preserved vegetation, indicating that conditions are favorable for preserving Paleoindian–age organic artifacts. Future plans call for mapping portions of the lake bottom, searching for promising landforms and conducting additional surveys.

References Cited


The Paleoamerican Occupation of Cueva Bautista: Late-Pleistocene Human Evidence from the Bolivian Highlands

Juan Albarracin-Jordan and José M. Capriles

➤ Keywords: Dry cave archaeology, lithic artifacts, Bolivia

Research on the early peopling of the Americas has progressed enormously during the last several decades. Unfortunately, archaeological research on late-Pleistocene human colonization in current Bolivian territory has received little attention. Here we report the first archaeologically documented late-Pleistocene human occupation from southwest Bolivia (Figure 1A). In 2008, we surveyed the Sora River valley, a narrow basin defined by two parallel outcrops of ignimbrite rock within the extremely high and dry Lípez desert (Albarracin-Jordan 2000). During this survey, a number of caves and rock shelters with stratified prehistoric sequences were discovered.

Test units were excavated in three of the caves, providing abundant evidence of pre-Hispanic occupations. Major findings came from Cueva Bautista (AL03) located at 3930 m above sea level and about 20 m above the nearby river. A 1-m² test unit located at the center of the cave produced the following stratigraphic sequence (Figure 1B), described from top downward. The first layer was a thick deposit (45 cm) of compacted llama and sheep manure that extended throughout the entire cave. Beneath this protecting event lay an ashy lens capping a cultural fill that contained a variety of fragmented artifacts, including pre-Hispanic ceramics, lithics, camelid bones, as well as rodent and camelid dung. At 75 cm beneath the surface, a ritual leather bag was discovered. The bag contained a set of eight polished stones and was embedded in a feature of well-preserved grass and cobbles. A leather fragment of the bag was AMS dated to 3111 ± 54 RCYBP or 3384–3101 CALYBP (AA84157). Beneath this layer, a thick organically rich fill was deposited containing...
smaller densities of artifacts and a great quantity of regurgitated owl (probably barn owl, *Tyto alba*) pellets. A layer followed composed of rock and wall fall deposited within sandy silt. This layer included several owl pellets and rodent bones but was otherwise culturally sterile. About 1.70 m below the surface, lithic artifacts were found in association with charcoal fragments from an ephemeral ash lens. A charcoal sample was AMS dated to 10,917 ± 69 RCYBP or 12,989–12,806 CALYBP (AA84158). Excavations stopped at 1.80 cm below the surface at what appeared to be culturally sterile fill.

The lithic artifacts recovered from the late-Pleistocene stratum at Cueva Bautista included five light brown chert flakes, one red jasper flake, one chalcedony flake, five obsidian flakes, and one black basalt flake (Figure 1C). One of the obsidian flakes had been retouched and was possibly used as a lateral scraper (i, Figure 1C). Most of the identified lithic raw materials are locally and regionally available; the closest known obsidian sources are Cerro Zapaleri and Caldera Vilama, near the Bolivian-Argentinean-Chilean border, and roughly 150 km southeast of the site (Nielsen 2004; Yacobaccio et al. 2004).

The late-Pleistocene human occupation surface recorded at Cueva Bautista represents the first radiocarbon-dated Paleoamerican site from southwest
Bolivia. Contextual evidence suggests the site was unused between this early occupation event and the Early Formative Period (ca. 3300 CALYBP). Paleoclimatological studies from the Bolivian Southern Altiplano report the presence of a minor lake cycle (Coipasa), between 13,000 and 11,000 CALYBP, accompanied by a much moister and warmer climate regime than today (Baker et al. 2001; Placzek et al. 2006; Rigsby et al. 2005; Sylvestre et al. 1999). Similarly, research carried out in the neighboring Chilean Atacama Desert suggests the terminal Pleistocene was characterized by a humid climate phase, followed by incremental aridity that peaked during the middle Holocene and caused major population displacements (Grosjean et al. 2005; Moreno et al. 2009; Nester et al. 2007; Núñez et al. 2002). Accordingly, Lípez was probably an attractive environment for foraging bands during episodes of climatic amelioration. Our research in Lípez continues, identifying additional sites and activities connected with early human adaptation to high altitude environments and changing climatic conditions.

Archaeological research in Lípez is supported by the National Geographic Society, Bartolomé de Las Casas Foundation, Monopol Ltda., the Viceministerio de Culturas de Bolivia, and the communities of Alota and San Agustín. Radiocarbon dating was supported by the NSF-AMS Facility at the University of Arizona.

References Cited


GIS Archaeological Site Record and Remarks on Paleoindian Finds in the Rio Negro River Basin, Central Uruguay

Jorge Femenías, Hugo G. Nami, Andrés Florines, and Arturo Toscano

Keywords: GIS database, Fishtail points, Uruguay

Systematic Paleoindian research began in Uruguay at the end of the 1990s, and since then various activities have been conducted and reported on Pleistocene topics (Cavalloto et al. 2002; López et al. 2001; Nami 2001a, 2001b, 2001c, 2008a, 2010). Identifying Paleoindian sites with stratigraphic evidence has been a significant focus of these surveys, among them a long-term project in the basin of the Rio Negro (Nami 2007, 2008b, 2009, 2010; Nami and Castro 2010), which had been a focus of archaeological interest during previous years (i.e., Baeza et al. 2001; Taddei 1980). This region is characterized by a large amount of flaked- and ground-stone remains, mostly Holocene projectile points, scrapers, blade and flake cores, and other artifacts, but Paleoindian Fishtail, or Fell, projectile points are also widespread compared with other parts of South America.

Beginning in the 1970s, Femenías recorded and photographed more than 120 specimens throughout Uruguay. Most of the Fell points were found by collectors and amateur archaeologists, who had varying motivations. Some destroyed archaeological deposits or removed surface artifacts without making any records. Generally, they sold them on the black market, which is characterized by commercialization of legitimate artifacts as well as falsifications, and some may have ended up in recognized museums (Meneghin 2008). A few individuals who are aware of the scientific value of Fishtail points have made surface collections when the water level falls in the river and behind the Gabriel Terra dam. They have carefully recorded their finds and have allowed profes-
sional archaeologists to study them (Frison 1984). In this physiographically complex area, their information is helpful in a number of ways. In the case reported here, they have been helpful in identifying Paleoamerican surface and stratigraphic sites, and discussing typological and technological topics.

We used geographical information system (GIS) software to produce a regional site database along the Negro River basin, where the Gabriel Terra dam was constructed in 1945. Its construction raised the river level ca. 15–20 m and formed the Rincón del Bonete Lake (Figure 1A). Our site database was augmented by data from field notes by the pioneering Uruguayan archaeolo-

![Figure 1A. Map of the Negro River basin and location of recorded sites.](image)

gist Antonio Taddei and by information provided by collectors living in the region. Most of the sites show vestiges of Holocene occupations, but indubitable Paleoindian remains were encountered on the surface of pre-dam sand dunes and eroded deposits along the post-dam basin (i.e., Paso del Puerto) (Nami 2001a, 2007; Taddei 1980). A remarkable feature is that most finds are located near the mouths of small creeks such as the Cacique, Minas de Callorda (MC), and Los Molles (LM) sites. Several of them yielded diverse kinds of Paleoindian surface finds, mainly Fell points (Figure 1F–I). Hence, they have been visited to evaluate their potential to provide stratified material. MC and LM have stratigraphic sections with evidence of multicomponent archaeological layers, and both sites are being excavated. A probable late-Pleistocene/early-Holocene layer has been identified at MC (Nami 2007), and the archaeological layer at the top of the probable late-Pleistocene “Dolores formation” at LM is being dated. Scattered Paleoindian artifacts have been found along the deposits eroded by the river and Rincón del Bonete Lake; in many cases, however, their precise locations were not registered, so their interpretation must be used with caution. This is also the case with a Fishtail
miniature recently recovered south of San Gregorio de Polanco beach (Figure 1E), which was studied before it was sold to an Uruguayan collector. Another well-made specimen from Tres Arboles Creek basin was also sold by its discoverer (Figure 1D). Some collectors have forgotten the precise locations of their finds (Figure 1C). In other cases, information has been lost because of the death of a collector, for example, the collection of Mr. Derici currently curated by the Junta Local Autónoma de Paso de los Toros; C, M. E. Vera; D, H–I, S. Bálsamo; E, W. Suárez; F, W. Aizpún. Photographs: B, D, E, H–I, H. Nami; C, G, U. Meneghin; F, J. Femenías.

In summary, Paleoindian archaeological remains are abundant in Uruguay, especially in the Rio Negro basin, although late-Pleistocene archaeological research is in its infancy. Useful information can be obtained from materials recovered by nonprofessionals, but extreme caution must be exercised in its interpretation.

We are indebted to the University of Buenos Aires and CONICET (PIP-114-200801-00344) for their continuous support; W. Aizpún and S. Bálsamo, who provided invaluable information, help and
cooperation during the GIS mapping and survey; and Betty Meggers, who edited an earlier draft of this paper.

References Cited


——— 2001b Consideraciones tecnológicas preliminares sobre los artefactos líticos de Cerro de los Burros (Maldonado, Uruguay). Comunicaciones Antropológicas de los Museos Nacionales de Historia Natural y Antropología de Montevideo 3(1).


——— 2007 Research in the Middle Negro River Basin (Uruguay) and the Paleoindian Occupation of the Southern Cone. *Current Anthropology* 48:164–76.

——— 2008a Paleomagnetic Results from the Urupez Paleoindian Site, Maldonado Department, Uruguay *Current Research in the Pleistocene* 25:40–43.

——— 2008b Observaciones experimentales sobre las puntas de proyectil Fell de Sudamérica. *II International Congress Experimental Archaeology*, edited by A. Morgado, J. Baena Preysler, and D. García González. Asociación Española de Arqueología Experimental, Universidad de Granada, Universidad Autónoma de Madrid, Museo de Ronda, Consejería de Cultura de la Junta de Andalucía, and Consejería de Innovación, Ciencia y Empresa de la Junta de Andalucía, pp. 31–33.


Coast-inland Mobility during the Early Holocene in the Semiarid North of Chile: La Fundición Site

**Donald Jackson, César Méndez, and Antonia Escudero**

**Keywords**: Mobility, hunter-gatherers, semiarid northern Chile

In the semiarid north of Chile, the first coastal human occupations are regionally known as the Huentelauquén Cultural Complex (Jackson and Méndez 2005; Llagostera et al. 2000). These contexts show a first phase (13,000–11,000 CALYBP) with a clear coastal adaptation, while in a second phase (11,000–9000 CALYBP) evidence shows humans being more hunting oriented, with settlements being located along ravines that connected coastal, inner valleys, and mountain range environments (Jackson and Méndez 2005).

Within this framework, the La Fundición site is located in the inner valley of Chile in the semiarid region (Lat. 29° S.), 60 km from the coast. The site shows an extensive hunter-gatherer residential camp with strong typological links to the Huentelauquén Complex (Castillo and Rodríguez 1978; Llagostera et al. 2000).

The archaeological deposit of this settlement is 70 cm deep, without significant changes in the stratigraphy. However, two previously obtained radiocarbon dates and one new AMS date (Table 1) indicate at least three occupational events. The earliest date of the site should be regarded as somewhat later taking into account that it is a marine mollusk sample uncorrected for local reservoir effect; consequently, the beginning of the occupation probably dates back to 10,200 CALYBP.

<table>
<thead>
<tr>
<th>Code Lab.</th>
<th>14C date, RCYBP</th>
<th>δ13C</th>
<th>Calibrated age, CALYBP (2σ)</th>
<th>Calibrated midpoint, CALYBP</th>
<th>Stratigraphic provenience</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>BETA 108308</td>
<td>8730 ± 90</td>
<td>-20.6</td>
<td>10,119–9489</td>
<td>9675</td>
<td>30–40 cm</td>
<td>Charcoal</td>
</tr>
<tr>
<td>BETA 108307</td>
<td>9640 ± 150</td>
<td>-20.6</td>
<td>11,385–10,524</td>
<td>10964</td>
<td>60–70 cm</td>
<td>Shell</td>
</tr>
<tr>
<td>UGAMS 8095</td>
<td>9130 ± 40</td>
<td>-20.6</td>
<td>10,484–9954</td>
<td>10231</td>
<td>30–35 cm</td>
<td>Bone</td>
</tr>
</tbody>
</table>

The site contains stemmed lanceolate projectile points (Figure 1), blanks and blank production debitage, knives, scrapers, and grinding stones among other implements, among which some polygonal stones similar to those recorded in coastal Huentelauquén sites stand out. Associated with this lithic assemblage are combustion features (i.e., hearths) and faunal remains that basically correspond to very fragmented camelid bones (*Lama guanicoe*), some with signs of fire exposure, as well as some rodent remains, bone fragments of otariids, and mollusk shells (Castillo and Rodríguez 1978; Llagostera et al. 2000). Among the mollusk remains are 120 fragments representing eight...
species, with a predominance of bivalves (61.3%) over gastropods (38.7%), in addition to the presence of some equinoderm remains (*Loxechinus albus*). The shell remains of some of these mollusks show anthropic signs (cuts and trimming) that indicate artifacts in their process of elaboration.

La Fundición also has yielded a burial of six individuals, including four male adults, one young adult, and a child of indeterminate sex. Two of the individuals were in flexed positions, while the remaining appear to represent secondary burials, following the same funeral pattern of sites along the coast (Costa-Junqueira 2001; Costa-Junqueira and Quevedo 1997).

The above-described characteristics of La Fundición suggest it served as a repeatedly occupied winter residential camp that was oriented essentially to hunting guanaco (*Lama guanicoe*), procuring lithic raw materials, and producing bifacial tools. The presence of some otariid remains and the abundant mollusk remains link this settlement to the coast, whereas the presence of obsidian and other siliceous raw materials suggests links to inter-Andean valleys.

This settlement is strongly connected to coastal Huentelauquén Complex occupations, which contain evidence of partial transport of camelid anatomical parts and lithic raw materials from the interior. Likewise, analogous sites in the inter-Andean valleys such as La Fortuna, located some 120 km from the coast, show the presence of sea mollusks and radiocarbon dates (8160 ± 160 RCYBP[9056 CALYBP]) (Gambier 1974) consistent with those obtained from La Fundición as well as coastal sites.

The evidence from La Fortuna site and other settlements situated in the middle valleys of the semiarid north of Chile (Jackson 1998; Méndez and Jackson 2008) supports the interpretation that the Huentelauquén Cultural Complex, after 10,000 CALYBP, was characterized by a mobility-settlement pattern that articulated coastal, valley, and mountain-range environments, with more of a hunting-oriented than marine-resource-oriented economy.

Special thanks to Museo Arqueológico de La Serena for allowing the researchers to look through La Fundición artifact collection. Research was funded by Fondecyt grant 1090044.

References Cited

A New Fishtail-Point Find from South Brazil

Lisiane da Silva Lopes and Hugo G. Nami

➤ Keywords: Fishtail points, lithic technology, Brazil

A long-term investigation of Paleoindian topics has included the technology and distribution of Fishtail or Fell projectile points. As a consequence, finds in the Southern Cone have become more numerous during the past two decades and a significant number of radiocarbon dates have been obtained that define their time span between ca. 11,000 and 10,000 uncalibrated RCY (Nami 2007). Although this tradition was reported several decades ago (Schobinger 1974, Politis 1991, Prous and Piazza 1977), these sorts of finds are scarce in Brazil and careful typological and technological studies have not been performed. Hence, to add new data on Fishtail technology and its continental distribution, we report an example found in 1997 by Carla Morgana de Oliveira and Pedro Brasil de Oliveira in a small cavity formed by soil erosion while a municipal team was working along Aloys Jacob Kerber Street in the urbanized part of Montenegro, Rio Grande do Sul (Figura 1A). Following its discovery, the object was displayed in a fish tank until one of its discoverers showed it at

Lisiane da Silva Lopes, Graduate fellow: Conselho Nacional de Desenvolvimento Científico e Tecnológico; Pontifícia Universidade Católica do Rio Grande do Sul – PUCRS; Museu Histórico Nice A. Schuler, Montenegro; Rio Grande do Sul, Brazil; Ramiro Barcelos Street, No. 1027, apartment 404, Montenegro, Rio Grande do Sul, Brazil, e-mail: jlmotta@terra.com.br

Hugo G. Nami, CONICIT Instituto de Geofísica Daniel A. Valencio (INGEOAV), Dpto. Ciencias Geológicas, FCEN, UBA. Ciudad Universitaria, Pab.II, (C1428EHA), Ciudad Autónoma de Buenos Aires, Argentina and Research Associate, National Museum of Natural History, Smithsonian Institution, Washington DC; e-mail:hgnami@fulbrightmail.org
a local school. The teacher recognized it as an archeological specimen, and it was identified as a Fishtail point by archeologist Pedro I. Schmitz (Instituto Anchietano de Pesquisas). It is now curated at the Museu Histórico Nice A. Schüler in Montenegro.

The specimen is made of high-quality pale brown chert (Figure 1B). It is 60.6 mm long and 23.2 mm wide, and has a symmetrical biconvex transversal cross section. Thickness is 7 mm in the middle part and 6 mm at the blade/stem intersection. The stem is 17 mm long, 15 mm wide in the middle, and 18 mm wide in the base. As usual in Fell points, the borders of the stem show abrasion along the edges. Between the blade and the stem is a slightly rounded shoulder, constituting a lanceolate variant observed in other Brazilian examples of Fishtail points (Nami 2010). A color difference between the original faces and the retouch scars on both faces suggests the stone was heated to improve its flaking qualities. It was made without the use of bifacial thinning

Figure 1. A, Location of the Fishtail point found in Rio Grande do Sul, Brazil; B, Fishtail point from Montenegro village; C, fragment from near the Jaguaruna 11 sambaqui (from Prous and Piazza 1977 Fig. 39).
and mostly flaked using a pressure technique that left short retouches not farther than 10–12 mm from the edges. A high proportion of retouch terminations show step and hinge fractures due to the flat surface of the flake blank that impeded the precise spread of the force (Nami 2010). It has been pointed out by several authors that removing thin flakes, then pressure retouching with short increments to finish the product is a typical Fell technological feature, which extends from northern to southern South America (i.e. Bird 1969, Mayer-Oakes 1986, Nami 2010).

The northernmost example of this kind of artifact is from the state of Bahia on the central Brasilian coast (Meggers and Barbosa, pers. com. 2006; Nami 2010 Lámina IIk). Finds are mainly located in the southern states, especially Rio Grande do Sul and Santa Catarina (Politis 1991, Schobinger 1974). The Montenegro specimen is remarkably similar to a specimen found near the Jaguaruna II sambaqui in Santa Catarina (Figure 1C). It is also similar in form and technology to a broken example from level XII CI at RS-C-43 site, which was also made with short retouches on a flake blank (Dias 1994, Fig. 30:2) Similar specimens have been found in several places in the Southern Cone, among them Cañada de Acaguá, Cerro Largo (Bosch et al 1980, Fig. 17), and the Río Negro basin, Uruguay; Paso Otero 5, Buenos Aires, Argentina (Martínez 2001), and Fell’s Cave, Magallanes, Chile (Bird 1969, Fig. 3f,5o).

In summary, the specimen reported here adds new data on the technology and distribution of this Paleo South American artifact, thereby contributing to reconstruction of the latest-Pleistocene human dispersal across the eastern part of South America (Nami 2007).

We are indebted to the University of Buenos Aires and CONICET (PIP-114-200801-00344) for their continuous support; Museu Histórico Nice A. Schüler and its Comissão de Acervo for allowed study the Fishtail specimen; Mrs. Rosani Brochier Nicoli and Mr. Renato Antônio Kranz, of the SEPAHC - Serviço de Patrimônio Histórico e Cultural and Secretaria Municipal de Educação e Cultura of Montenegro, respectively, for their support; and Betty Meggers especially for editing an earlier draft of this paper.

References Cited


——— 2007 Research in the Middle Negro River Basin (Uruguay) and the Paleoindian Occupation of the Southern Cone. Current Anthropology 48: 164–74.
Equus and Palaeolama Direct $^{14}$C Ages at Las Monedas Site, Semi-arid North of Chile

César Méndez, Donald Jackson, and Roxana Seguel

Keywords: Extinct fauna, Pleistocene $^{14}$C ages, semi-arid north of Chile

Direct dating of extinct fauna is of key significance for understanding the paleoecological scenario of the Pleistocene-Holocene transition in any region. Besides characterizing coexisting faunas, it is crucial for interpreting extinction rates and climatic implications, and for assessing the availability and diversity of prey during the first peopling of a given area. Despite the frequent detection of extinct faunal bones at Los Vilos (~31° S) along the Pacific coast of South America (Méndez et al. 2004), direct radiometric dating has been stubbornly difficult because of collagen loss (i.e., Méndez and Jackson 2006; Núñez et al. 1994). The only previous local $^{14}$C dates were the 9100 ± 300 RCYBP age on mastodon (possibly Cuvieronius) obtained at the Quereo site (Paskoff 1971) and the 13,500 ± 65 RCYBP on Mylodon sp. at El Membrillo site (Jackson 2003). The former is difficult to link to the limited human evidence at the site, and the latter comes from a surface context where, despite some suggestive associations, wind deflation has severely affected site integrity.

In this paper we present the first direct $^{14}$C AMS dates and stable-isotope analyses on Equus and Palaeolama from the Los Vilos coast and the wider region of central Chile (30° to 34° S). Las Monedas site is located along a small ravine, 2 km from the edge of the sea. Excavations in a 15-m² area adjacent to an exposed profile yielded 33 well-preserved bones of extinct fauna in low-energy fine-grained sands (Méndez and Jackson 2006; Méndez et al. 2005–6) (Figure 1). Though three lithic artifacts were recorded within the same stratigraphic unit, their association with the bones remains ambiguous owing

César Méndez and Donald Jackson, Departamento de Antropología, Facultad de Ciencias Sociales, Universidad de Chile, Ignacio Carrera Pinto 1045, Nuñoa, Santiago, Chile; e-mails: cmendezm@uchile.cl djackson@uchile.cl
Roxana Seguel, Laboratorio de Arqueología, Centro Nacional de Conservación y Restauración, Dirección de Bibliotecas, Archivos y Museos, Tabaré 654, Santiago, Chile; e-mail: rseguel@cnr.cl
to the complex formation processes in a fluvial environment (Méndez 2010). We selected one sample identified as a thoracic vertebra of *Equus* sp. (unit D4, #33a, depth 330 cm), and one lumbar vertebra of a juvenile *Palaeolama* sp. (unit D6, #18, depth 314 cm) for $^{14}$C analyses. Results are presented in Table 1. Both $^{14}$C dates are of late-Pleistocene age; however, they are significantly different at 95% level, indicating bones are not contemporaneous and that major rates of sedimentation prevailed. Though both samples, as well as all the rest of the bone assemblage, were identified within the same stratigraphic unit (layer 6), they were located at different depths and could be regarded as secondarily deposited as was previously suggested by Méndez et al. (2005–6; see also Méndez 2010).

Stable-isotope results are as yet quite limited and should be regarded as part of an initiating program for building a database for understanding the isotopic ecology of extinct mammalian taxa. Results for the largest extant artiodactyl *Lama guanicoe* (C3 feeder) in central Chile have mean values of $-19.47\%o$ (sd: 0.58) for $\delta^{13}$C col and of $4.97\%o$ (sd: 0.9) for $\delta^{15}$N (Falabella et al. 2007), and are similar to those obtained for our *Equus* sp. sample.

Table 1. Radiocarbon and isotopic data presented in this paper. Dates were 2$\sigma$ calibrated with OxCal 4.1 (Bronk Ramsey 2009) using IntCal 09.

<table>
<thead>
<tr>
<th>Lab. code</th>
<th>Species</th>
<th>Skeletal element</th>
<th>$^{14}$C age, RCYBP</th>
<th>Age, CALYBP</th>
<th>$\delta^{13}$C&lt;sub&gt;col&lt;/sub&gt;</th>
<th>$\delta^{13}$C&lt;sub&gt;ap&lt;/sub&gt;</th>
<th>$\delta^{15}$N&lt;sub&gt;col&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>UGAMS 7605</td>
<td><em>Equus</em> sp.</td>
<td>Thoracic vertebra</td>
<td>10,950 ± 35</td>
<td>12,951–12,655</td>
<td>-16.3‰</td>
<td>-13.9‰</td>
<td>5.5‰</td>
</tr>
<tr>
<td>UGAMS 7606</td>
<td><em>Palaeolama</em> sp.</td>
<td>Lumbar vertebra</td>
<td>10,310 ± 30</td>
<td>12,377–11,983</td>
<td>-24.4‰</td>
<td>-12.7‰</td>
<td>0.6‰</td>
</tr>
</tbody>
</table>

Material tested is bone collagen; ap = apatite, col = collagen.
At Los Vilos there is consistent evidence supporting *Equus* sp. processing at 13,100 CALYBP at the Quebrada Santa Julia campsite (Jackson et al. 2007). However, despite the high frequency of *Palaeolama* sp. evidence (López 2007) and the simultaneous occurrence with local human occupations, there is as yet no evidence that humans consumed them. This raises several questions. Were all Pleistocene faunas equally represented in the diets of early inhabitants? And if not, what were the causes for this selectivity?

The research presented here was funded by FONDECYT 1090044 grant.

**References Cited**


Techno-Morphological and Use-Wear Analysis on Lithic and Bone Tools from Campo Laborde Site (Pampean Region, Argentina)

Pablo G. Messineo and Nélida Pal

Keywords: Lithic tools, megamammal bone tools, use-wear analysis, Pampean region

Investigations carried out at Campo Laborde site provide new evidence for technological strategies associated with hunting and butchering a giant ground sloth (*Megatherium americanum*) during the early Holocene (Messineo and Politis 2009; Politis and Messineo 2008). Debitage analysis developed previously indicates that the last stages of the lithic reduction sequences (production and resharpening of cutting tools) were recognized both on non-local quartzite and on local raw materials such as chert and silicified dolomite (Messineo 2008; Politis and Messineo 2008). This paper reports techno-morphological and use-wear analysis performed on two lithic and two megamammal bone tools found in the site.

Both lithic tools were made on quartzite. One is interpreted as the base of a broken lanceolate bifacial projectile point. The bottom of this piece is convex with a transverse fracture, and with the edge not abraded. One face has laminar pressure-flaked scars along the base, and the opposite face has a single tiny fluting scar (Figure 1A). Use-wear analysis indicates that both edges have sedimentary abrasion and soil sheen and lack diagnostic features associated with tool use. The face with the small fluting scar, on the other hand, has fractured quartz crystals and micropolishing in the first stages of formation associated with striations and small pits (Figure 1B). This evidence suggests that this projectile point was probably used hafted. The second tool is a sidescraper made from a large flake without cortex. It has two working edges with unifacial and marginal retouches (Figure 1C). This tool has been completely modified by sedimentary abrasion and soil sheen (Figure 1D), but shows no evidence of polishing.

Both bone tools were made on megafaunal remains. One of them is made from the right distal end of a giant ground sloth rib. This implement is a fracture-based utilitarian bone tool (*sensu* Johnson 1985). Its fracture edge is rounded and polished. These modifications are localized on the end section of the fracture edge; adjoining segments of the fracture edge and the rest of the rib are unmodified (Politis and Messineo 2008: Figure 10). The second bone tool is a fragment of a rib from an unidentified megafaunal species.
Along the exterior compact bone are negative flaking scars produced during tool manufacture (Figure 1E). One bone flake was refitted on one of these negatives (Messineo 2008). The end edge of this piece is rounded and polished with parallel striations and microflaking on the exterior cortical surface.
that are probably related to its use (Figure 1F). The rest of this piece does not show these types of modifications. Use-wear analysis of the end segment of the fracture edge (Figure 1G) detected polishing with thin and wide parallel striations. This polish was the result of contact between the bone piece and a hard material, perhaps associated with its use. In contrast, the rest of the tool has an irregular surface with moderate to severe alteration associated with a taphonomic origin (Figure 1H).

Campo Laborde was interpreted as a megamammal hunting and butchering site. For these activities, people used lithic and bone tools. Lithic tools were curated items associated with the individual toolkit of the hunters. The megamammal bones were fractured and used as expedient tools in butchering tasks. Different megafaunal species have been interpreted as food resources for hunters (Gutierrez and Martínez 2008; Politis and Gutierrez 1998; Politis and Messineo 2008). At Paso Otero 5 site megamammal bones were exploited as raw material for combustion (Martínez 2001). Campo Laborde yields the first evidence in the Pampas for megamammal bone-tool technology.

Thanks to Estela Mansur for her comments and Angélica Tivoli for her review of the English version. This article is a production of the INCUAPA, which received grants from CONICET (PIP 5424), the ANPCYT (PICT 04-12776 and 08-0430) and the Universidad Nacional del Centro de la Provincia de Buenos Aires.

References Cited


Exceptional Fell Projectile Points from Uruguay: More Data on Paleoindian Technology in the Southern Cone

Hugo G. Nami

Keywords: Lithic technology, Fishtail points, Uruguay

Until recently, the largest known complete “Fishtail” or Fell projectile points with no or little resharpening barely exceeded 60–70 mm long. In Argentina, examples have been encountered at Cerro El Sombrero, Buenos Aires (Flegenheimer and Zárate 1990) and La Crucesita, Mendoza (Schobinger 1971); in Chile, at Fell’s cave (Bird and Cooke 1979: Figure 12H) and Salto Chico (Dillehay 1997: Figure 3.2), and more recently in different locales from Uruguay (Nami, 2007: Fig. 7e, 2010a: Figure IId, 1, Femenías et al. 2011: Figure 1d). This paper reports technological and morphological evidence on two extraordinary additional “Fishtail” specimens from the Republic of Uruguay.

Recent explorations along the Santa Lucia River and its tributaries near San Ramón village produced paleoecological and archaeological remains (Meneghin and Sánchez 2009). A broken stemmed Fishtail point found at Arroyo Vejigas, a tributary of the Santa Lucia, deserves special attention because of its size. It is 76.1 mm long, 66.3 mm wide, and weighs 59 g. Its thickness is 9.6 mm at the middle and 10.6 mm at the blade/stem intersection. A transverse fracture probably occurred in the middle of the blade (Figure 1A), suggesting the original length may have been 130–150 mm. It is made of high-quality brown chert with different tones.

The origin of the second artifact is unknown. It is also among the largest Fell points known from South America and is now in the Rolf Nussbaum collection, currently exhibited in the Museo MAPI, Montevideo (Figure 1B). It is complete without signs of resharpening. It was made on a red silcrete from the Queguay Formation, a preferred raw material among regional Paleoindians. It is 138 mm long, 58 mm wide, and weighs 82 g. Maximum thickness at the blade-stem intersection is 10 mm; the blade is 8 mm thick. The stem is 25 mm long and 21 mm wide. The base of the stem was finished by short pressure retouch.

Both pieces have rounded shoulders, a morphological variant among Fishtail specimens (Nami 2010a). They exhibit symmetrical and longitudinal biconvex cross sections and bifacial flake scars produced by soft percussion flaking to thin the blank to a very advanced preform stage (Callahan 1979; Nami 2010a), a strategy often used in the production of large Fishtail points.

Hugo G. Nami, Instituto de Geofísica Daniel A. Valencio (INGEODAV), Dpto. Ciencias Geológicas, FCEN, UBA. Ciudad Universitaria, Pab.II, (C1428EHA), Ciudad Autónoma de Buenos Aires, Argentina; Associated researcher, National Museum of Natural History, Smithsonian Institution, Washington, D.C.; e-mail: hgnami@fulbrightmail.org
The process was finished using short retouches not deeper than 10 mm from the edges that regularized the preform. This manner of obtaining the final form by using short retouches on thin flakes or biface performs might be considered a stylistic feature of Fell points (Bird and Cooke 1979; Nami 1997, 2003, 2010a). Both edges of the stem show strong abrasion.

Another exceptional fluted specimen has been found in the state of Bahia, central Brazil (Meggers and Barboza, pers. comm., 2006: Figure 1c). It is 90 mm long and 32 mm wide and was very carefully made by percussion and pressure flaking using an excellent flint-like material. Other examples have been reported from Belize (Pearson and Bostrom 1998) and Madden Lake in Panama (Bird and Cooke 1979: Figure 6c) in Central America. Another large Fishtail point has also been found in Ecuador (Nami 2010a: Figure 1g). In this context, a large fluted stem from Cerro los Burros, southern Uruguay (Meneghin 1977: Figure 20, Nami 2001) might be considered part of a large Fishtail piece.

The exceptional finds described here are adding new light to the recent technological studies on the diverse stone and bone implements in Fishtail assemblages (i.e., Nami 2010b). Contrary to earlier opinions that the human groups that used these points had a very simple technology (i.e., Orquera
1987), the new finds are showing that their technological knowledge was as refined, complex, and sophisticated as that of other Paleoindian groups in the Americas. Like Clovis, this evidence suggests that Paleo South Americans living ca. 11,000–10,000 RCYBP shared technological knowledge, signifying some kind of social or historical relationship with the second colonizing wave of humans that peopled the Americas (Goebel et al. 2008, Nami 2010b).

I am indebted to the University of Buenos Aires and CONICET (PIP-114-200801) for continuous support; the Museo Nacional de Antropología de Uruguay for sponsoring the archaeological research in that country; A. Toscano, Director of the Museum for his support; U. Meneghin, Fundación de Arqueología Uruguaya, for facilitating the study of diverse aspects of the artifacts depicted here; A. Sanchez for allowing me to study his collection; A. Florines for his constant support, help and counsel during different aspects of the research; B. Meggers and A. Barbosa for providing the images in Figure 1c and invaluable information about the Fishtail piece from Brazil; M. Meneghin Mauro for helping me improve the figure. Special thanks to B. Meggers for editing an earlier draft of this paper.

References Cited


Rescue of *Mammuthus* sp. Remains Associated with a Possible Artifact at Villa Hidalgo, Zacatecas, Mexico

Silvia Puga Pérez, Carlos A. Carrillo Rodríguez, and Ciprian F. Ardelean

**Keywords**: Mammoth, lithics, Mexico

Ongoing research on late-Pleistocene megafauna at Laguna El Salitre, near Villa Hidalgo (Mexican state of Zacatecas), provided the motivation for salvage excavation in 2010 of a buried *Mammuthus* sp. skull threatened by modern sediment extraction associated with mud-brick manufacture. Beyond rescuing the remains, another goal was to study the possible association of the proboscidean with other Pleistocene species previously reported for the region but without clear contextual data. The coordinates of the site are 22° 23′ 2.23″ N, 101° 46′ 10.03″ W, altitude 2,107 m.a.s.l.

Aside from the report of a *Mammuthus americanum* mandible fragment (Polaco et al. 1998) and pioneering research in nearby regions (Mirambell 1982), little is known about the Pleistocene archaeology of this area. Earlier geological studies provided preliminary information about the area’s sediments, mainly lagoonal deposits (Cárdenas 1992). The stratum containing mammoth remains consists of gray lacustrine silts that are soft when wet, but become rock-hard when dry.

Locals digging out mud discovered the cranium, destroyed the frontal portion including most of the tusks, and then refilled the pit before archaeologists arrived. Our analysis later determined that the skull showed an inverted position with the tips of the damaged tusks clearly intruding downward into
sediments. Related and well-preserved vertebrae and a scapula were found near the skull. They belong to the same individual, showing little post-depositional disturbance.

The interesting discovery is a small piece of reddish brown flint (Munsell 10R3/4-4/6) found buried at a depth of 141 cm, just a few centimeters north of the mammoth’s skull, clearly in an undisturbed portion of the same deposit as the animal (Figure 1). It is the only rock encountered in the excavation. This object lacks the “classic” features of an artifact, but it shows a uniform shiny patina all over its surface. It proves to be the proximal end of a thick, heavily worn and reworked flake extracted from a square-sided nodule. Its edges are slightly smoothed by natural polish. Signs of contact with fire are visible in color changes and tiny fractures on the proximal end and across the flat ventral side. It has a triangular cross section, and its distal portion is wedge shaped by fracture. This possible artifact is 45.1 mm long, 37.9 mm wide, and 17.4 mm thick. The right convex edge shows small-scale, continuous bifacial micro-flaking most likely caused by use of the flake as a scraper.

Stratigraphic layers above the level of the mammoth yielded rare dispersed and mixed faunal remains (like an Equus sp. molar), but no lithics or other traces of human presence.

Figure 1. A, the inverted cranium of a mammoth uncovered in lacustrine silt deposits at Villa Hidalgo, Zacatecas, Mexico, as seen from the east. The white arrow points to the place of discovery of the flint flake, almost adjacent to the skull on its north side. B, the flint fragment; the rectangle on the edge indicates the area shown in C, 40x magnification of microflaking possibly generated by scraping shown magnified on the left.
Paleoindian Occupation in the Central Mountains of Argentina: Was It a Failed Colonization?

Diego Rivero and Eduardo Berberián

Keywords: Peopling, Pleistocene/Holocene transition, central Argentina

The aim of this report is to present information about human presence during the Pleistocene/Holocene transition in the Central Mountains of Argentina and to discuss its implications for the peopling of the Southern Cone of South America. The Central Mountains are located in Córdoba and San Luis provinces, in central Argentina. They consist of a number of main strands, with heights ranging between 1,000 and 2,800 m above sea level, extending along a north-south direction more than 600 km (Figure 1).

The Paleoindian occupation of the Central Mountains dates from the Pleistocene/Holocene transition. At the El Alto 3 site (EA3), in the basal unit was uncovered the oldest evidence for human presence in the region. Two charcoal concentrations associated with the cultural remains were dated to 9790 ± 80 (LP-1420) and 11,010 ± 80 RCYBP (LP-1506). In the context of the human peopling model proposed by Borrero (1994) for southern South America, these results were interpreted as an occupation assignable to the territorial exploratory stage (Rivero and Roldán 2005). Recently a new charcoal sample from this site associated with quartz flakes was dated to 9371±51 RCYBP (AA94987).

Recent 14C analysis of human bones from the Gruta de Candonga site (GC) have yielded one date of 10,450 ± 50 RCYBP (SRLA-1062; Cornero y Neves 2011).

Other evidence for Paleoindian occupation in the Central Mountains is scarce and consists only of three Fishtail projectile points found in surface collections from two localities (Laguenes et al. 2007; Politis 1991). This Paleoindian occupation is of low density, especially when compared with the
Paleoindian record from other sectors of the Southern Cone of South America like Uruguay, Chile, and the Pampas and Patagonia in Argentina (e.g., Steele and Politis 2009; Suárez 2003).

The scarce Paleoindian records of the Central Mountains belong to groups with a technology of Fishtail projectile points. This is followed by a period of ca. 9300–8000 RCYBP, which has yielded no archaeological evidence (Rivero 2010). Only after ca. 8000 RCYBP does the archaeological signal resurface in the region (González 1960; Rivero and Berberián 2008). This archaeological record is characterized by sites with a technology of lanceolate or foliate projectile points, known as “ayampitín,” dated ca. 8000–6000 RCYBP (e.g., González 1960; Rivero 2009, 2010; Rivero et al. 2009).

These scarce archaeological data for the Pleistocene/Holocene transition in the region were not due to sampling problems. The Central Mountains have been intensively investigated for the last 20 years (e.g. Laguens et al. 2007; Rivero 2009; Rivero and Berberián 2008; Rivero and Roldán 2005). To date, more than 700 archaeological sites have been recorded, and a total of 62 $^{14}$C dates are available. Only four dates and two archaeological sites belong to the Pleistocene/Holocene transition. The remaining dates and archaeological sites belong to the period after ca. 8000 RCYBP.
These observations have strong implications for the peopling of the Southern Cone of South America because we could be facing failed colonization situations in certain regions. In the Central Mountains of Argentina, this situation might be produced because the Paleoindian groups may have been few and far between, hindering the maintenance of reproductive viability (e.g., Anderson and Gillam 2001; Moore and Moseley 2001).

Only after ca. 8000 RCYBP could there have occurred a new Exploration and Colonization Process (sensu Borrero 1994) in the Central Mountains of Argentina, which finally led to the effective settlement of the region.

This project is funded by CONICET PIP 11220080102678.

References Cited


Early Hunter-Gatherers and Miners (ca. 12,000 CALYBP) in the Arid Coast of Northern Chile

Diego Salazar, Donald Jackson, and Douglas Jackson

Keywords: Hunter-gatherers, mining, Chile

The early hunter-gatherers and fishers of the Pacific coast of South America have been regarded as rather simple societies, dependent on subsistence and technological imperatives (De France et al. 2001; Jackson and Méndez 2005; Lavallée et al. 1999; Llagostera 1979; Sandweiss et al. 1998; Stothert 1988). However, the recent discovery of the site San Ramón 15 (SR-15) in the northern coast of Chile (Lat. 25 S.) shows that these early coastal groups conducted a complex operation to mine iron oxide, probably for ritual purposes.

The San Ramón 15 site is located in a ravine 800 m from the coastline in the arid coast of northern Chile. The settlement is associated with an iron oxide mine with a stratigraphic sequence of 6 m, which was heavily exploited during early (12,543 CALYBP) and late (4350 CALYBP) Holocene times. Evidence of mining and cutting technology consists of numerous lithic hammers anddebitage. Also present are some essentially marine faunal remains (Salazar et al. 2011).

Evidence from early levels includes trimming debitage from biface pieces and a discoidal stone, which, in conjunction with its chronology (Table 1), links this settlement to groups with a marine/coastal adaptation regionally known as the Huentelauquén cultural complex (Jackson and Méndez 2005; Llagostera 1979; Llagostera et al 2000). Possibly related to the San Ramón mine is a small shelter some 9 km north of the site called Quebrada Cascabeles, with two occupational events attributed to the Huentelauquén cultural complex dating to 11,000 CALYBP (Casteletti et al. 2009).

Table 1. Radiocarbon dates of the San Ramón 15 (Salazar et al., 2011).

<table>
<thead>
<tr>
<th>Lab no.</th>
<th>14C date, RCYBP</th>
<th>Calibrated age, CALYBP (2σ)</th>
<th>Stratigraphic provenience</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta – 255687</td>
<td>9160 ± 80</td>
<td>10,519 – 9948</td>
<td>Unit 2/Layer 2-3</td>
<td>Charcoal</td>
</tr>
<tr>
<td>UGAMS – 5440</td>
<td>9250 ± 30</td>
<td>10,490 –10,246</td>
<td>Unit 1/Layer 4</td>
<td>Charcoal</td>
</tr>
<tr>
<td>UGAMS – 5441</td>
<td>9360 ± 30</td>
<td>10,651–10,301</td>
<td>Unit 1/Layer 6</td>
<td>Charcoal</td>
</tr>
<tr>
<td>UGAMS – 5442</td>
<td>9390 ± 30</td>
<td>10,666–10,421</td>
<td>Unit 1/Layer 7</td>
<td>Charcoal</td>
</tr>
<tr>
<td>POZ – 32943</td>
<td>9310 ± 50</td>
<td>10,570–10,264</td>
<td>Unit 1/Layer 9</td>
<td>Charcoal</td>
</tr>
<tr>
<td>Beta – 280992</td>
<td>10,430 ± 60</td>
<td>12,543–12,095</td>
<td>Unit 2/Layer 5</td>
<td>Shell</td>
</tr>
</tbody>
</table>

Diego Salazar and Donald Jackson, Departamento de Antropología, Facultad de Ciencias Sociales, Universidad de Chile, Ignacio Carrera Pinto 1045, Nuñoa, Santiago, Chile; e-mails: dsalazar@uchile.cl  djackson@uchile.cl

Douglas Jackson, Sociedad Chilena de Malacología, Museo Nacional de Historia Natural, Interior Quinta Normal S/N, Santiago, Chile; e-mail: sillitus@hotmail.com
The stratigraphy of the early levels of the San Ramón mine reveals evidence of repeated mining operations using lithic hammers along with fragments of mollusks (*Choromytilus chorus*, *Argopecten purpuratus*, and *Concholepas concholepas*). Striations and signs of wear suggest they were used to extract iron oxide from narrow seams and veins.

The associated faunal remains consist of unidentified mammal skeletons, bird remains (*penguin, Spheniscus sp.*), and at least five fish species (*Citharichthys gilberti*, *Hydrolagus macropthalamos*, *Synodontis violacea*, *Trachurus symmetricus* and *Paralichthys microps*). Marine fauna remains consist of 19 mollusk species (MNI 221), including 10 gastropod, 6 polioplacofor, and 3 bivalve, and one echinoderm species, all of them present in the rocky intertidal zone. Marine faunal remains show signs of fire exposure, suggesting they were transported to the site and consumed as food by workers engaged in mining.

The exceptional evidence from this site shows a diversified settlement pattern that included systematic mining exploitation in a hunter-gatherer-fisher context, in which pigments were acquired for multiple uses, probably linked to ritual activities. The multiplicity of activities suggests a more complex and sophisticated society than previously thought.

Research funded by FONDECYT 1080666 grant.

References Cited


Two Directly Dated Early-Holocene Archaic Burials from Pains, State of Minas Gerais, Brazil

André Strauss, Edward Koole, Rodrigo Elias de Oliveira, Mariana Inglez, Tatiana Nunes, Pedro Da-Gloria, Alexandre Robazzini, Fernando Costa, and Walter Neves

Keywords: Archaeology of death, funerary rituals, cremation

Here we report two early-Holocene burials from the karstic region of Pains, eastern central Brazil. In 2003 and 2004 the archaeological site located at the Loca do Suin rockshelter (UTM 23K 417314L/7752410S) was excavated by a team coordinated by one of the authors (Koole 2007). These are referred to as Burials 1 and 2. Lithic, pottery, and animal bones were also recovered but are not described in this contribution.

Within the pit of Burial 1 bones of at least four different individuals were present. The bones were poorly preserved, highly fragmented, and mixed. No anatomical order could be detected, but two adults could be confidently distinguished. One was heavily cremated (individual 1B) while the other was not cremated at all (individual 1A). Together they account for approximately 90% of the bones from Burial 1. In spite of the high level of fragmentation of both individuals 1A and 1B, complete skeletons seem to be represented. Charcoal was not present within the grave.

Age at death was estimated to be 20 years for Burial 1A and 50 for Burial 1B. In the absence of more reliable indicators sex was estimated from the lateral angle of the petrous bone (Nóren et al. 2005). Accordingly, individual 1A is male and 1B is indeterminable.

In individual 1A osteophytoses were observed in the cervical vertebrae. In the proximal articular surface of the left halux there is marked osteoarthritis. In both external acoustic meatus, severe tori (exostoses) were observed. Caries are almost absent, with a single occurrence in the third left inferior molar.

Individual 1B also presents severe exostoses in both meatus. In one of the few vertebrae that could be observed and confidently associated with these
individuals there is a strong presence of osteophytes. Osteoarthritis was also observed within the glenoid fossa of the left temporal bone. Variation of structural and chromatic modifications indicates the presence of different levels of burning, ranging the entire scale proposed by Stiner et al. (1995). The presence of thumbnail fractures and warping, together with the fact that all anatomical regions were represented, suggests that the corpse was still fresh when exposed to heat (but see Gonçalves et al., 2011) (Figure 1). The regions mostly spared from burning are the calvaria, mandible, glenoid region of the scapula, and some bones of the feet. Our interpretation is that individual 1B was intentionally cremated as part of a funerary ritual.

Bones of two other individuals were also recognized within Burial 1. One of them, labeled 1C, is a child of about five years in age represented by a set of both deciduous and permanent teeth (RM₁ present a cavity on its buccal face), the left humerus, and the left temporal. None of these bones present signs of burning. The other individual, labeled 1D, is a very young child, probably a stillborn, from whom only a talus and half of a burned humerus were identified.

The poor preservation and highly fragmented nature of these remains make it very difficult to determine the sequence of events associated with Burial 1. We do not believe there is enough information even to determine whether individuals 1A and 1B represent independent interments. While the burned nature of Burial 1B makes it by definition a case of secondary burial, the chaotic disposition of the bones from Burial 1A could be the result of grave disturbance added to post-depositional processes. Therefore, although we believe individual 1A is not a primary burial, the most conservative judgment is that it is not possible to fully determine its nature.

An unburned fragment of rib bone was directly dated yielding a non-calibrated age of 7440 ± 50 RCYBP (Beta-210400; \(^{13}C/^{12}C = -19.5\)). Although unburned, it is not possible to be sure if this fragment belonged to individual 1A or 1B.

Burial 2 was composed of a single male individual (Black 1978). Although fragmented and poorly preserved, the bones are better preserved in comparison with Burial 1. Although the majority of bones were not articulated, the recognizable anatomical organization suggests that this was a primary burial later disturbed by post-depositional agents. Age at death was estimated to be between 20 and 24 years based both on the pubic symphysis (Brooks and Suchey 1990) and dental wear (Lovejoy 1985). In spite of his young age, this individual exhibits a high incidence of caries (20%). No sign of osteopathy could be identified. A fragment of rib bone was directly dated, yielding an age of 7530 ± 50 RCYBP (Beta-210401; \(^{13}C/^{12}C = -20.9\)).

In sharp contrast to the Andean region, which presents a relative abundance of early- and middle-Holocene sites where human burials were found (Santoro et al. 2005), in South American lowlands skeletons from this time are extremely rare (Strauss 2010). Findings from Pains constitute an important step in the direction of changing this situation and dictate further exploration in the region. Moreover, if the dated bone from Burial 1 belongs to the cremated individual, this would constitute one of the oldest directly dated cases of such practice in South America. Further investigations will clarify this point.
First Early Human Occupations in Caves and Rockshelters in Uruguay and Diverse Landscapes Utilized by Early South Americans

Rafael Suárez, David S. Leigh, and Mario Trindade

Keywords: Early Holocene, AMS dates, southeastern South America

Research on the first Americans in northern Uruguay is a long-term project that started over 10 years ago. All Pleistocene and early-Holocene transition sites documented so far in Uruguay are open-air sites. Recent field work...
conducted since 2008 by the research team of the Museum of Archaeology and Natural Sciences of Salto led to the discovery of a series of caves \((n = 5)\) and rockshelters \((n = 4)\) with early human occupations among the rolling hills of Cuchilla de Haedo. Additionally, surveys helped to identify an additional 112 archaeological sites, including quarries for raw materials (silicified sandstone and translucent agate), rock-art sites, and stone structures (cairns and stone circles). Between November 2009 and May 2010 test excavations were conducted in three rockshelters (ZT-1, TN 1, TN9). In this paper we present the results obtained at the Zanja del Tigre 1 site (ZT-1) an overhang 6.75 \(\text{m}\) long, 2.25 \(\text{m}\) wide, and 3.00 \(\text{m}\) high (Figure 1). In ZT-1 we excavated a 2.00-by-0.50-\(\text{m}\) unit, which recovered 5,652 pieces of debitage and 43 formal tools (bifaces, projectile points, unifacial tools, and abraders). The two main raw materials are local silicified sandstone \((92\%)\) and chalcedony-agate \((5.4\%)\). A very low frequency of raw material is silicified limestone \((0.2\%)\), whose source is over 150 \(\text{km}\) from the site. Other raw materials are present \((2.4\%)\), such as quartz, jasper, opal, basalt, and unidentified. The test excavation reached a depth of 0.47 \(\text{m}\), then encountered a probable collapse of roof rock. Two charcoal samples taken at a depth of 0.37-0.40 \(\text{m}\) were dated by AMS at 8770 ± 30 \((\text{UGAMS 7459})\) and 8750 ± 30 \((\text{UGAMS 7460})\), or approximately 9750 \(\text{cal}\) \(\text{yr}\) \(\text{BP}\). These are the oldest dates obtained in a rockshelter in Uruguay and reveal new perspectives for comparing the occupation in rockshelters \((\text{or confined spaces})\) with chronologically similar occupations in southern Brazil and the Pampa-Patagonia region in Argentina. In 2011 we will excavate a more extensive area in the ZT-1 rockshelter and the Cueva del Tigre site ZT-2.

The early-Holocene occupation at circa 10,000 \(\text{cal}\) \(\text{yr}\) \(\text{BP}\) at ZT-1 provides new evidence that indicates the presence of early sites in environments and landscapes not previously recognized. Our research confirms that early occupations in Uruguay were not limited to open-air sites. The presence of heterogeneous sites with diverse functions \((\text{residential, logistical, supply quarries, lithic workshops})\) existed in virtually every area of Uruguay, suggesting great human diversity during the Pleistocene-Holocene transition \((\text{ca. 11,000–8500 RCYBP})\). Early hunter-gatherers occupied various environments and practically all the landscapes available in Uruguay. The Uruguayan early occupation sites occur in Atlantic coastal dunes, grasslands surrounding ponds and lakes margins, on top of hills, on floodplains and different terraces of major rivers \((\text{Uruguay, Cuareim, Arapey, Negro, etc.})\), and on inland eolian dunes along the Tacuarembó River and the middle Negro River \((\text{Suárez} 2011)\); now we integrate new sites from the rolling hills of Cuchilla de Haedo. These landscapes would have offered diverse resources \((\text{fauna, vegetation, water, firewood, raw materials, etc.})\) that were exploited by early hunter-gatherers from the end of the Pleistocene. Moreover, early South American generalists or foragers engaged in exploring this part of the continent would have found in these various environments great diversity of animal species for hunting \((\text{extinct and present-day fauna})\).

We thank the Intendencia Municipal de Salto for their encouragement and constant help, including the Intendente Germán Coutinho and the Secretaria General María Cecilia Eguiluz. Juan Suárez for...
his help in both the field and lab, Héctor Silva and Daniel Donatto collaborated in field work. We also thank Walter López and Sandra Langorte by the access to their ranches (estancias) and the logistic support.

References Cited

For at least the last 12,000 years, several thousand ephemeral, internally drained playa wetlands distributed throughout the High Plains have provided essential food, water, and shelter to wildlife (Smith 2003). These “oases of the Plains” were also widely utilized by Native American cultures and their ancestors: Playas were used prolifically because they supplied some of the only reliable water sources, which also attracted game. Lunettes, isolated eolian dunes found along the downwind margin of some larger playas, were ideal for seasonal and permanent use as campsites (e.g., south-facing slopes of lunettes provided protection from the predominantly northern winds while admitting maximum winter insolation). Use of playas and lunettes by Paleoindian peoples is well documented on the High Plains (Holliday 1997; LaBelle et al. 2003; Mandel and Hofman 2002; Mandel et al. 2004).

The goal of this project was to develop a comprehensive geospatial database that includes all lunettes associated with playas on the High Plains of Kansas. To accomplish this, 1:24,000-scale digital raster graphics (DRGs) were loaded in a GIS environment, and then visually scanned in one-square-mile intervals for 46 counties in western Kansas. All isolated ridges, identified by subcircular to crescentic-shaped closed contour lines associated with playas, were digitized on-screen and included in the lunette database, followed by limited ground-truthing. All playas, mapped earlier by Bowen et al. (2010), with a surface area greater than 5 ha were also visually inspected in GIS to inventory lunettes. Only larger playas were individually inspected because lunettes are typically only associated with larger, deeper playas (Reeves 1990; Sabin and Holliday 1995).

Results of the lunette inventory indicate that 135 playa-lunette systems with a total of 174 lunettes occur in Kansas (Figure 1). Of these, 105 consist of a
single lunette associated with a single playa, while 30 PLs consist of multiple lunettes associated with a single playa or multiple playas in immediate proximity to one another. As a result of predominantly north-to-northwest winds throughout much of the Quaternary period (Muhs and Bettis 2003), most of the lunettes (157) are located along the southern, southeastern, or eastern margin of playas. Lunette surface area ranges from 0.6 to ~150 ha; mean surface area is 20 ha, and median surface area is 7 ha. The dataset is biased towards larger lunettes because smaller, shorter lunettes were not discernible on DRGs. Playa and lunette geospatial databases are available at the State of Kansas GIS Data Access and Support Center at www.kansasgis.org.

**Figure 1.** Distribution of lunettes on the High Plains of western Kansas. Data were derived from DRG contour data. Owing to small map scale, lunettes are plotted as point data, rather than as polygons.
Soil Stratigraphy of the Lindenmeier Folsom Site

Vance T. Holliday

**Keywords:** Lindenmeier, Folsom, soil stratigraphy

The well-known Lindenmeier site in northern Colorado was among the first stratified Paleoindian sites subjected to careful geological scrutiny (Bryan and Ray 1940; Haynes 2003). Subsequent work (Haynes and Agogino 1960) resulted in a standardized lithostratigraphic scheme (e.g., Wilmsen and Roberts 1978). This paper presents additional geoarchaeological data focused on the Folsom soil-stratigraphic record. Soils are important at Lindenmeier because: 1) they are a significant component of the stratigraphy, 2) they may have affected the distribution of artifacts, and 3) they indicate local environments when they formed.

Field work (1995, 2007) focused on continuous exposures of valley fill along the main arroyo. It did not include the bison kill/processing area east of the arroyo. From bottom to top, Haynes and Agogino (1960) identified seven lithostratigraphic units (A–G) and nine unconformities (Z1–Z9) (Figure 1). Buried soils are numbered top to bottom (b1–b7). The key strata here are B and D, and soils b5, b6, and b7.
Stratum B, up to 2 m thick, is a massive pale brown to brown (10YR 6/3, 5/3, 4/3) silt. This silt is probably Peoria Loess, the youngest and most widespread upper-Pleistocene loess unit on the Great Plains (Bettis et al. 2003). A well-developed soil (Btkb7-Btb7) (“Deposition B, Unit c” in Haynes and Agogino 1960:7) formed in the loess. The A horizon was truncated by erosion (Z3) before burial, but the B horizon is welded to the soil formed in overlying Stratum D. Stratum C is a local accumulation of alluvium that thins out against B. The top of Stratum C and locally upper B were truncated by erosion (Z4).

Stratum D is a clay loam with localized lenses of gravel, subdivided into: lower D (dark grayish brown to dark brown, 10YR 4/2 and 3/3), middle D (a lighter gray gravel lens), and upper D (dark grayish brown to dark brown, 10YR 4/2 and 3/3) (equivalent to Da, Db, and Dc of Haynes and Agogino 1960:12, respectively). Z5 truncates the top of D. Stratum D varies from 50 to 100 cm thick due to local erosion and local gravel deposition, and it thins upslope.

Stratum D also represents a pedocomplex (ABtkb5-Cb5-ABtkb6) resulting from soil formation throughout the valley following Z4 erosion. The thickness of the pedocomplex is indicative of a cumulic soil that slowly aggraded on the valley floor. The thick, dark, base-rich character of the soil suggests significant
biological productivity, perhaps a dense, continuous grass cover. The soil geomorphology suggests a broad valley with a gentle south slope, similar to the modern valley. The carbonate in the Stratum B soil is likely related to formation of the cumullic A horizon in Stratum D, because carbonate is superimposed on the Bt horizon and it is immediately below the A horizon in Stratum D.

The Folsom artifacts were found in upper B, on Z4, and in D. Haynes and Agogino (1960:9, 11–12) suggest that the Folsom material was found only in lower D, whereas Roberts and Wilmsen (1978:37) state that it was “throughout this unit.” The artifact assemblages could represent multiple Folsom occupations in the valley in the late phases of Stratum C deposition through Stratum D formation. Alternatively, the Folsom presence could have been more limited. Bison bones were noted at the base of D (Wilmsen and Roberts 1978:35, fig. 154), and bones and associated occupation debris were noted on top of B, buried by D (C. V. Haynes, pers. comm. 2007). Human activity and post-depositional processes could have mixed the finer occupation debris, such as charcoal, through upper B and lower D, but large bone is unlikely to be mixed up or down. Backplots of artifacts from Stratum D also suggest multiple occupations during the cumulization processes (J. LaBelle, pers. comm. 2007).

The archaeological and pedological records indicate that the site was subjected to repeated occupation during cumulization, resulting in at least some mixing of artifacts. The erosion forming Z5 also resulted in redeposition of Folsom-age charcoal and artifacts. Interpretations of the Folsom archaeological record and future field work at Lindenmeier clearly should include consideration of soil-forming processes. Pedogenesis was likely an important factor in site formation. Micromorphological analyses of thin sections might be able to detect subtle evidence for occupation surfaces and/or microlamination. A search for vertical refits among the considerable Folsom lithic assemblage would provide insights regarding the degree of soil mixing.

This work benefited from the assistance and insights of Vance Haynes, Adrienne Anderson, Diane Holliday, and Jason LaBelle.

References Cited


Haynes, C. V., Jr., and G. A. Agogino 1960 Geological Significance of a New Radiocarbon Date from the Lindenmeier Site. The Denver Museum of Natural History, Proceedings 9, Denver, CO.

Post–Last Glacial Maximum Dune Sequence for the “Parsonburg” Formation at Elliott’s Island, Maryland

Darrin Lowery, John Wah, and Torben Rick

Keywords: Paleoenvironments, geosciences, dune formation

Elliott’s Island (~1.3 km wide and ~2.3 km long) is located on Fishing Bay, Maryland, a tidal tributary of Chesapeake Bay. Elliott’s Island consists of an arc-shaped ridge of well-sorted, very fine to medium-grained sands. The island is a barchanoid dune and part of the Parsonburg Formation (Denny et al. 1979). Markewich et al. (2009: 409–425) recently suggested that Parsonburg formation dunes in the region formed as a result of strong mid-latitude WNW-NW winds coeval with rapid growth of the Laurentide ice sheet during the last glacial maximum (LGM).

Research along exposed coastal bank profiles indicates that Elliott’s Island formed as a result of episodic post-LGM dune-building events. A 15-cm-thick upland freshwater peat was buried by eolian deposits. Depth to the peat ranges from 1.5 to 5.0 m. Plant macrofossils collected from the peat stratum on Elliott’s southern shore were dated to 20,400 ± 90 RCYBP (OS-81222), with a second sample from the northern shore exposure dated to 20,020 ± 80 RCYBP (Beta-286851). Calibrated ages of 24,342 ± 305 and 23,946 ± 318 CALYBP for the peat stratum make it coeval with the LGM and associated with one of the coldest episodes recorded in the GISP2 ice core dataset (see Alley 2004). The Elliott’s Island LGM peat is contemporaneous with the “Tilghman Soil” within loess along the western flanks of the Delmarva Peninsula (Lowery et al. 2010).

Six Clovis points have been found along the eroded shorelines adjacent to Fishing Bay. On northern Elliott’s, a regionally uncommon “Fishtail” Clovis point (Brown 1979) was found on the surface near a 5-m-high eroded bank at site 18DO440 (Figure 1). It is likely that the Clovis occupation is at the top of a truncated paleosol buried by ≥1 m of eolian sand. However, no Pleistocene artifacts have yet been found in situ.

Elliott’s Island documents complex landscape evolution, LGM vegetation and climate, and regional dune-building episodes that occurred after the LGM through the late Holocene. People appear to have occupied these dunes since at least Clovis times. For example, several late-Holocene shell middens have been recorded in the dunes (Lowery 2005). Data from Elliott’s Island...
and elsewhere in the region (Wah 2003) indicate landscape stability and vegetation cover during the LGM (Lowery 2009). Further research is needed to determine the composition of these vegetation communities and the timing and extent of dune formation on Chesapeake Bay.

References Cited


Lowery, D. L. 2005 Archaeological Survey of the Fishing Bay and the Fairmount Wildlife Management Areas within Dorchester and Somerset County, Maryland. Monograph on file at the Maryland Historical Trust, Crownsville, Maryland.

——— 2009 Geoarchaeological Investigations at Selected Coastal Archaeological Sites along the Delmarva Peninsula. Unpublished Ph.D. dissertation, Department of Geology, University of Delaware, Newark.


Deglaciation and the Archaeology of Trapper Creek, South-Central Alaska

Brian T. Wygal and Ted Goebel

Keywords: Deglaciation, late Pleistocene, south-central Alaska

The Trapper Creek Overlook (TCO) site occupies an esker formed by ice stagnation in the middle Susitna River valley of south-central Alaska and has yielded two Holocene archaeological components, the earliest dated between 9500 and 7800 CALYBP (Wygal 2009). A significant unanswered question regarding the prehistory and paleoecology of the middle Susitna basin between Cook Inlet and Broad Pass surrounds the timing of glaciation during the late Pleistocene. Refined glacial histories are essential for understanding the paleoecology of early hunter-gatherers in the region, and for reconstructing the process of human colonization of deglaciated landscapes.

Ice flows from high mountain valleys mantled the Trapper Creek area sometime during the late Pleistocene (Hamilton and Thorson 1983:38); however, the timing of deglaciation is not well understood (Schmoll and Yehle 1986). The OSL-dated stratigraphic record from TCO may shed light on this problem. Figure 1 represents the 12 strata at TCO beginning with basal morainal gravel (Stratum 1) capped by 95 cm of sediments including four soil complexes and a series of tephras (Wygal 2009). Optically stimulated luminescence (OSL) dating at TCO suggests postglacial sediment deposition occurred during the last glacial maximum (LGM). Laboratory analyses included multiple aliquot regenerative dosing processes (for descriptions of method, see Jain et al. 2003; Murray and Wintle 2003) and employed infrared excitation on components dominated by feldspar and blue or green excitation on quartz particles. Because multiple methods produced statistically identical ages overlapping at 1σ, the feldspar and quartz components of these sediments appear to be consistent geochronometers (Forman 2007).

In 2006, two sediment samples were dated from Stratum 3a, a 25- to 35-cm-thick loess deposit grading from greenish gray loamy sand at its base (3a) into a yellowish brown sandy loam at its top (3b). While 3a lacks artifacts, overlying Stratum 3b contains the earliest component. The lowest OSL sample (UIC1865) produced three ages (32,540 ± 2480, 27,610 ± 2125, and 24,710 ± 1510 CALYBP). The second (UIC1935) yielded two aberrant dates (42,860 ± 3260 and 47,800 ± 3650 CALYBP) from 14 cm above basal gravel; and UIC1866 from Stratum 3b produced four ages (19,530 ± 1500, 17,685 ± 1360, 17,450 ± 1050, and 15,580 ± 980 CALYBP). Several unusually old estimates did not conform to stratigraphic superposition and were dismissed (Wygal 2009).
In 2007, six additional samples were collected from pure aeolian sediments with little sign of oxidation or pedogenesis. Blue excitation was employed with sample UIC2000 from the contact of Stratum 2 with 3a, yielding an age of 31,780 ± 2410 CALYBP, similar to the 2006 results. Additional dates from 10 cm above Stratum 2, clearly within Stratum 3a (UIC2002), again yielded estimates that fit the 2006 results (22,470 ± 1720 and 21,310 ± 1630 CALYBP). Furthermore, an OSL date (UIC2003) on an ash pocket from Stratum 4a (8120 ± 620 CALYBP) was consistent with five AMS dates ranging between 7870 ± 50 (AA67360) and 8800 ± 120 CALYBP (BETA208283), suggesting the 2007 OSL calibration methodology was accurate. Moreover, samples UIC2001 and UIC2004 from Stratum 7 yielded ages of 2400 ± 195, < 2370 ± 160, 2335 ± 195, and < 2060 ± 135 CALYBP, consistent with their position near the top of the profile, the known age of the Hayes tephra in lower-lying Stratum 6 (ca. 4000 CALYBP), and AMS dates on upper-lying tephras in stratum 9 (ca. 800–900 CALYBP).

Two interpretations for the ages of the basal sediments at TCO are possible. On the one hand, the results may be spurious, because they do not conform to the commonly held notion that southern Alaska was heavily glaciated until the end of the Pleistocene. On the other hand, the OSL ages from Stratum 3a suggest the lower loess deposits at TCO accumulated during or immediately after the LGM, implying deglaciation occurred much earlier than previously thought. We conclude that the latter interpretation is more probable given the conformance of OSL chronology with AMS ages on charcoal from the overlying stratum 4a, tephrochronological correlations, and AMS dating of strata 7 and 9. These results suggest a relatively early age for loess deposition at
TCO and support previous reports from 140 km north of the site suggesting final deglaciation by 17,200 CALYBP (Briner and Kaufman 2008; Dortch 2006). West of Bootlegger’s Cove in northern Anchorage, the lower Susitna River debouches into upper Cook Inlet. Here, the Susitna valley was isostatically depressed and flooded with glacioestuarine waters extending upstream during the Elmendorf stadial at ca. 15,000 CALYBP (Reger et al. 2007:10); it therefore was not glaciated at that time. Because LGM glacial retreat occurred first from the valley floor moving toward alpine sources, it is probable that the middle Susitna was ice-free during or shortly after the LGM. Potentially correlative research from the neighboring upper Copper River basin suggests a catastrophic draining of Glacial Lake Ahtna because of ice-dam failure between 26,000 and 15,000 CALYBP (Wiedmer et al. 2010). Wood fragments recovered from Glacial Lake Ahtna bottom sediments yielded the uncalibrated date 17,600 ± 400 RCYBP (Williams 1989:82).

We thank Steve Forman at the Luminescence Dating Research Laboratory, University of Illinois, Chicago for conducting a thorough analysis of OSL ages for this project. Beta Analytic and University of Arizona laboratories provided radiocarbon assays. We also thank Randy Tedor and Kelly Graf for contributing to discussions on the sedimentology of the TCO site, and Gary Haynes, David Rhode, Scott Mensing, and Michael Bever for thoughtful comments on previous drafts of this research. This research was funded by the National Science Foundation (Arctic Social Sciences Program) and Department of Anthropology at the University of Nevada, Reno.

References Cited


Paleobotany

Nonsiliceous Algae and Aquatic Pollen Spectra from the Portage River Channel, Northeast Minnesota

James K. Huber

Keywords: Nonsiliceous algae, river channel, Minnesota

Nonsiliceous algae were extracted from the basal portion of a sediment core recovered from the Portage River Channel, Carlton County, Minnesota (92° 38′ 05″ N, 46° 27′ 50″ W). The site is located in the southwestern end of the Lake Superior basin and is in an old drainage channel of Glacial Lake Duluth (Bacig and Huber 1993).

At approximately 11,000 RCYBP during the Nickerson Phase of Wisconsin Glaciation, the southwest end of Lake Superior was last glaciated. A series of small glacial lakes formed between the retreating ice margin and the rim of the Superior basin as the ice of the Superior Lobe melted (Farrand 1960). These glacial lakes were named Nemadji, Ashland, Brule, and Ontonagon by Leverett (1929). These proglacial lakes combined to form Glacial Lake Duluth as the Superior Lobe ice retreated. The Portage River channel is interpreted to be the outlet for Glacial Lake Nemadji and the early stages of Glacial Lake Duluth. The Portage River channel was abandoned when the Lake Superior Lobe retreated further, dropping the level of Glacial Lake Duluth and opening an outlet at the Brule River (Wright et al. 1970).

The basal portion of the core (230–237.5 cm) is composed of medium- to fine-textured organic sands with small wood fragments and is overlain by a thin layer (228–230 cm) of organic-rich clay. The remainder of the core (0–228 cm) grades from amorphous to fibrous peat. A channel-fill sequence is interpreted based on the stratigraphy (Bacig and Huber 1993).

Three sediment samples for nonsiliceous algae and pollen were analyzed from the basal portion of the core. The pollen spectra are dominated by *Picea* (spruce) and *Pinus* (pine), mostly *Pinus banksiana/resinosa*-type (jack/red pine), and is interpreted as representing a transition from a boreal to mixed

James K. Huber, Department of Geoscience, University of Iowa, Iowa City, IS 52242 and James K. Huber Consulting, 2573 58th St., Vinton, IA 52349; e-mail: jhuber@fmtcs.com
conifer-hardwood forest. At various sites in northeast Minnesota has been
dated between 10,700 and 9500 RCYBP (Bacig and Huber 1993).

Most of the algae taxa occur in all three samples and consist of Botryococcus
(0.0–0.5%), Pediastrum Boryanum (0.4–0.9%), P. duplex var. clathratum (0.0–
0.2%), Scenedesmus (1.1–2.7%), Spirogyra-type (0.5–0.9%), Tetraedron (0.0–
1.4%), and Zygnema-type (1.8–2.0%), all green algae (Chlorophycophyta).
Gloeotrichia-type (0.0–0.7%) is the only blue-green algae (Cyanochlororonta) to
occur in the sequence. Pollen from four aquatic plant taxa also occur in the
Portage River Channel sequence: Brasenia Schreberi (watershield; 0.0–0.2%)
Potamogeton sp. (pondweed; 0.0–0.2%), Sparganium-type (bur-reed; 0.0–0.5%)
and Typha latifolia (cattail; 0.2–1.9%). Percentage values for nonsiliceous algae
and aquatic pollen were calculated, respectively, by adding the pollen sum to
the nonsiliceous algae sum and by adding the pollen sum to the aquatic pollen
sum. A minimum of 400 pollen grains of trees, shrubs and herbs was identified
for each sediment sample.

All the nonsiliceous algae taxa occurring in the basal portion of the Portage
River Channel core are predominantly euplankton or tychoplankton. They
are free-floating and commonly inhabit open water lakes and/or shallow open
water lakes (Prescott 1962). The aquatic plants are all indicative of ponds or
slow-moving streams (Fernald 1970). The aquatic pollen and algae are consis-
tent with the early stages of a channel fill sequence.

References Cited

Bacig, E. J., and J. K. Huber 1993 A Late Glacial Sequence from the Portage River Channel,

Farrand, W. R. 1960 Former Shorelines in Western and Northern Lake Superior Basin. Unpublished
Ph.D. dissertation, University of Michigan, Ann Arbor.

York.

Leverett, F. 1929 Moraines and Shorelines of the Lake Superior Basin. USGS Professional Paper
154-A.


Wright, H. E., Jr., L. A. Mattson, and J. A. Thomas 1970 Geology of the Cloquet Quadrangle,
Biogenic silica (e.g., phytoliths) and charcoal data derived from loess samples and uppermost 10 cm of underlying till on morainal ridges within the Jarvis Creek valley of the Tanana River system provide a robust local signature for reconstructing postglacial climatic conditions from well-drained sites in this area of interior Alaska. The thin mantle of loess (<50 cm) capping the morainal ridges was likely derived from the Tanana River and its tributaries, with possible contributions from the Yukon and/or Nenana river systems (Muhs and Budahn 2006). The modern soil, imprinted on the loess and upper till, is a Eutrochrept with Oe, Bw/Ajj, and 2BC/CB (till) horizonation developed under a shrub and conifer cover. A prominent quasi-horizontal lamella, common within soils of the region (Dilley 1998), occurs within the Bw/Ajj horizon, in about the center of the loess mantle. Several pronounced changes in soil and sediment parameters occur from below to above the lamella, including an increase in frequency dependence of magnetic susceptibility (greater percent of very fine magnetic grains), a shift in L*a*b- and Munsell-derived colors, an increase in very fine silt, a C/N increase and a decrease in δ¹³C and δ¹⁵N values. These changes and lamella morphology suggest a pedopedogenetic origin for the lamella (Rawling 2000), i.e., development at the contact between two loess units where surface stability, albeit perhaps short lived, likely occurred. Representative AMS ¹⁴C ages are 10,870 ± 50 RCYBP (Beta 227161; Betula spp. charcoal; 12,700 CALYBP) within the middle of the lower loess and 5900 ± 50 RCYBP (Beta 227159; Picea spp. charcoal; 6700 CALYBP) immediately (0.5 cm) below the lamella.

Phytoliths, other biogenic silica, and particulate charcoal, extracted from the soil samples using a heavy-liquid extraction protocol (Bozarth 1997), were analyzed under ≥625x magnification. Microfossil data generated from profiles established in excavations at four archaeological sites (XMH-874, XMH-878, XMH-915, and XMH-917) depict similar vegetation histories for the past 13,000–12,000 years, with data from XMH-878 being presented herein. Phytolith data from the uppermost 10 cm of the till indicate prevalence of a C₃ grass (Pooideae subfamily) cover, interpreted as a cold, slightly mesic environment. No Picea- or Betula-type phytoliths were recovered. Fire occurrence was rare, given the lack of charcoal and charred phytoliths. Data from the lower loess (below the lamella, prior to 5900 ± 50 RCYBP) indicate persistence of
treeless, C$_3$-dominated grassland. Presence and near-pristine condition of sponge spicules suggests a loess source from the nearby Delta River, a tributary to the Tanana River. Phytolith concentration, a proxy for relative surface stability, increases upward from a low of ~1,400 phytoliths/gram and ~13,000 phytoliths/gram of sediment within the uppermost till and lowermost loess, respectively, to a lower loess maximum of ~120,000 immediately below the lamella. Low counts of particulate charcoal and charred phytoliths indicate a continued minor role for fire. High frequencies of algal statospores in the uppermost lower loess indicate also that this surface remained relatively moist for an extended period of time owing to rain, snowmelt, and perhaps changes in the local soil hydrology.

Phytoliths within the base of the upper loess drop in concentration from ~96,000 immediately above the lamella to a low of ~4000 in the middle of the upper loess; however, charcoal concentration increases to levels not observed below, especially in the >80 $\mu$m size (indicative of proximal or on-site fires). Within the upper ~22 cm of the profile, phytolith concentration increases dramatically to >1.5 million, and both small (10–80 $\mu$m) and large (>80 $\mu$m) charcoal increase to surface (upper 1 cm) maxima; conifer-type phytolith concentrations display a similar pattern of increase.

Scores of paleoecological studies have been reported for Alaska (Anderson et al. 2004), with the Tanana River valley the focus of some of the earliest research (see Ager 1975). While the thin mantle of loess on morainal ridges in the Tanana River Lowlands lacks the resolution and detail of the lake, muskeg, and other lowland records, it provides a relatively complete local environmental record from the late-Pleistocene/Holocene transition to the present. Given the AMS $^{14}$C age of ~12,700 CALYBP above the loess-till contact and a presumed sedimentation rate, a basal-loess age estimate of ~13,500 years ago seems appropriate and agrees with ages of ~13,200 CALYBP obtained above the sand-silt contact on a loess-mantled sand dune at the Upward Sun River site (Potter et al. 2008, 2011).

The microfossil assemblage within the lower loess indicates that late-Pleistocene/early-Holocene human inhabitants of the region would have experienced an exposed treeless, grass environment on the morainal ridges. This environment would have supported large grazing herbivores such as elk and bison. Surrounding lowland areas, however, may have been occupied to varied extents by trees and shrubs at this time (Ager 1983, Anderson 2004).

References Cited


Bozarth, S. R. 1997 Pollen and Phytolith Analyses. In Vanishing River: Landscapes and Lives of the


A Geometric Morphometric Study of North American Late-Pleistocene Equid Upper Premolars and Its Potential Significance for Equid Systematics

Christian Raúl Barrón-Ortiz and Jessica Theodor

Keywords: Geometric morphometrics, Equus, cheek teeth, late Pleistocene, North America

The systematics of North American late-Pleistocene equids continues to be problematic. More than 20 species have been named, but recent revisions recognize fewer species. Molecular analyses (Weinstock et al. 2005) indicate that only two are valid (a stilt- and a stout-legged species). Qualitative morphological studies suggest up to ten species (e.g., Azzaroli 1995), whereas quantitative revisions indicate at least three (e.g., Winans 1989).

Recent morphological revisions have concentrated on cranial and postcranial material, while study of the cheek teeth has been mostly limited to some observations (e.g., linguaflexid morphology) and measurements (e.g., tooth length and width). This is partly because of variability in the occlusal pattern and the difficulty of measuring its features. Methods for metrically studying cheek teeth concentrate primarily on overall dimensions (Eisenmann et al. 1988). This can be useful when comparing material from a particular region. However, when comparing across different regions, identifying taxonomic groups can become complicated because the main variation in the data is size-related, and size varies geographically.

Both these limitations can be overcome. The occlusal pattern can be taxonomically informative if teeth with an equivalent wear stage are compared (Barrón-Ortiz et al. 2008). Secondly, different methodologies such as geometric morphometrics exist for studying size separately from shape. In this report we describe the results of a geometric morphometric analysis of third and fourth upper premolars of North American late-Pleistocene equids.

The sample consisted of 78 specimens from 25 localities arranged into 6
geographic regions: Beringia (n = 4), northern Great Plains (n = 14), South- 
eastern U.S. (n = 13), American Southwest (n = 9), Southwest coast, U.S. 
(n = 4), and central Mexico (n = 34). Specimens of extant equids were also 
analyzed: Equus caballus (n = 21), E. asinus (n = 10), E. zebra (n = 4), E. burchelli 
(n = 4), and E. hemionus (n = 10). Teeth showing a crown height representing 
30–40% of the estimated unworn height were studied. The specimens were 
obtained from collections and figures published in the literature.

For each tooth, 26 landmarks were located on a digital image of the occlusal 
enamel pattern using tpsDig 2.12 (Rohlf 2008). Centroid size was calculated in 
PAST 1.99 (Hammer et al. 2001). Subsequently, the landmark configurations 
were superimposed (Procrustes superimposition), and a relative warps analy-
sis (alpha of -1) was performed. Differences in centroid size were tested using 
one-way ANOVA and Student’s t-test; shape differences were tested using NP-
MANOVA. To increase sample size, both tooth types were combined. A test on 
14 teeth from a single species indicated no significant differences in centroid 
size and shape between these tooth types. Sexual dimorphism was tested on E. 
caballus with no significant differences found.

The teeth of the extant species, except zebras, separated in terms of shape. 
The fossil specimens showed overlap in size across the different geographic 
regions. However, within each region, there were between one and three 
different sizes represented; in accordance with other studies (e.g., Malgarejo-
Damián and Montellano-Ballesteros 2008; Winans 1989). In terms of shape, 
two distinct morphotypes were identified. For every region, except the South-
west Coast, these two morphotypes correspond to the stout-legged and stilt-
legged groups that have been recognized on morphological (e.g., Azzaroli 
1995; Winans 1989) and molecular (Weinstock et al. 2005) grounds.

The results for each region can be summarized as follows. Only one size 
category (medium) was evident for the Beringian specimens, which in terms of 
shape clustered within the stout-legged morphotype. For the Great Plains there 
were two sizes (large and medium) that clustered within the stout-legged group. 
Two of four Southwest Coast specimens have been identified as E. occidentalis 
(Azzaroli 1998), and although this was a large stout-legged horse, the four 
specimens clustered within the stilt-legged morphotype group. Large, medium, 
and small specimens were found for the American Southwest sample that 
separated into stout-legged (large and medium) and stilt-legged (small) groups. 
Two size categories (large and medium) were present for the Southeastern U.S. 
specimens that clustered within the stout-legged group. Finally, for Mexico 
there were three different sizes (large, medium, and small) and two shape 
morphotypes: stout-legged (large and medium) and stilt-legged (small).

The results suggest four morphological groups (F = 5.68, p<0.001; p<0.05 
for all pairwise comparisons) which might represent separate species. These 
are a small stilt-legged equid (including specimens previously identified as E. 
tau and E. francisci), a medium stout-legged equid (specimens previously 
identified as E. conversidens, E. fraternus, and E. lambei), a large stout-legged 
horse (specimens previously identified as E. complicatus, E. niobrarensis, and E. 
mexicanus) and E. occidentalis. Further analyses employing more specimens, 
other tooth positions, and outline-based morphometric methods are under-
way and will contribute to better understanding variation in cheek-tooth morphology.

We thank Joaquín Arroyo-Cabrales (Instituto Nacional de Antropología e Historia), Christopher Jass (Royal Alberta Museum), and Arthur Harris (University of Texas at El Paso) for access to specimens in their care.

References Cited


Reexamining the Geological Context and Age of the Walhalla, North Dakota, Mammoth

Ashley Breiland and Kenneth Lepper

➤ Keywords: Lake Agassiz, mammoth, OSL dating

During the recession of Glacial Lake Agassiz a series of beach ridges formed in the Dakotas, Minnesota, and several Canadian provinces. Within these ridges...
a variety of mammal fossils have been discovered, including the remains of mammoths (Hoganson 2006; Ashworth and Cvancara 1983). The Herman is the earliest of the well-developed ridges, and at least four mammoth specimens have been reported in association with beach deposits of the Herman stage within North Dakota and Minnesota. However, no mammoth remains have been linked to younger beaches or stages of Lake Agassiz.

One of the scientifically reported Herman beach mammoth specimens was found near Walhalla, North Dakota. It is identified in two published reports as catalog #5388 of the University of North Dakota Paleontology Collection (UND-PC 5388; Ashworth and Cvancara 1983; Harington and Ashworth 1986). Both these reports indicate clearly that the specimen was associated with Herman level beach-ridge deposits of Lake Agassiz, but they disagree with the UND-PC catalog entry on the specific location where the specimen was collected. The objective of our project was to investigate the location where the Walhalla mammoth specimen was found and, if possible, determine a geologic age for the mammoth remains using optically stimulated luminescence (OSL) dating.

The specimen, a single tooth, was described by Harrington and Ashworth (1986) as a heavily worn upper molar from a woolly mammoth (Mammuthus primigenius). Ashworth and Cvancara (1983) documented the collection location of the tooth as “NE1/4, NE1/4, Sec 29, T163N, R56W near the USGS gauge at Walhalla.” This subsection is underlain by floodplain deposits of the Pembina River and does not include the gauging station or Herman beach ridge deposits. If recovered from floodplain deposits the specimen would most likely be reworked and its geologic age undeterminable. The UND-PC catalog card for specimen #5388 also indicated that the tooth had been found near the USGS gauge, but the section number had been typed over with the section number changed from “26” to “25” (pers. comm., Joseph Hartman, 2010). Neither of these sections corresponds to the gauge location but instead to sections within the Lake Agassiz basin. We proposed an additional interpretation of the site location: NE1/4, NE1/4, Sec 26, T163N, R57W (the McDonald site). This location is the site of a sand and gravel borrow pit that lies within Lake Agassiz beach deposits and has been active since at least 1979, based on USGS mapping (Walhalla, ND, 7.5’ quadrangle).

In the summer of 2010 two sediment samples (Figure 1) were collected for OSL dating from the McDonald site (48° 55′ 08.39″ N; 97° 58′ 18.40″ W; surface elevation 356 m). Clean quartz sand in the grain-size range of 150–250 µm was isolated from each field sample (supplement to Lepper et al. 2007). OSL data were collected using single-aliquot regeneration experimental procedures (SAR: adapted from Murray and Wintle 2000; 2006), and the data were analyzed using the approach described in the supplement to Lepper et al. (2007). The equivalent dose distributions for both samples were symmetric; therefore, their mean and standard error were used for age calculations (Table 1).

The OSL age obtained for the upper portion of the section, 14,300 ± 300 CALYBP, is consistent with OSL ages that have previously been reported for the Herman strandline of Lake Agassiz (Lepper et al. 2007; Lepper et al., in review). Below a transitional layer of crossbedded gravels (Figure 1), an age of 18,300 ± 400 CALYBP was obtained. This age from lower in the profile could
potentially represent deposition of sediments in the Pembina deltaic complex prior to beach ridge formation.

Previously published reports regarding the Walhalla mammoth definitively state its connection to the Herman beach ridge. Therefore, if our interpreted location (NE1/4, NE1/4, Sec 26, T163N, R57W) is correct and the specimen was recovered from the upper portion of the profile, then and only then could it be assigned an age of 14,300 ± 300 CALYBP, which would be consistent with the Herman stage of Lake Agassiz. Unfortunately, however, no stratigraphic context is recorded for this specimen and the possibility that it was recovered from the floodplain site cannot be ruled out. Its heavily worn condition also supports reworking prior to burial. Consequently, we conclude that the Walhalla mammoth should not be considered among the group of “Lake Agassiz beach mammoths.”

Table 1. OSL data and results.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>N*</th>
<th>Dose rate (Cy/ka)</th>
<th>Equivalent dose (Gy)</th>
<th>Age (ka)</th>
<th>Age uncertainty (ka)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KL1002AB</td>
<td>94/95</td>
<td>1.334 ± 0.108</td>
<td>19.117 ± 0.427</td>
<td>14.3 ± 0.3</td>
<td>1.0</td>
</tr>
<tr>
<td>KL1003KB</td>
<td>91/94</td>
<td>1.322 ± 0.114</td>
<td>24.225 ± 0.475</td>
<td>18.3 ± 0.4</td>
<td>1.6</td>
</tr>
</tbody>
</table>

*Number of aliquots suitable for analysis/number of aliquots from which data were collected.

References Cited

Mammal Extinction at the Pleistocene-Holocene Boundary in South America

**Alberto L. Cione, Eduardo P. Tonni, and Leopoldo Soibelzon**

➤**Keywords:** South America, mammals, extinction, pseudo-extinction

Extinctions throughout the Neogene in South America at species, genus, and even family levels were mostly related to climate and environmental changes. They affected different components of the biota. However, by the late Pleistocene and early Holocene there was an extinction event of extraordinary features, when 100% of the remarkably abundant megamammal species (37 species with body mass over 1,000 kg) and about 80% of the large mammal species (those over 44 kg) became extinct. With the exception of some small mammals, no other animals or plants disappeared. Consequently, the extinction event was distinct from “normal” mass extinctions (see comments in Cione et al. 2003). This extinction has been attributed to climate change, epidemics, or human action, and Cione et al. (2009) proposed an alternative, which they called the “Broken Zig Zag” theory. According to these authors, the distribution and abundance of mammals alternated from wider to narrower ranges, following the cycles of spread and reduction of open-vegetation zones responding to climate changes in the middle and late Pleistocene (see Vivo and Carmignotto 2004). During the cold events, megamammals had a wider distribution. During the warm periods, open environments shrank owing to the expansion of forests. These climatic and faunal changes can be modeled as zig zags. Twenty pairs of changes in temperature from hot to cold and back.
occurred during the middle and late Pleistocene (see Petit et al. 1999), but no extinctions occurred. At the beginning of the current interglacial, when temperatures were rising, moisture increased, and forests expanded; megamammals and many large mammals that had survived for hundreds of thousands of years became extinct, and the “zig zag” was broken. The arrival of humans in South America was the sole new biological or geological event that occurred in the present interglacial period. Consequently, the entrance of humans and their pressure on numerically reduced mammal populations must have been the factor that led to local extinction (extirpation) or total (global) extinction. The different extinction of related species (e.g., between Cervidae and Camelidae, cited by Cione et al. 2009), may correspond to subtle differences in ecological plasticity.

The process of extinction appears to have taken several thousands of years in South America. Politis and Messineo (2008) published six AMS $^{14}$C ages from *Megatherium americanum* bone collagen from the site Campo Laborde (37° 00′ 36″ S and 60° 23′ 05″ W), ranging from ca 9700 to 6700 RCYBP. The evidence obtained from Campo Laborde as well as from the La Moderna site (Politis et al. 2003) indicates that some Pleistocene species such as giant ground sloth and some glyptodonts (*Doedicurus clavicaudatus* and *Neosclerocalyptus sp.*.) survived in the Pampas until the early Holocene. Recently, Cajal et al. (2010) proposed that the extinction of a camelid, *Lama gracilis*, can be attributed also to the anthropic action that not only includes the hunt burden but also other factors (i.e., environmental change and ethological changes caused by human presence).

References Cited


Environmental Stability During the Pleistocene-Holocene Transition in Northwestern Patagonia? The Small Mammals of Cueva Huenul 1 as Evidence

Fernando J. Fernández, Ulyses F. J. Pardiñas, Pablo Teta, and Ramiro Barberena

Keywords: Micromammals, taphonomy, paleoenvironments, Argentina

Paleoenvironmental studies in northwestern Patagonia are mostly focused on forest and ecotone forest-steppe areas (e.g., Whitlock et al. 2006 and references therein). The obtained data indicate dry and cold conditions for the late-Pleistocene/Holocene transition (see also Markgraf et al. 2009). For the steppic and hilly ranges east of the Andes in northern Neuquén province there are no studied paleoclimatic records, despite the potential interest of this region, because it has the highest elevations in Patagonia (Domuyo system) and is situated near the western limit of the South American Arid Diagonal. Recent excavations at Cueva Huenul 1 (CH1; 36° 56′ 45″ S, 69° 47′ 32″ W, 1008 m, Neuquén province, Argentina, Figure 1) yielded a rich sequence spanning the late-Pleistocene/early-Holocene (Barberena et al. 2010), and reaching the late Holocene. In this note we briefly address the taphonomy and paleoenvironmental significance of the micromammal remains obtained in CH1.

Bones and teeth of rodents and marsupials (NISP = 1418, MNI = 81) were recovered from late-Pleistocene/early-Holocene layers [units VIII-VII = 13,844 ± 75 RCYBP (AA-85722); units VI-IV = 11,841 ± 56 RCYBP (AA-85720); 9531 ± 39 RCYBP (AA-85718)]; and late-Holocene layers [units III-I = 1416 ± 37 RCYBP (AA-85721)]. We also analyzed samples of fresh pellets from *Tyto alba* (Strigiformes, Tytonidae) obtained from the surroundings of CH1, to compare them with the fossil samples (Figure 1).

The finding of pellets preserved in stratigraphy, together with light digestive traces on some teeth and postcranial bones, and relative abundance of skeletal elements, suggests that the main accumulator agent was an owl, probably *T.*
alba (see Andrews 1990). Moreover, no evidence of weathering and other post-depositional processes, such as hydraulic transport, root action, and diagenesis, were found. However, the high breakage of cranial elements and long bones, taken with the good preservation of smaller elements such as vertebrae, calcaneus, astralagus, metapodials, and phalanges, may indicate some trampling action (Andrews 1990).

Species richness was related to sample sizes \((r = 0.74)\), a situation that, coupled with the small NISP studied, hampers the scope of our conclusions. Fossil samples are dominated by silky desert mouse \((Eligmodontia\ spp.)\), leaf-eared mouse \((Phyllotis\ spp.)\), cavy \((Microcavia\ australis)\) and tuco-tuco \((Ctenomys\ spp.)\). Early-Holocene and late-Holocene assemblages are richer than those of the late Pleistocene and include species typically associated with the Monte
Desert, such as the sigmodontine *Akodon iniscatus* and the mouse opossum (*Thylamys pallidior*), and the Patagonian rat (*Euneomys* spp.) (early Holocene). This situation, with the risk of a biased interpretation due to the small Pleistocene sample sizes, appears to be indicative of a smooth change toward a more heterogeneous environment after ca. 9500 RCYBP and up to the late Holocene, including a mosaic of shrubby steppes, open bare areas, and large rocky outcrops. However, the basic signature (i.e., the codominance of *Ctenomys* spp., *Eligmodontia* spp., *M. australis*, and *Phyllotis* spp.) of the small-mammal assemblages of CH1 remained almost without changes during the Pleistocene-Holocene transition, even up to the late Holocene. A few kilometers west of this cave a recent owl pellet sample shows the occurrence of several abrotrichines (*Abrothrix longipilis*, *A. olivaceus*) and high proportions of *Euneomys* and *Reithrodon auritus* under cooler and wetter conditions. This faunal assemblage never reached CH1 vicinities according to the preserved record, an expectable situation if cooling events had occurred (Pardiñas and Teta 2008), suggesting instead a remarkable ecological resilience to climate change. The general faunal stability of CH1 agrees with the environmental stability inferred on the basis of pollen data from the segment 14,800-8,900 RCYBP of Mallín Vaca Lauquen (Markgraf et al. 2009). Additionally, small mammals of CH1 do not reflect the occurrence of the Huelmo/Mascardi Cold Reversal (HMCR; Hajdas et al. 2003). However, the HMCR is broadly coincident with an erosive unconformity recorded at CH1 that is bracketed between the ages of 11,841 ± 56 and 9531 ± 39 RCYBP (Barberena et al. 2010).

We thank Gustavo Neme and Adela Bernardis for providing a part of the recent pellet samples of *Tyto alba*; the effort of Anahi Formoso and A. Bernardis in sorting and confirming the taxonomy of those samples is greatly appreciated. We also thank CONICET and Agencia (PICT 2008-0547 to UFJP) for economic support.

References Cited


The “Living Fossil” Peccary, *Catagonus wagneri* (Tayassuidae), and Its Climatic Significance during the Pleistocene and Holocene

**Germán M. Gasparini, Esteban Soibelzon, Eduardo P. Tonni, and Martín Ubilla**

**Keywords:** *Catagonus*, Tayassuidae, paleonvironments, Pleistocene, South America

The Tayassuidae first expanded their range into North America from Eurasia and then extended into South America during the “Great American Biotic Interchange,” becoming one of the first North American mammalian immigrants. Three genera are recognized in South America: *Platygonus* Le Conte (middle Pliocene to early Pleistocene), *Catagonus* Ameghino (late Pliocene? early Pleistocene to Recent), and *Tayassu* Fischer (middle Pleistocene to Recent; see Gasparini et al. 2009, 2010).

*Catagonus wagneri* was assigned to the genus *Catagonus* Ameghino by Wetzel et al. (1975); it is commonly known as Chacoan peccary, taguá or chancho quimilero. It has the most restricted geographical distribution among extant Tayassuidae and inhabits semiarid thorny forests of Dry Chaco in western Paraguay, southeastern Bolivia and northern Argentina (Mayer and Wetzel 1986; Gasparini et al. 2006; see Figure 1). The genus *Catagonus* was known from early- to middle-Pleistocene deposits in Buenos Aires City, Argentina (the extinct species *C. metropolitanus*). The species *C. wagneri* was reported by Rusconi (1930) in archaeological sites from Santiago del Estero Province, Argentina (ca. 1000 RCYBP; see Tonni 2006); it was believed to be extinct until it was described by Wetzel et al. (1975). Recently a partial skull from late Pleistocene of Uruguay (Cuareim River, Artigas Department) was assigned to *C. wagneri* (Gasparini et al. 2009, 2010). This material comes from the Sopas Formation (>45,000 RCYBP; 43,500 ± 3600 and 58,300 ± 7400 CALYBP [TL dates]; see Ubilla 2004). This is the oldest fossil record of this species and shows that the species ranged out of its present distribution during late Pleistocene.

Chacoan peccary is more like the extinct *Platygonus* than the other living peccaries. Certain anatomical features of *C. wagneri* are linked with a cursorial life in open and arid or semiarid environments (e.g., elongated limbs, a reduction of the lateral digits, and a great development of the sinuses and nasal chambers; see Wetzel 1977).
At present, *C. wagneri* inhabits areas of rainfall between 800 mm (Mariscal Estigarribia, Paraguay) and 80 mm (Las Lomitas, Argentina)—concentrated in summer months—and high temperatures (mean annual temperature over 24°C). During the late Pleistocene (Uruguay) and the late Holocene (Argentina), *C. wagneri* is recorded in association with mammals that also indicate arid or semiarid conditions (e.g., *Lama guanicoe*, *Myrmecophaga tridactyla*) linked to chacoan vegetation.

During the arid phases of the Pleistocene and Holocene, *C. wagneri* extended its geographic range; during the mainly humid phases—similar to the present ones—it has survived in a scrub-thorn refugium.

The authors thank the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Universidad Nacional de La Plata, ANPCyT, and CIC-PBA, for financial support.

References Cited


Using Morphometrics to Identify Shape Differences on Isolated Teeth in Pleistocene Tapir Species

Matthew Lewis Gibson and Steven C. Wallace

Keywords: Morphometrics, tapir dentition, taxonomic identification

Tapirs are considered relatively conservative Perissodactyls, sometimes referred to as living fossils (Janis 1984), and possess generalized dentitions (Simpson 1945), which can make identifying species and running statistical analyses using isolated teeth problematic (Graham 2003). Unfortunately, tapir material is frequently recovered from cave deposits as only fragmentary dental remains, so several taxa have been described based on isolated teeth alone, primarily based on size (Ray and Sanders 1984). Naming species based on size differences can create problems, however. Rather than being two species, they may simply be different-sized individuals of the same species. Additionally, defining one species as two also fractionalizes the true historical range for the species. Consequently, different methods for identifying isolated teeth to species are needed to ensure proper paleoenvironmental interpretations of such cave faunas. With this in mind, morphometrics could prove to be a useful alternative to identifications based on size.

Identifying shape differences among the various tapir taxa is difficult considering the similar dentitions seen throughout the group. Moreover, it is often difficult to identify with certainty tooth location for isolated teeth, let alone to assign them to a species. However, using geometric morphometrics, it may be possible to recognize even minor shape change, which could be used to differentiate isolated teeth, thereby allowing direct comparison to “known” specimens. Fortunately, the unique shape of the P1 and M3 means that only P2–M2 are problematic and therefore are the focus of this study. Therefore, using a landmark-based scheme applied to P2 through M2, we identified
shape differences among the cheek teeth of two Pleistocene tapirs (*Tapirus veroensis* and *T. haysii*) as a test case and sought to identify an unidentified premolar from a cave deposit in eastern Tennessee. *Tapirus veroensis* and *T. haysii* were used for this analysis because they are the most likely candidates for the Tennessee specimen based on overall morphology and previously reported taxa from Tennessee. However, there are some potential problems which would need to be addressed in future applications of this method. First, the sample sizes are fairly small (*T. haysii*, n = 4; *T. veroensis*, n = 8; and the unknown), so true natural variation is not likely well represented. Secondly, discriminant analysis works best when an unknown belongs to one of two groups; therefore we assume that these are the only two possible taxa (an as yet recognized species of large tapir could have coexisted).

Initial discriminant analysis of the buccal teeth had difficulty grouping the unknown with either *T. veroensis* or *T. haysii* likely due to the unknown being a juvenile with several deciduous teeth. Step-wise discriminant analysis removed landmarks that provided the least discriminating power (likely noise) (Figure 1). Focusing on those characters that best distinguished the two taxa, both separate well, with the unknown grouping with *T. veroensis*. It is likely that the initial discriminant analysis was picking up on the differences between deciduous and adult teeth, or that the results suggest a species of *Tapirus* not considered in this study. Further study is needed to test the utility of this method, but results seem promising.

Figure 1. A, Step-wise Discriminant analysis of premolars. Note that the analysis groups the unknown with *T. veroensis*; B, Step-wise Discriminant analysis of molars. The unknown specimen lacked M2 so it was not included.

References Cited

A Review of the Nye Site, Wisconsin

Marlin F. Hawley, Matthew G. Hill, Christopher C. Widga, and Darrell W. Kittleson

Keywords: Bison, Holocene, Early Man

The Nye site (47PK206) was reported in 1935 by zoologist S. Eddy and anthropologist A. E. Jenks at the University of Minnesota (UM). According to their Science article (Eddy and Jenks 1935), on 28 October 1934 a farmer in the St. Croix River valley (between Minnesota and Wisconsin) brought to them several large animal bones, which Eddy identified as an extinct species of bison (*Bison oliverhayi*) (Eddy and Jenks 1935). Over the next several months Eddy collected an estimated 1,500 bones from the undisclosed source, said to be marl pits. Rosendahl (1948:290) reported a personal communication from Eddy indicating that fully 90% of the bones were bison. Elk and caribou bones were also reportedly present. Eddy and Jenks (1935) offered an MNI of 40 bison ranging in age from calves to 3 years; at least 6 adults were supposed to be represented. McDonald (1981) examined bison crania from Nye at the Bell Museum of Natural History at UM, and identified *B. antiquus antiquus* and *B. a. occidentalis*. More recently, preliminary analysis of the Nye bison crania indicates that their morphology could be accommodated within the variability of other regional bison assemblages from the early to mid Holocene (Hill et al. 2011).

By 1934–1935 Jenks, a prominent UM anthropologist, was already deeply involved in investigating putative Early Man sites in the upper Midwest, including the Arvilla Culture and Minnesota Woman (Jenks 1932a, 1932b, 1933, 1934, 1935). Not surprisingly, Eddy and Jenks (1935) framed the discovery as yet another in a growing list of Early Man sites in the region. Bone preserv-
tion was excellent; thus “many of the bones show that they were food refuse. Cuts and scratches made as by flint implements are present on some 20 per cent or more of the bones” (Eddy and Jenks 1935:535). Other bones appeared burned. Importantly, “[a] small number of artifacts . . . have been recovered. These include . . . artifacts made of elk and bison bones, one . . . of oak wood and a few of stone.” Although “the age of this kitchen-middens [sic]” was unknown, they emphasized that “the artifacts are quite unlike those associated with modern North American Indians in the area.” A full report on the site was never prepared.

In 1948, UM paleobotanist C. O. Rosendahl (1948:290) revealed that the site was located “near the village of Nye in Polk County, Wisconsin.” The specific location was finally established 29 June 2010 through the assistance of the Polk County Historical Society, Balsam Lake, Wisconsin, and an informant, Mr. Eldred Anderson, of Dresser, Wisconsin. Mr. Anderson’s grandfather, Martin Anderson, managed work at the marl pits, and young Eldred (then ca. 10 years old) was dispatched daily to deliver lunches to the 5–6 workmen. (Hans Anderson, Eldred’s uncle, may have been the farmer who visited Eddy at UM.) Mr. Anderson recalled that marl was dug with a drag line and backhoe from a sheltered spring-fed marsh east of Round Lake. (Excavated marl was dried and applied to cut-over land to deacidify the soil.) Thus the bone was exhumed in a non-systematic manner. With the location of the site in hand, an aerial photograph of the area (U.S. Department of Agriculture 1938) confirms the presence of two long curvilinear trenches, as well as the haul road into the site described by Mr. Anderson. A long overlooked contemporary article in The Amery (Wis.) Free Press (Anonymous 1935) indicates that the project was supported with Federal Emergency Relief Administration dollars.

Rosendahl (1948:290), based on recovered woody plant remains, reasoned that the site dated to the late Pleistocene. This estimate suggests that the site is older than the nearby Interstate Park Bison site (excavated in 1936–1937 by the CCC), which dates to the early Holocene (ca. 7500 CALYBP) (Hawley et al. 2007; Hill et al. 2011). As bone and floral remains at Nye were apparently recovered from different depths—the former from 10–18 ft and the flora from 6–10 ft—their association is far from certain. Moreover, the floral assemblage, especially in the absence of spruce, closely mirrors the early- and mid-Holocene regional vegetational record. Now perennially inundated, the site has been exhaustively quarried, rendering the 1934–1935 collection (the extant portion recently has been transferred to the University of Wisconsin Zoology Museum) that much more important. The next logical phase of research would be to date one or more samples of bone from the site and analyze the whole assemblage. Data from Nye, together with that from the Interstate Park Bison site, would add immeasurably to knowledge of regional paleoecology in the early and mid Holocene.

The Nye site was relocated, after 75 years, through the efforts of Darrell Kittleson, Dan Mosay, Greg Marsten, and most critically, Eldred Anderson. We are especially grateful also to Bill and Jean Dehning for permitting access to the site. The timely assistance of the staff of the Arthur H. Robinson Map Library, UW Madison is also acknowledged.
References Cited


Weevil (Strangaliodes sp., Curculionidae) Records for the Early Holocene in the Semiarid North of Chile

Douglas Jackson

Keywords: Coleoptera, Curculionidae, early Holocene, northern Chile

Studies of fossil insects in Chile are circumscribed to records of the south part of the country (40–45° S), and essentially include coleoptera and cephalic capsules of diptera chironomidae (Ashworth and Hoganson 1987; Ashworth and Marckgraf 1989; Ashworth et al., 1991; Borrero et al. 1991; Massaferro and Brooks 2002; Saxon 1979). On the other hand, the only archaeological site in the south of America with well-documented records of insects is Monte Verde, which includes predominantly coleoptera, among which weevils stand out (Curculionidae) (Ashworth et al. 1989).

In this context, the reevaluation of samples from an early archaeological site

Douglas Jackson, Sociedad Chilena de Entomología, Casilla 21132, Santiago (21), Chile, e-mail: sillitus@hotmail.com
known as (Curculionidae), an early-Holocene hunter-gatherer-fisher habitation site located along the coast of Los Vilos (31°) in the semiarid north of Chile, has recovered one elytron of a weevil (Figure 1A) of the genus *Strangaliodes*.

The remains of this insect were recovered along with other organic remains in a soil sample (3 liters) processed by flotation (light fraction), which was obtained from the lower levels (105–110 cm) of the archaeological deposit, formed by a sand matrix of a paleo-sand dune with mollusk remains and other cultural signs dated to Beta 106802: 10,200 ± 70 RCYBP [11,895 CALYBP]) /Beta 94101: 9320 ± 60 RCYBP (10,439 CALYBP) (Jackson and Méndez 2005). The remains of the insect were probably deposited at some point in the abandonment of the settlement, which was repeatedly occupied.

The specimen consists of a right elytron that is morphologically assignable to the genus *Strangaliodes*, by displaying a soft and constant convexity in the elytral declivity and a back of longitudinal convexity, which are typical features of this genus of weevil (Elgueta 1985). The elytron is 8.10 mm long and dull black in color; the striae puncture is deep without scales (Figure 1B). The darkening of the structural color (Elias 1994), the detachment of the scales from the striae, and the stratigraphic position and radiocarbon dating of the layer where this elytron was recorded confirm that it was deposited during the early Holocene.

However, taphonomic samplings from present-day dune systems in the same locality have led to recovery of 128 remains of this weevil. This record confirms that the elytra are the best preserved parts (23.44%), being considerably unaffected by meteorization processes owing to their rigid and highly sclerotized structure.

The genus *Strangaliodes* is endemic (or native) to Chile and at present consists of nine species (Elgueta and Marvaldi 2006), four of which live in the hyperarid north extreme of the country (15°–25°), while *S. niger, S. sticticus*, and *S. sulcatulus* live in the central valley (35° S), and *S. albosquammosus* and *S. mutuarius* are found in the Andean foothills of the south-center of Chile.
(35° S). Although the elytron reported here belongs to the genus *Strangaliodes*, it is not assignable to any of the above-mentioned species, and instead corresponds to a new species not yet described. The study of its ecology shows that it is nowadays restricted to dunes, where it is associated with *Baccharis* sp. (Asteraceae), where it develops its larval state.

The record of this species of *Strangaliodes* in early-Holocene archaeological deposits is concurrent with Asteraceae predominance (*Baccharis* sp.) for this period (Maldonado et al. 2010; Maldonado and Villagrán 2006a, 2006b), when environmental conditions were relatively dry. This suggests that this species of weevil once enjoyed a wider dispersion, owing to the predominance of Asteraceae in this period and to the strict development of this weevil in this kind of plant (monophagous).

This type of record could yield relevant insights into the environment of archaeological sites, because one of the most important features of insects is their sensitivity to environmental change (Elias 1994). At the same time, the record of old insects contributes to the paleogeographical knowledge of the biological diversity of the environments occupied by the first human populations that inhabited the continent.

Research was funded by Fondecyt grant 1090044.

References Cited


Elgueta, M., and A. Marvaldi 2006 Lista sistemática de las especies de Curculionoidea (Insecta: Coleoptera) presentes en Chile, y sus sinonimias. *Boletín del Museo Nacional de Historia Natural* (Santiago, Chile), 55:113–53.


Maldonado, A., and C. Villagrán 2006a Climate Variability over the Last 9900 cal yr BP from a Swamp Forest Pollen Record along the Semiarid Coast of Chile. *Quaternary Research* 66:246–58.
Additional Records of Late Pleistocene Sciurids from the Hand Hills, Alberta

**Christopher N. Jass, David (Tim) Schowalter, Lisa Bohach, and Emily Frampton**

➤ **Key Words:** *Cynomys*, *Spermophilus*, Sciuridae

Localities characterized by Pleistocene burrow casts and associated fossils of an extinct form of white-tailed prairie dog (*Cynomys niobrarius churcherii*) were previously reported from the Hand Hills and Wintering Hills regions of Alberta (Young et al. 1999). Those remains, and fossils of other taxa preserved in the burrow casts, were collected primarily from outcrops associated with aggregate operations; therefore, both burrow casts and associated skeletal remains represent nonrenewable resources that will disappear as aggregate excavations continue. Given that vulnerability, and the potential for additional fossils to be used to address new research questions (e.g., morphological variation in extinct populations), we initiated new field efforts in the Hand Hills and Wintering Hills. Here we present early results of those efforts.

In 2010, we visited localities that included reported sites in the Hand Hills (Winter Site I and II of Young et al. 1999) and Wintering Hills (Schowalter Site; Burns 1996), and potential new sites in the Hand Hills. Previously reported sites were in an advanced stage of development, and no specimens were exposed where outcrops remained visible. However, we recovered Pleistocene fossils from three new sites, all of which occur in close proximity to previously reported localities (Burns 1996). The depositional framework of new sites was consistent with that previously reported.
for Pleistocene burrow casts and associated skeletal elements (i.e., Young et al. 1999).

Vertebrate fossils were identified based on comparisons with paleontological and modern specimens housed at the Royal Alberta Museum (RAM), and descriptions from the literature. Fossils are housed at the RAM. Reported measurements taken with an ocular micrometer follow Goodwin (1995) for orientation and position of measurement.

Records of Pleistocene sciurids from new sites include *Cynomys* (P10.7.1–P10.7.2; P10.9.1–P10.9.9; P10.11.2) and *Spermophilus* (P10.7.3–P10.7.13, P10.7.15). On specimens of *Cynomys* (P10.7.1, P10.9.1) with a complete lower cheek tooth series (p4–m3), qualitative characters of the p4 and m3 permit referral to the subgenus *Leucocrossuromys* (see Semken 1966, Burns and McGillivray 1989), and the specimens exhibit overall similarity to *C. n. churcherii*. Measurements of individual teeth of P10.7.1 and P10.9.1 are provided in Table 1. Other elements identified as *Cynomys* are morphologically indistinguishable from similar elements preserved in the holotype of *C. n.

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Tooth</th>
<th>Length</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>P10.7.1</td>
<td>p4</td>
<td>2.8</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>m1</td>
<td>2.7</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>m2</td>
<td>2.9</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>m3</td>
<td>5.0</td>
<td>4.4</td>
</tr>
<tr>
<td>P10.9.1</td>
<td>p4</td>
<td>2.9</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>m1</td>
<td>3.1</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>m2</td>
<td>3.2</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>m3</td>
<td>4.9</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Table 1. Measurements of individual teeth of P10.7.1 and P10.9.1 in mm.

Recovered specimens of *Spermophilus* consist of isolated teeth and are similar to *S. richardsonii* in size and structure.

Given previous identifications of fossils from adjacent localities, it seems likely that the fossils reported here represent *C. n. churcherii* and *S. richardsonii*. However, we conservatively refer the records to *Cynomys* (*Leucocrossuromys*) sp. and *Spermophilus* sp. For specimens of *Cynomys*, this reflects the fact that *C. n. churcherii* was originally diagnosed (in part) on the basis of cranial morphometrics (Burns and McGillivray 1989), and we do not currently have a sample size from new sites that would allow us to reasonably evaluate such characteristics. For specimens of *Spermophilus*, the identification reflects uncertainty with respect to our ability to separate isolated teeth of *S. richardsonii* from all other *Spermophilus* in western North America. Because any white-tailed prairie dog (subgenus *Leucocrossuromys*) in Alberta is outside of the modern range (Young et al. 1999), it seems appropriate to minimize any assumption that fossil *Spermophilus* represents a locally-extant taxon. Future, periodic inspection of new localities will continue to increase sample sizes, leading to the possibility of further taxonomic refinement.

We thank the landowners and gravel pit operators who provided access to sites. The editor and two anonymous reviewers provided constructive comments on the manuscript.
References Cited


Sexual Dimorphism in the Black-Footed Ferret (*Mustela nigripes*) Revealed by Geometric Morphometrics

*Leigha M. King and Steven C. Wallace*

**Keywords:** Geometric morphometrics, *Mustela nigripes*, sexual dimorphism

Mustelids exhibit sexual dimorphism (Fairbairn 1997; Gliwicz 1988; Moors 1980) that strongly correlates with body size (Fairbairn 1997). *Mustela nigripes*, black-footed ferret, exemplifies this characteristic, with males consistently being larger (Moors 1980; Vargasj and Anderson 1996). Females are approximately 10% smaller than males in linear skeletal measurements (Hall 1981) and have skulls approximately 93% the size of males (Anderson et al. 1986; and see summaries provided by Hillman and Clark 1980; Nowak 2005). Although previous authors found clear separation between the sexes, none characterize in detail the morphology of the differences. Therefore, we aimed to describe such change in the cranium using geometric morphometrics.

Specimens analyzed, housed in the collections at East Tennessee State University, include eight females and nine males. Following Anderson et al. (1986), all individuals were classified as adults based on full fusion of cranial and epiphyseal sutures, and full eruption of permanent dentition. Each skull was photographed and analyzed in dorsal, ventral, and left lateral views. A total of 66 landmarks were placed on the skulls. Once digitized, a consensus skull was created for each sex.

Leigha King and Steven C. Wallace, Department of Geosciences and Don Sundquist Center of Excellence in Paleontology, East Tennessee State University, Johnson City, TN 37614; e-mails: kingl1@goldmail.etsu.edu  wallaces@etsu.edu
and directly compared with that of the other using thin plate spline analysis (essentially a grid is placed over the consensus skulls and then deformed during comparison to visualize what happens between landmarks).

Splines created of the dorsal view showed little shape change within the grid as the consensus female was warped to the consensus male; however, several regions exhibited an expansion and/or overall elongation: 1) widening of the inter-ridge space located between the postorbital and lacrimal processes; 2) sagittal crest lengthening; and 3) expansion of the braincase associated with further thinning of the postorbital constriction. The ventral spline highlighted: 1) braincase expansion; 2) thinning in the postorbital constriction; 3) secondary palate expansion at the carnassials; 4) lengthening between the occipital condyles and palatal opening; and 5) posterior squamosal lengthening. Such lengthening may in turn allow for a more anterior attachment of the temporals, which typically results in a greater bite force (Greaves 1982). The lateral spline (Figure 1) showed the clearest changes, including: 1) sagittal crest lengthening; 2) carnassial lengthening; and 3) dorsal rotation of the rostrum. Overall, changes in cranial morphology between the two sexes reflected an enlargement of the skull as well as dorsal rotation of the rostrum.

Better understanding of the sexual differences within black-footed ferrets will be beneficial in identifying this species in the fossil record by helping avoid oversplitting of species simply due to morphological differences (i.e., not recognizing sexual dimorphism). More accurate identification of species will in turn improve our interpretations of past environments (e.g., Mead and Mead 1989). Moreover, because the furs of this animal were commonly used by various Native American tribes (U.S. Fish and Wildlife Service 1998), identifying sexes of ferrets collected from archaeological sites may prove insightful as to how the tribes affected the populations of this species. Continuation of this work, among other outcomes, will likely lead to a better understanding of genetic bottleneck effects; specifically, how loss of genetic diversity affects morphology. Lastly, future comparisons between *M. nigripes* and other closely related taxa (e.g., *M. eversmanii*) could also reveal range shifts not previously recognized.
Extinct Fauna from the Calama-Chiuchiu Basin, (North Arid, Chile): Taphonomic and Archaeological Relevance in the Late Pleistocene

Patricio López M. and Osvaldo Rojas M.

Keywords: Calama Basin, late Pleistocene, northern Chile

In recent years, the discovery of paleontological sites with the remains of extinct fauna in the Calama-Chiuchiu basin (Second Region, Chile) has multiplied (Alberdi et al. 2007; Cartajena et al. 2010; López et al. 2010). This goes hand in hand with the chronological reevaluation of the lithostratigraphic units containing fossil remains that have been dated to the late Pleistocene. This basin was divided by Marinovic and Lahsen (1984) into three discordant units called the “Calama Formation” (middle-late Miocene), “El Loa Formation” (late Miocene–early Pliocene) and “Chiuchiu Formation”
(late Pliocene–Pleistocene). Their antiquity was confirmed by May et al. (2005) using \(^{40}\text{Ar}/^{39}\text{Ar}\) dating.

Recently, Blanco and Tomlinson (2009) state in the “Chiuchiu Geological Letter” that four main sequences on top of the Paleozoic-Triassic base that make up the sedimentary filling of the Cenozoic basin in Calama from the Chiuchiu Formation (Pleistocene). Characteristically, this was a fluvial fan system fed by the former Loa and Salado rivers that formed ephemeral lagoon marshes in the middle and distal sectors (Blanco and Tomlinson 2009). The Chiuchiu Formation toward the east and southeast is joined with alluvial beach facies attributed to the Pleistocene–middle Holocene (Blanco and Tomlinson 2009). Of all the sites registered in the Calama-Chiuchiu basin and the nearby mountain range with remains of extinct fauna (Table 1), only two have been \(^{14}\text{C}\) dated.

Table 1. Sites of the Calama-Chiuchiu Basin with extinct faunal remains (data from Nuñez et al. 2002 and López et al. 2010).

<table>
<thead>
<tr>
<th>Equidae</th>
<th>A</th>
<th>P</th>
<th>Paleontological site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equus (Amerhippus) sp.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hippidion saldiasi</td>
<td>P</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>cf. Gomphotheriidae</td>
<td></td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>cf. Lama gracilis</td>
<td>P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rheidae</td>
<td></td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Macrauchenia cf. patachonica</td>
<td></td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Xenarhra</td>
<td>P</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Megatherium medinae</td>
<td>P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Megatherium sp</td>
<td></td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Canidae</td>
<td></td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Two samples of a *Hippidion saldiasi* skeleton from the Betecsa-1 paleontological site have been dated using AMS \(^{14}\text{C}\) to 21,070 ± 100 (GrA-29389) and 21,380 ± 100 RCYBP (GrA-29388) (Alberdi et al. 2007); organic remains associated with an Equidae sacrum from the “Tuina-5” archaeological site (in the mountain range) have been dated between 10,000 and 9800 RCYBP (Nuñez et al. 2002). Nevertheless, the fact that alluvial sediments from the Calama-Chiuchiu basin have been assigned to the Pleistocene–middle Holocene by Blanco and Tomlinson (2009) implies that deposits from the Jalquincha-1, La Vega, Ojo Opache, Opache-2, Kamac Mayu and Río Salado-1 sites should also be assigned to this temporal range. Cultural remains have not been observed in the aforementioned sites. The mortality events of diverse fauna ensembles are associated with fluvial courses over exokarst formations, which functioned as natural traps in the case of the Ojo Opache and Kamac Mayu sites. In the latter site, the remains of *Macrauchenia cf. patachonica* and cf. *Lama gracilis* include individuals from every age range, suggesting mortality events of flocks.
that fell into these exokarst canals, covered by water and sand and gravel sediments (Cartajena et al. 2010). In the other sites, mortality events are associated with former fluvial beaches, such as La Vega, Jalquincha-1, Betecsá-1 and Río Salado-1 (López et al. 2010).

In summary, recent studies of sites from the Calama-Chiuchiu basin with remains of extinct fauna have redefined their temporality and enhanced our understanding of the diverse fauna that existed at the end of the Pleistocene and associated formation processes. Further archaeological study of these remains must focus on the former fluvial basins that encouraged cinegetic activity owing to entrapment zones and faunal concentration.

The research presented here was funded by the Museo de Historia Natural y Cultural del Desierto de Atacama.

References Cited


Cartajena, I., P. López, and I. Martínez 2010 New Camelid (Artiodactyla: Camelidae) Record from the Late Pleistocene of Calama (Second Region, Chile): a Morphological and Morphometric Discussion. Revista Mexicana de Ciencias Geológicas 27(2):197–212.


One of the last North American gomphotheriid proboscideans, *Stegomastodon* Pohlig, has a Plio-Pleistocene temporal range of early Blancan (~4 Ma) to early Irvingtonian (~1.2 Ma). Although some have argued that *Stegomastodon* descended directly from an Old World ancestor (Prado and Alberdi 2008), most regard it as a descendant of New World *Gomphotherium* (e.g., Lambert and Shoshani 1998; Savage 1955; Tobien 1973). All agree that *Stegomastodon* is closely related to the derived Plio-Pleistocene New World gomphotheres *Cuvieronius* and *Rhynchotherium*. Identification of *Stegomastodon* in South America has been controversial, and we accept arguments that the genus is confined to North America (e.g., Ferretti 2008; Lucas and Alvarado 2010). In North America, the extinction of *Stegomastodon* approximately coincided with the arrival of *Mammuthus*, and this eliminated *Stegomastodon* as a potential food source for Early Americans. Its absence from the Pleistocene of South America also precluded its utilization as a food item by Early Americans.

*Stegomastodon* is distinguished from other gomphotheres by a combination of cranio-dental features that include a high-domed, elephantid-like cranium, slightly curved upper tusks that lack enamel bands, no lower tusks in a short (brevirostrine) lower jaw, and third molars with five or more lophs/lophids. There are three different views of the species-level taxonomy of North American *Stegomastodon*, which recognize one, two, or as many as seven valid species (e.g., Kurtén and Anderson 1980; Lambert and Shoshani 1998; Osborn 1936). The extremes are Kurtén and Anderson (1980), who identified the genotypic species *S. mirificus* Leidy as the only valid species, and Osborn (1936:727), who recognized seven species (*S. primitivus*, *S. successor*, *S. mirificus*, *S. chapmani*, *S. texanus*, *S. arizonae* and *S. aiftonae*) as a series of “ascending mutations.” Most workers, however, have argued that there are two valid species of the genus—a primitive and generally older species, called *S. primitivus* or *S. rexroadensis*, and a more derived species, usually called *S. mirificus* (e.g., Lambert and Shoshani 1998; Lucas and Morgan 2005; Lucas and Oakes 1986; Savage 1955).

We recently revised and redescribed many North American *Stegomastodon* (Lucas et al. 2011; Morgan and Lucas 2011; Pasenko and Lucas 2011) to...
conclude that although there is extensive morphological overlap and polymorphism in the entire sample of North American Stegomastodon, it is possible to construct a chronomorphocline that recognizes three successive species that temporally and morphologically overlap. This is similar to the taxonomy of North American Mammuthus in which the chronomorphocline M. meridionalis (or M. hayi) → M. imperator → M. columbi recognizes three distinct morphotypes that nonetheless grade into each other and temporally overlap (e.g., Agenbroad 1994; Lucas 1996). Cuvieronius is a similarly long-lived proboscidean genus, but a chronomorphocline of its variation apparently cannot be constructed (Lucas 2008).

The most primitive species of Stegomastodon, *S. primitivus* Osborn (= *S. rexroadensis* Woodburne) is characterized by cheek teeth with simple trefoils, second molars with three lophs/lophids, and third molars with 5–6 lophs/lophids. The morphologically intermediate species encompasses most known Stegomastodon specimens, and is *S. mirificus* (= *S. successor* Cope, = *S. texanus* Osborn, = *S. arizonae* Gidley). This species has cheek teeth that wear to double trefoils, second molars with rudimentary fourth lophs/lophids, and third molars with 6–7 lophs/lophids. The derived species, *S. aftoniae*, has very complex trefoils, a fourth loph/lophid on the second molar, and seven lophs/lophids on the third molars. There is also an increase in the amount of cement and the choerodonty (number of tubercles) on the molars from *S. primitivus* to *S. mirificus* to *S. aftoniae*.

*S. primitivus* is early Blancan in age, including the type of *S. primitivus* from the Stegomastodon Quarry in Nebraska, part of the Sand Draw fauna (Osborn 1936; Skinner and Hibbard 1972), the type of *S. rexroadensis* from Rexroad in Kansas (Woodburne 1961), and referred specimens from Elephant Butte Lake and Cuchillo Negro Creek in New Mexico and Duncan in Arizona (Morgan and Lucas 2000, 2011). The type of *S. mirificus* is from a site of unknown age in Nebraska; however, most specimens of this species are late Blancan, including Blanco and Cita Canyon in Texas and possibly Curtis Ranch in Arizona, the type locality of *S. arizonae* (Gidley 1926; Savage 1955). The type of *S. aftoniae* is from the early Irvingtonian of Iowa (Osborn 1924). *S. aftoniae* is also known from the early Irvingtonian Tortugas Mountain gravel pit in New Mexico (Lucas et al. 2000).

We view the evolution of Stegomastodon as the development of a derived, grazing gomphothere. The tall, elephantid skull directly above the short, robust lower jaw suggests a powerful vertical bite of the relatively broad and increasingly complex grinding cheek teeth. Thus, Stegomastodon was likely a grazer, and it is no coincidence that its disappearance during the early Irvingtonian is almost coeval with the appearance of a more effective grazer, *Mammuthus*.

References Cited


Explorations in the Early Pleistocene of West Texas

John Moretti and Eileen Johnson

➤ Keywords: Faunal Diversity, Early Pleistocene, Southern Plains

Ongoing excavations at Roland Springs Ranch Locality 1 (RSR-1) have produced a unique, varied, and diverse terminal-Blancan fauna with over 50 taxa identified to at least the family level. The locality is situated on the Southern Plains within the western Rolling Plains, on a tributary of the Clear Fork of the Brazos River. The fauna is contained in a gleyed deposit, exhibiting swirls and cross-bedding indicating a fluvial environment, with the gleyed deposit itself set into an extinct ancient drainage. The surface of this ancient drainage reveals a micro-topography that provides an opportunity to study the dynamics and deposition patterns of a terminal-Blancan stream.

The fauna contains members of all vertebrate classes. Represented are taxa of a wide range of sizes. Abundant microfaunal remains comprise a variety of fish, amphibian, reptile, avian, and small mammals. Multiple rabbit taxa are identified in the fauna, with *Aztlanolagus agilis* and cf. *Lepus* spp. present.

The fauna is dominated by Testudines, primarily *Chrysemys picta* (pond turtle) and extinct land tortoises of the genus *Hesperotestudo* (= *Geochelone*). *Geochelone* taxonomy currently is in flux, but the generic elevation of the subgenus *Hesperotestudo* is recognized here (Holman and Fitz 2005; Le et al. 2006; Meylan and Sterrer 2000).

Among the ungulates, *Platygonus* (peccary) and a small camelid are tentatively identified, as are at least two antilocaprids, including *Capromeryx* spp. *Equus simplicidens* (American zebra) and *Nannippus peninsulatus* (three-toed horse) are present. *Equus* remains are rare, and *Nannippus* material is common.

The Blancan carnivores *Buisnictus breviramus* (pygmy skunk) and *Canis lepophagus* (ancestral coyote) are present, but *Borophagus* (bone-eating dog) is absent. The cheetah-like felid *Miracinonyx* cf. *trumani* could be the earliest record of this species and the first occurrence in pre-Rancholabrean deposits (Bell et al. 2004; Van Valkenburgh et al. 1990). The specimen, a right ramus, is significantly smaller in all measurements than *M. inexpectatus* but agrees with published metrics for *M. trumani* (Orr 1969; Van Valkenburgh et al. 1990). In view of the relative paucity of *Miracinonyx* discoveries, however, it is possible that this specimen falls outside the currently recognized size range of *M. inexpectatus*, or perhaps is a transitional form between the two species.

The presence of several cursorial forms (e.g., equids, antilocaprids, and *Miracinonyx trumani*) indicates a grassland ecosystem, as does *Hesperotestudo*, an open-land grazer/browser (Gibson and Hamilton 1983; Heller 1903). Supporting this view are other grassland-adapted taxa that inhabit the region today. The abundance of *Hesperotestudo* indicates a climate that was warmer, more equable, and perhaps wetter than today’s continental climate (Hibbard...
1960). Fish, frogs, pond and mud turtles, and an ardeid (heron/bittern) indicate a rich stream and riparian environment, with water present at least regularly in the drainage. Hackberry (*Celtis* spp.) bordered the drainage and perhaps existed throughout the bottomlands, providing habitat and roosts for wild turkey (*Meleagris*) and raptors (Accipitridae).

Since absolute dates are not available yet for RSR-1, the age estimate is based on faunal composition. The primitive vole *Ogmodontomys poaphagus* indicates a Blancan age later than the earliest faunas of the period (Bell et al. 2004; Repenning 1987; Zakrzewski 1967). A small form of the cotton rat *Sigmodon minor* (*medius* chronomorph), within the range of variation (although at the larger end of the range) of *S. minor* from the latest Blancan Borchers fauna (Pelaez-Campomanes and Martin 2005), suggests a late-Blancan age (Martin et al. 2003; Martin et al. 2008). *Canis lepophagus*, *Nannippus peninsulatus*, *Geomys* (*Nerterogeomys*) *minor* (pocket gopher), *Prodipodomys centralis* (kangaroo rat), and *Scalopus* (*Hesperoscalops*) cf. *rexroadi* (mole) indicate a middle- to late-Blancan age, while cf. *Lepus* suggests a late-Blancan age (Bell et al. 2004; Martin et al. 2003; White 1991). *Miracinonyx trumani* occurs rarely in the Rancholabrean, while *M. inexpectatus* ranges from the late Blancan to late Irvingtonian (Bell et al. 2004; Van Valkenburgh et al. 1990). To date, no South American immigrants have been recorded at RSR-1.

The Pleistocene, its beginning recently revised to 2.58 Ma, incorporates the terminal Blancan (Gibbard et al. 2010). The youngest recognized occurrence of *Nannippus* is at 2.1 Ma in the Macasphalt Shell Pit fauna of Florida (Bell et al. 2004; Jones et al. 1991); the oldest recognized record of *Lepus* is in the Borchers fauna of Kansas dated to 2.0–2.1 Ma (Gansecki et al. 1998; Hibbard 1941; Honey et al. 1998). Taken as a whole, these indicators place the estimated age for the RSR-1 fauna at early Pleistocene (perhaps 1.8–2.1+ Ma) and latest Blancan Land Mammal age.

Research at RSR-1 is funded by the Museum of Texas Tech University, two foundations that wish to remain anonymous, and the landowners. We are indebted to the landowners for access, donation of the generated collections to the Museum, their financial support, and continuing great interest in the research and dissemination of knowledge gained. This manuscript is part of the ongoing Lubbock Lake Landmark regional research into Quaternary climatic, ecological, and biogeographic change on the Southern Plains.

References Cited


Keywords: Younger Dryas, climate change, comet impact

Sheriden is a deeply stratified cave site situated in the glaciated Silurian karst plain of northwest Ohio. The sinkhole entrance formed and exposed the cave after glacial ice covering the site retreated during the late Pleistocene. The cave rapidly filled with sediments, and the entrance was completely buried by the early Holocene. During the Allerød, plants, animals, and Clovis people entered the sinkhole and cave (Tankersley 1999).

Clovis artifacts and contemporary faunal remains include two complete bone projectile points made from dense cortical megamammal long bones, a Clovis fluted point, a scraper-knife made on a large flake, two biface fragments, a graver, a portion of an endscraper, 28 pieces of microdebitage, a cervical vertebra of *Chelydra serpentine* (snapping turtle) with cut and chop marks, and burned and disarticulated elements of *Platygonus compressus* (flat-headed peccary) and *Castoroides ohiensis* (giant beaver) (Redmond and Tankersley 2005). The age of the Clovis assemblage was determined by direct AMS radiocarbon dating of purified collagen extracted from one of the two bone points. The calibrated $^{14}C$ age was 13,000 to 12,900 RCYBP at two standard deviations (Waters et al. 2009). This date overlaps the current, revised age range of Clovis and makes Sheriden Cave the twelfth firmly dated Clovis site in North America (Waters and Stafford 2007). The age from the bone point also overlaps the AMS radiocarbon dates obtained from two extinct taxa, flat-headed peccary and giant beaver, and a distinctive charcoal layer (Tankersley 1999). Comparable organic layers have been identified at other Clovis sites across North America (Haynes 2008).

The charcoal layer contains above-background levels of carbon spherules, 148/kg by weight and 100 microns to 1 mm in size, as well as magnetic grains, 2.5 g/kg by weight and up to 300 microns in size, magnetic microspherules, more than 100/kg by weight and 20 to 100 microns in size, nanometer-sized diamonds, 400 ppb by weight 0.5 microns to 0.5 mm in size, and Lonsdaleite, a hexagonal nanodiamond polymorph found at other postulated Clovis comet impact sites across North America (Kennett et al. 2009). Lonsdaleite, nanodiamonds, magnetic microspherules, magnetic grains, and carbon spherules were absent in layers above and below the Clovis assemblage (Figure 1).

Of the 63 floral and faunal taxa recovered in direct stratigraphic association from the Clovis layer, 52 species of amphibians, arboreal plants, fish, mammals,
and reptiles were unaffected by the theoretical Clovis comet impact event and are still living in the immediate vicinity of the cave today. Only two species of megamammals in the assemblage went extinct, flat-headed peccary and giant beaver, while five microtines (Microtis xanthognathus, yellow-checked vole; Phenacomys intermedius, heather vole; Sorex cinereus, masked shrew; Sorex hoyi, pygmy shrew; and Synaptomys borealis, northern bog lemming), three small carnivores (Martes americana, pine martin; Martes pennanti, fisher; and Mustela erminea, ermine), and an artiodactyl (Rangifer tarandus, caribou) migrated northward to their present ranges in boreal and tundra environments. Although the disappearance of two species of megamammals at Sheriden Cave coincides with the proposed Clovis comet impact event, the survival of more than 50 taxa of diverse plants and animals suggests that factors such as climate change during the subsequent Younger Dryas were more likely a contributing cause of their extinction instead of the theorized comet impact (Graham 1996). This study was made possible with support from the National Science Foundation and the Court Family Foundation. The assistance and support of Keith Hendricks and the Cleveland Museum of Natural History is greatly appreciated. Allen West provided sediment analyses and Greg McDonald and the late Fran King identified the faunal and floral species.

References Cited
A New Occurrence of Toxodonts in the Pleistocene of México

Rubén A. Rodríguez-de la Rosa, José Rubén Guzmán-Gutiérrez, and Carlos Ortega-Hurtado de Mendoza

➤ Keywords: Toxodonts, Pleistocene, Veracruz, México

Toxodonts were South American rhinoceros-like mammals, belonging to the extinct group Notoungulata. Prior to 2004, the northernmost record of toxodonts was from Guatemala, in Central America (Woodburne, 1969); however, Polaco and coworkers reported the occurrence of toxodonts in two different localities from Mexico (Polaco et al. 2004). A right mandibular ramus was collected from Hihuitlán, Michoacán, western Mexico, and partial molars and an incomplete upper incisor were collected from la Estribera, Veracruz, eastern Mexico (Polaco et al. 2004).

One of the authors (C.O.H.M.) collected fossil material from a Pleistocene locality in the Municipio of Pánuco, northern Veracruz (587592.48 m E, 2442482.10 m N). This material included at least four isolated toxodont molars, the subject of this report (Figure 1). However, the authors were recently informed about the existence of at least four other partial molars collected at the same locality.

Two of the molars presented here are a right M₁ and a left M₂; the other two specimens are a right P₄ and a left M₁ (Figure 1). These specimens are slightly
larger than the specimens reported by Polaco et al. (2004), suggesting a rather mature individual. The right $M_1$ is 54 mm long (as preserved), 110 mm tall, and 17.5 mm broad (at the level of the entocnoid; the left $M_2$ is 52 mm long, 108 mm tall, and 23 mm broad (at the protoconid-paraconid level); the right $P^4$ is 131 mm tall, 39 mm at its widest portion of the crown, and 28 mm in anteroposterior breadth; the left $M^1$ is 114 mm tall (as preserved), 63 mm at its widest portion, and 29 mm in anteroposterior breadth.

As noticed by Polaco et al. (2004), all Central American toxodont fossils have been assigned to *Mixotoxodon larensis* Van Frank (1957), a toxodont first reported from northern Venezuela (Laurito 1993; Lucas et al. 1997; Polaco et al. 2004; Webb and Perrigo 1984).

The Mexican fossils show dental features similar to those present in *Mixotoxodon larensis*; however, there exist some subtle morphological differences, such as the meta-entocnoid folds in both right $M_1$ and left $M_2$. However, more material is still needed to know if these features represent only morphological variation within a single species or if the Mexican toxodont really represents a new taxon.

Hulbert (2001) suggested the occurrence of toxodonts in Mexico; Polaco et al. (2004) confirmed their presence. The occurrence of toxodonts in western and eastern México strongly suggests the possibility of finding more toxodont remains in other Pleistocene deposits present in coastal states of the Country, thus favoring the idea of toxodont migration to northern areas of North America.

Authors want to thank Dr. Enrique Ortega Lozano, who initiated the fossil collection at the locality.

References Cited

Keywords: Sylvilagus, Pleistocene, Florida

The Ichetucknee River flows through north-central Florida and intersects several sinkhole deposits that contain a diverse assemblage of Rancholabrean (late-Pleistocene) fossil vertebrates from both forest and open-terrain ecosystems (Lambert and Holling 1998; Webb 1974). This assemblage, housed at the Florida Museum of Natural History (UF), contains two species of lagomorphs: Sylvilagus palustris (marsh rabbit) and Sylvilagus palustrellus (Ruez 2003). Although the extant marsh rabbit, S. palustris, is abundant in many fossil and modern faunas of Florida, the Ichetucknee River sample of 22 lower third premolars (p3), the most diagnostic element of fossil rabbits, is the largest known fossil collection of the species.

The crenulate enamel on the PER of the p3 (Figure 1) differentiates S. palustris from other species of Sylvilagus except for S. hibbardi, S. webbi, and S. aquaticus. In the two extinct species, S. hibbardi and S. webbi, the PER does not reach the lingual border of the p3. Sylvilagus aquaticus (swamp rabbit) is larger than S. palustris and exhibits more extreme complexity of the ARs.

The length of the teeth ranges from 2.83 mm to 3.72 mm, with an average of 3.31 mm. Width ranges from 2.30 mm to 2.97 mm, with an average of 2.70 mm. The number of ARs varies from 1 to 6 (average = 2.9), but there is no correlation between the number of reentrants and the size of the tooth. Additionally, there is no correlation between ARs and the depth of the AER or the length/width ratio.

Dennis R. Ruez, Jr., Department of Environmental Studies, University of Illinois at Springfield, One University Plaza, MS PAC 308, Springfield, IL 62703-5407; email: druez2@uis.edu
On all teeth, the PER has thick enamel anteriorly, and thin enamel posteriorly. The PER becomes constricted about a third to half across the tooth. Labially, the thick enamel exhibits either one or two anterior curves, which widen the PER. In one tooth (UF 48460) the PER extends completely through the lingual edge; no enamel closes the PER. Although this pattern occurs in ontogenetically young rabbits, this tooth is parallel sided and larger (length = 3.38 mm; width = 2.72 mm) than the averages for this sample of *S. palustris*. Additionally, this tooth only has one well-developed AR; *S. palustris* individuals typically show an increased number of ARs as they mature. I am not aware of other published records of a neotenic fossil lagomorph tooth. This specimen coupled with many others from other localities is yielding insight into the evolutionary patterns with *Sylvilagus*.

**References Cited**


Evaluating the Co-occurrence of *Platygonus compressus* and *Mylohyus nasutus* at Sheriden Cave, Wyandot County, Ohio

*Kenneth B. Tankersley*

➤ Keywords: Peccary, radiocarbon dates, stable carbon isotopes

The biogeographic distribution of *Platygonus compressus* (flat-headed peccary) and *Mylohyus nasutus* (long-nosed peccary) suggests that they were sympatric omnivores with foraging specificity and niche partitioning during the late Pleistocene. This hypothesis is based on the fact that their skeletal remains are widely known from late-Wisconsin cave deposits across North America. However, specific details concerning their temporal and paleoenvironmental association remain poorly understood.

Although dentition suggests that both species of peccaries were omnivorous, some vertebrate paleontologists believe that significant differences in their feeding strategies made forage partitioning necessary. It has been assumed that *Mylohyus nasutus* was more of a solitary browser because they occur as isolated individuals in the fossil record (Munson 1984). The gregarious nature of *Platygonus compressus* was inferred from large fossil bone assemblages in various stages of growth and development in caves, rockshelters, and sand-dune deposits (Graham and Lundelius 1994). With the exception of Sheriden Cave, Ohio, only *Platygonus compressus* was recovered from sites located north of the Wisconsin glacial maximum and late glacial margins (Faunmap Working Group 1996).

Over the past two decades, cranial and postcranial elements of more than 40 *Platygonus compressus* and a single *Mylohyus nasutus* were excavated from the late-Pleistocene strata of Sheriden Cave (Tankersley 1999). Bones of *Platygonus compressus* were recovered in direct association with Clovis artifacts (Redmond and Tankersley 2005; Waters et al. 2009). *Mylohyus nasutus* remains were recovered from gray silt and in contact with the Clovis-age stratum, but 10 cm below the deepest artifacts.

To determine if *Platygonus compressus* and *Mylohyus nasutus* coexisted at Sheriden Cave, samples of bone collagen were submitted for AMS 14C dating, and cortical bone was subjected to fluoride dating. Chemical preparation of the bone collagen for AMS 14C dating followed procedures described by Waters and Stafford (2007), and cortical bone was chemically prepared for fluoride dating following the procedures described by Tankersley et al. (1998). Two AMS radiocarbon dates were obtained on collagen from a single *Platygonus compressus* bone, 11,060 ± 60 (CAMS-10349) and 11,130 ± 60 RCYBP (CAMS-33970). A single AMS radiocarbon date, 11,860 ± 40 RCYBP (Beta-
was obtained on *Mylohyus nasutus* bone collagen. Despite their close vertical and horizontal proximity, these ages differ by more than 600 $^{14}$C years. Similar results were found in the fluoride content of the cortical bone. *Platygonus compressus* cortical bone contained 1.0 ± 0.2 % fluoride and *Mylohyus nasutus* cortical bone contained 2.0 ± 0.2 % fluoride. The disparate chronometric and relative age ranges on the Sheriden Cave peccary specimens demonstrate that only *Platygonus compressus* is contemporary with the Clovis occupation of the site and that their sympatric biogeographic distribution with *Mylohyus nasutus* at the cave is temporally biased.

To determine if significant differences occurred in the feeding strategies of *Platygonus compressus* and *Mylohyus nasutus*, stable carbon isotope values were obtained from their bone collagen. A $\delta^{13}$C value of -20.9 was obtained on *Mylohyus nasutus* bone collagen, and a $\delta^{13}$C value of -21.4 was obtained on *Platygonus compressus* bone collagen. These values for stable carbon isotopes are essentially the same, which suggests an absence of forage specificity. Because these two species of peccaries did not temporally overlap at Sheriden Cave, their co-occurrence does not need to be explained in terms of foraging partitioning. Indeed, these stable carbon isotope values are comparable to those obtained on peccary bone collagen from other cave sites (Tankersley et al. 2009).

To better infer the vegetation communities around Sheriden Cave at the time remains of *Platygonus compressus* and *Mylohyus nasutus* were deposited, stable carbon isotope values were obtained on twelve samples of bulk soil organic matter (SOM) from a vertical profile of the peccary-bearing late-Pleistocene strata. Ten $\delta^{13}$C values were obtained from the *Platygonus compressus*-bearing strata: -24.1, -24.3, -25.9, -24.1, -25.5, -25.6, -25.5, -23.3, -24.9, and -24.5. Two identical $\delta^{13}$C values of -25.7 were obtained from the stratum containing *Mylohyus nasutus*. The mean $\delta^{13}$C value for the 12 samples was -24.9, with $\sigma$ of 0.8. These $\delta^{13}$C values are consistent with the carbonized remains of C3 plants such as *Abies balsamea* (balsam fir), *Juniperus virginiana* (eastern red cedar), *Larix laricina* (larch), *Picea sp.* (spruce), *Pinus sp.* (pine), *Populus sp.* (poplar), *Salix sp.* (willow), *Thuja occidentalis* (white cedar), and *Tsuga canadensis* (eastern hemlock) recovered from the peccary-bearing strata (Tankersley 1999). A single $\delta^{13}$C value of -17.9 was obtained on SOM from a 13,000 RCYBP stratum underlying the fossil-bearing deposits. While this value suggests that the surface vegetation around Sheriden Cave was more open at the period 13,000 RCYBP, C3 plant remains dominate the strata associated with *Platygonus compressus* and *Mylohyus nasutus*.

This study was made possible with support from the National Science Foundation and the Court Family Foundation. The author wishes to thank Greg McDonald and the late Fran King for the faunal and floral species identifications.

**References Cited**


Compression Fractures in Dwarf Elephants from Malta Give an Insight into Their Small Size

George E. Theodorou, Bruce M. Rothschild, and Larry D. Martin

Keywords: Proboscidea, compression fracture, dwarfism

Agenbroad (2002a,b) has characterized proboscidean dwarfism in islands off the California coast, suggesting an evolutionary disadvantage to the species. Examination of pathology in dwarf elephants exposes one of the factors that contributes to dwarfism and its implication for organismal health.

Compression fractures are quite rare in the fossil record. They include impaction or pilon (from the Latin pilum, or pounder) fractures (wherein one bone penetrates the distal joint or portion of the same bone (Hastings and Carroll, 1988; Stern et al., 1991) and the subject of the current report, fractures of vertebral centra. The latter may take several forms, related to direct trauma and a form of disruption referred to as a burst fracture (Bensch et al., 2006; 2009), endplate shattering cracks, and compression or wedge fractures. Wedge or compression fractures suggest an underlying process, osteoporosis (Jacobs-Kosmin et al., 2010).

In a sample of 58 cervical vertebrae of the pygmy elephant, Elephas tiliensis, from the late Pleistocene of Tilos Island, Dodecanese Greece, an “impact” fracture was noted in Athens University Museum of Palaeontology and Geol-
ogy #2312. Examination of lumbar vertebrae revealed compression fractures in #6453 and #2286 (Figure 1). This is a relatively high rate of occurrence and suggests some underlying cause.

Causes of wedge fractures include infections such as tuberculosis, but those are associated with external signs of vertebral erosion or holes and reactive new bone formation. These were not found in our study. Osteoporosis can also be caused by estrogen deficiency, inflammatory bowel disease, and liver failure. Metastatic disease and infection can mimic it (Jacobs-Kosmin et al., 2010). Other causes of vertebral wedging include hyperparathyroidism, kidney disease, infection, and metastatic cancer. There was no evidence of subperiosteal resorption characteristic of hyperparathyroidism (Resnick, 2002) or periosteal reaction characteristic of kidney disease (Rothschild and Martin, 2006; Rothschild et al. 2002). There was no change in limb morphology to suggest rickets. Vitamin D is necessary to utilize calcium; osteomalacia, the result of vitamin D deficiency in mature animals, could be considered. But what would cause deficiency that was limited to mature animals? It seems probable that we are observing a dietary deficiency, but there is no evidence of hyperparathyroidism, excess phosphate intake, or magnesium deficiency. There might have been excess phytates in their diet that bound the dietary calcium, preventing absorption. As an island population, their dietary opportunities were more limited than for elephants on the mainland. It is not clear

Figure 1. Lateral view of pygmy elephant lumbar vertebra #2286 with 2.5 cm coin. Note significant reduction of ventral vertebral centra height (compared with posterior centra height) from compression fracture.
that the animals with compression fractures were disadvantaged. In humans
disease is often asymptomatic (except for loss of height) until a fracture occurs
in the peripheral skeleton.

Foster’s Rule (1964) states that large mainland animals get smaller on
islands, with the converse noted for small mainland animals. Sondaar (1977)
suggested that size-reduction stresses include increased mobility and reduced
food and range requirements. Agenbroad (2002a,b) suggested that smaller,
more agile animals with a lower center of gravity, would have selective advan-
tage in rugged island areas, such as those on Santa Rosa Island.

The energy needed for growth competes with that required to put on body
fat. In mammals a certain amount of body fat is required for reproductive
activity in the females, and malnourishment can delay puberty. When food
availability is limited by competitors on an overpopulated island or in a large
herd, inability to obtain surplus energy for body fat may result in delayed
sexual maturity. This could be compensated for by ceasing growth at a smaller
size, resulting in a higher reproductive potential for significantly smaller
individuals. The reported compression fractures are consistent with nutrition
stress on the population of dwarf mammoths on Malta and suggest that this
was a contributing factor to their small size. Roth (1992) also suggests that
compensation for population density might explain dwarfism in insular dwarf
elephants. The pathology findings in European dwarf elephants suggests the
possibility that nutritional limitations may have been a factor in the demise of
the California dwarf proboscidea.

References Cited

Agenbroad, L. D. 2002a California’s Channel Islands: A One Way Trip in the Tunnel of Doom.
In Proceedings of the Fifth California Islands Symposium, edited by D. Browne, K. Mitchell, and H.
Chaney, pp. 1–6. Santa Barbara Museum of Natural History, Santa Barbara, California.
Agenbroad, L. D. 2002b New Localities, Chronology, and Comparisons for the Pygmy Mam-
Barbara, California.

Bensch, F. V., M. P. Koivikko, M. J. Kiuru, and S. K. Koskinen 2006 The Incidence and Distribu-
——— 2009 Measurement of Spinal Canal Narrowing, Interpedicular Widening, and Vertebral
Compression in Spinal Burst Fractures: Plain Radiographs Versus Multidetector Computed Tomog-


Hastings, H., and C. Carroll 1988 Treatment of Closed Articular Fractures of the

medscape.com/article/330598-overview, accessed 12/20/10


Roth, V. L. 1992 Inferences from Allometry and Fossils: Dwarfing of Elephants on Islands. In
Oxford University Press, New York.

Rothschild, B. M., and L. D. Martin 2006 Skeletal Impact of Disease. New Mexico Museum of
Natural History, Albuquerque, New Mexico.


THE CENTER FOR THE STUDY OF THE FIRST AMERICANS

The Center for the Study of the First Americans (CSFA) is a unit of the Department of Anthropology, College of Liberal Arts, Texas A&M University, College Station, TX. The CSFA was established in July 1981 by a seed grant from Mr. William Bingham’s Trust for Charity (renamed Bingham Trust). The mission of the Center is the promotion of interdisciplinary scholarly dialogue and the stimulation of public interest on the subject of the peopling of the Americas through research, education, and outreach. Toward these goals:

- CSFA designs and implements programs of study and research involving the physical, biological, and cultural sciences;
- CSFA provides leadership and coordination to scholars world wide on the subject of the First Americans;
- CSFA promotes an open dialogue between government, business, avocation archaeologists, and the Native American community on the preservation of cultural and biological resources, and other issues relating to the study of the First Americans.
- CSFA disseminates the product of this synergism through education programs reaching a broad range of groups, including school children, the general public, and international scholars.

The mission of the Center’s staff and Advisory Board is to further the goals and programs of the CSFA, which has a membership of over 1400 individuals. The Center’s office and research laboratories are located in the Anthropology Building on the TAMU campus. The Center’s faculty and associates include:

Michael R. Waters  Director and General Editor  e-mail: mwaters@tamu.edu
Ted Goebel  Editor, CRP  e-mail: goebel@tamu.edu
Laurie Lind  Office Manager  e-mail: csfa@tamu.edu
James M. Chandler  Editor, Mammoth Trumpet  e-mail: wordsmiths@touchnc.net
Ruth Gruhn  Series Editor of CSFA books

The Center’s Peopling of the Americas publication program focuses on the earliest Americans and their environments. The Center solicits high-quality original manuscripts in English. For information write to: Michael R. Waters, Center for the Study of the First Americans, Department of Anthropology, Texas A&M University, 4352 TAMU, College Station, TX 77843-4352. Current Research in the Pleistocene presents note-length articles about current research in the interdisciplinary field of Quaternary studies as it relates to the peopling of the Americas. The submission deadline is February 15 of each calendar year. In addition, the Center publishes a quarterly newsmagazine, the Mammoth Trumpet, written for both general and professional audiences. Subscription to the Mammoth Trumpet is by membership in the Center. Contact Laurie Lind, CSFA, Department of Anthropology, Texas A&M University, 4352 TAMU, College Station, TX 77843-4352; phone (979) 845-4046, fax (979) 845-4070 for more information about the CSFA, its programs, and membership in the Center. The CSFA is a non-profit organization that depends on gifts and grants for its support. To learn about America’s earliest cultural and biological heritage, join the Center today.
## Author Index

Aguilar, R. H. 173  
Albarracín-Jordan, J. 95  
Ardelean, C. F. 116  
Asher, B. P. 47  

Backhouse, P. N. 19  
Barberena, R. 154  
Barrón-Ortiz, C. R. 147  
Bement, L. C. 22, 27  
Berberián, E. 118  
Blong, J. C. 25  
Bohach, L. 166  
Bowen, M. W. 129  
Bozarth, S. R. 143  
Breiland, A. 149  
Broster, J. B. 67  
Buehler, K. J. 27  
Burgess, D. 67  
Buvit, I. 1  

Capriles, J. M. 95  
Carrillo Rodríguez, C. A. 116  
Carter, B. J. 22, 27  
Cione, A. L. 152  
Coffman, S. 29, 39  
Costa, F. 123  
Crass, B. A. 73  

da Silva Lopes, L. 104  
Da-Gloria, P. 123  

Easton, N. A. 75  
Elias de Oliveira, R. 123  
Ellis, C. 32  
Erlandson, J. M. 35  
Escudero, A. 102  
Everhart, G. D. 37  

Femenías, J. 98  
Fenner, L. A. 39  
Fernández, F. J. 154  
Florines, A. 98  
Fowler, B. 71  
Frampton, E. 166  

Gaines, E. P. 42, 143  
Gasparini, G. M. 157  
Gavrilkina, S. A. 15  
Gibson, M. L. 159  
Gilbert, P. J. 73  
Gillispie, T. E. 75  
Gish, J. W. 58  
Gladyshev, S. 3  
Goebel, T. 136  
Grishchenko, V. A. 11  
Grooms, M. 75  
Gunchinsuren, B. 3  
Guzmán-Gutiérrez, J. R. 181  

Hamaguchi, K. 1  
Harmon, B. M. 45  
Hawley, M. F. 161  
Hellebrekers, N. 86  
Hill, C. L. 65  
Hill, M. G. 60, 161  
Hofman, J. L. 47  
Holliday, V. T. 131  
Holmes, C. E. 73  
Huber, J. K. 141  
Huckell, B. B. 37, 49  
Hughes, R. E. 58  
Hurst, S. 52  

Inglez, M. 123  
Izuho, M. 1  

Jackson, Donald 102, 107, 121  
Jackson, Douglas 121, 163  
Jass, C. N. 166  
Jew, N. P. 35  
Johnson, E. 19, 52, 176  
Johnson, W. C. 42, 129, 143  

King, L. M. 168  
Kittleson, D. W. 161  
Konstantinov, A. V. 8  
Koole, E. 123  
Kozachek, A. V. 15  
Kunesh, J. F. 42  

193
Laub, R. S.  55
LaValley, S.  81
Leigh, D. S.  125
Lepper, K.  149
López M., P.  170
Lowery, D.  134
Lucas, S. G.  173

Mabrey, L.  67
MacDonald, D. H.  58
Martin, L. D.  187
May, D. W.  60
Meltzer, D. J.  78
Méndez, C.  102, 107
Merriman, C. W.  49
Messineo, P. G.  110
Moretti, J.  176
Morgan, G. S.  173
Mulholland, S. C.  62, 65
Mulholland, S. L.  62, 65

Nami, H. G.  98, 104, 113
Neves, W.  123
Norton, M. R.  67
Noyes, G. D.  39
Nunes, T.  123

O’Brien, M. J.  49
O’Grady, P. W.  69, 89
Olsen, J. W.  3
Ortega-Hurtado de Mendoza, C.  181

Pal, N.  110
Pardiñas, U. F. J.  154
Pasenko, M. R.  173
Pitblado, B. L.  71
Popov, A.  3
Potter, B. A.  29, 73
Puga Pérez, S.  116

Rapson, D. J.  60
Razgildeeva, I. I.  8
Redmond, B. G.  179
Rick, T. C.  35, 134
Rivero, D.  118
Robazzini, A.  123
Rodriguez-de-la Rosa, R. A.  181
Rojas M., O.  170
Rondeau, M. F.  69, 89

Rothschild, B. M.  187
Ruez, D. R., Jr.  183
Salazar, D.  121
Sattler, R. A.  75
Schowalter, D.  166
Seguel, R.  107
Sellet, F.  78
Shackley, M. S.  49
Shirar, S. J.  42
Skinner, C.  81
Slobodin, S. B.  6
Smith, A.  86
Smith, G. M.  39, 81
Smith, H.  83
Smith, K. P.  86
Soibelzon, E.  152, 157
Spielmann, J. A.  173
Strauss, A.  123
Suárez, R.  125
Syromyatnikova, E. V.  15
Tabarev, A.  3
Tankersley, K. B.  179, 185
Terry, K.  1
Teta, P.  154
Theodor, J.  147
Theodorou, G. E.  187
Thomas, S. P.  69, 89
Thulman, D. K.  91
Tonni, E. P.  152, 157
Toscano, A.  98
Trindade, M.  125

Ubilla, M.  157
Vasil’ev, S. A.  15
Vasilevski, A. A.  11
Vialou, A. V.  78
Vialou, D.  78
Wah, J.  134
Wallace, S. C.  159, 168
Widga, C. D.  161
Wygal, B. T.  136

Yamskikh, G. Y.  15
Yeske, K. S.  42
Zubkov, V. S.  15
General Index

$^{13}$C 124
abalone 35
*Abies balsamea* See balsam fir
abrader 126
abrotichines 156
accelerator mass spectrometry (AMS) 25, 35, 42, 58, 61, 95–96, 102, 107, 125–126, 137, 143–144, 153, 171, 179, 185
Accipitridae See hawk
*Acinonyx trumani* See cheetah
*Acrocomia* See palm
Adair-Steadman site 52–53
agate 84–85, 126
*Akodon iniscatus* 155–156
Alaska 25, 29, 31, 42, 73, 75–77, 136–137, 143–144
Alaska Range 25, 31
Alberta 166–167
Alborn phase 65
Albuquerque 37
*Alces alces* See moose
algae 141–142, 144
Alibates dolomite 85
alluvial terrace 6, 9, 42
*Alticola* See vole
Altithermal 58–59
*Amerhippus* See *Equus*
American mastodon See mastodon
American zebra (*Equus simplicidens*) 176
amphibians (tetrapods) 176, 179
AMS See accelerator mass spectrometry
*Amsden Formation* 84
Amur River 7
*Anas* See duck
Anatidae See duck
ancestral coyote (*Canis lepophagus*) 176–177
Andes 124, 154, 164
andesite 12
ANOVA 148
Anseriformes See duck and goose
antelope 176
anvilstone 9, 12
apatite 108
Arctic ground squirrel (*Spermophilus parryii*) 167
Argentina 106, 110, 113, 118–120, 126, 154–155, 157–158
*Argopecien purpuratus* 122
Arizona 23, 38, 173–174
Arlington Canyon 35
arrowhead 80
Arroyo Cacique site 100
*Artemisia* See sage
artiodactyl 108, 180
Asteraceae (*Baccharis*) 165
Atacama Desert 97
Athabasca 76
Aubrey site 23
auroch 16
Automba phase 65
*Aztlanolagus agilis* 176
*Baccharis* See Asteraceae
Badger Creek 82
balsam fir (*Abies balsamea*) 186
barn owl (*Tyto alba*) 96, 154
basalt 12, 14, 37, 45, 96, 126
bead 6
Bear Springs Peak 50
beaver See giant beaver
Beaver Lake 67–68
Beaver (North Canadian) River 22–23
Belize 114
Beringia 6–8, 30, 42–43, 73, 75–77, 148
Betecsa site 171–172
Betula See birch
biface 6–7, 17, 20, 25, 30, 42, 45, 47, 50–57, 65–70, 72, 76, 87, 92, 103, 105, 110, 113–114, 117, 121, 126–127, 179
Big Blue River 47
Big Stick 69, 90–91
birch (Betula) 77, 143
bison 16, 22–24, 27–31, 42, 54, 61, 73–74, 131, 133, 144, 161–162
Biwabik silica 62–63
Black Rock Desert 81–82
black-footed ferret (Mustela nigripes) 168–169
Blackwater Draw 19, 53, 60
blade, blade tool 3, 5–6, 12, 17, 20, 47–48, 67–68, 98, 105, 113, 127
Blancan 173–174, 176–177
blue-green algae See Cyanochloronta
boar (Sus scrofa) 1
Boca Negra Wash site 49–51
Bodie Hills 41
bog lemming (Synaptomys) 180
Bolen 92
Bolivia 95, 97, 157
Bolshie Arbaty site 15–16
bone-eating dog (Borophagus) 176
Bordwell Springs 82
Borophagus See bone-eating dog
Bos See cow
Bostrom site 114
Botryococcus 142
Branta See goose
Brasenia Schreberi See watershield
Brazil 104–105, 114, 123, 126
Brazos River 19, 176
Bredthauer site 47–48
Broken Mammoth site 73–75
Broken Zig Zag theory 152
Bronze Age 15
Brule River 141
Buck Mountain 82
Buck Springs 70, 90
Buenos Aires 106, 113, 157
Buffalo Museum of Science 55
Buisectus brevipes See pygmy skunk
Bull Creek 27
Burgess-Mabrey site 67–68
burin 2, 6–7, 17, 74–75
bur-reed (Sparganium-type) 142
butchering 22, 28, 54, 110, 112
Calama-Chiuchiu basin 170–172
calcium 28, 188
Caldera Vilama 96
caliche 20
California 35–36, 40, 81, 187, 189
California mussel 35–36
Camelid (Lagidium sp.) 95, 102–103, 153, 176
Campo Laborde site 110, 112, 153
Canadian River 22–23
Canidae 171
Canis lepophagus See ancestral coyote
Cape site 60–61
Capreolus capreolus L. See roe deer
Cardwell Bluffs 36
carbon, carbonate 28, 133, 179, 185–186
caribou (Rangifer tarandus) 25, 30–31, 161, 180
Carson-Conn-Short site 68
Casa Diablo 41
Castoroides ohiensis See giant beaver
Catagonus 157
cattail (Typha latifolia) 142
cavy (Microcavia australis) 155–156
cedar (Cupressaceae, Juniperus) 38, 186
celtis See hackberry
Central America 114, 181–182
Central Basin 67
Central Mountains 118–120
Central Plains 47, 49
Central Valley 164
ceramics 95
Cerro del Medio  50
Cerro El Sombrero  113
Cerro Largo  106
Cerro los Burros  114
Cerro Toledo  50
Cerro Zapaleri  96
Cervid, Cervidae, Cervus  See elk
Chacoan peccary (taguá, *chancho quimilero*)  157
*Chancho quimilero*  See Chacoan peccary
channel flake  50, 87
Channel Islands  35–36
charcoal  2, 25, 42, 58, 61, 76–77, 96, 102, 118, 121, 123, 126, 133, 137, 143–144, 179–180
cheetah (*Acinonyx trumani*)  176
*Chelonia serpentina*  See snapping turtle
chert
  Alibates  20, 85
  Balsam Lake  162
  Bigby-Cannon  67
  black  87
  Car-ter  22, 27
  Cochrane  62–63
  Edwards Formation  20, 52–53, 85, 92
  Flattop  47, 78, 80
  Fort Payne  67
  gray-tan  5, 25, 48, 87
  Green River  84
  Kakabeka Falls  65
  Miocene  170
  Mount Merino  87
  Normanskill  87
  Ogallala Formation  20
  olive brown  96, 105, 113
  Onondaga  57, 87
  Pedernal  51
  Permian  28, 48
  Prairie du Chien  62–63
  red  38, 84, 96
  Salem/St. Louis  65
  Silurian  179
  Suwanee  91–92
Washington  1
Chesapeake Bay  134–135
Chile  97, 102–103, 106–108, 113, 119, 121, 163–164, 170
Chindadn Complex  31, 75–77
chisel  11
Chlorophycophyta (green algae)  142
chopper  6, 9
*Choromylus chorua*  122
*Chrysemys picta*  See pond turtle
Chukotka  3
*Githarichthys gilberti*  122
Clear Fork  176
Cloquet River  65
cobble  6, 9, 55, 67–68, 95
Cochiti Lake  37–38
Cody complex  53
collagen  107–108, 153, 179, 185–186
Colorado  27, 47, 80, 131
Colorado Flattop Butte  47
Composite family (Compositae)  17, 87, 135, 177
conch (*Strombus gigas*)  55, 57, 122
*Concholepas concholepas*  122
Cooper site  23
core  1–2, 5–7, 9, 12–13, 17, 28, 53–54, 66–67, 98, 134, 141–142
Coso  41
cotton rat (*Sigmodon minor*)  177
cottontail (*Sylvilagus* sp.)  183–184
cow (*Bos*)  20, 22, 82, 181
Cowhead Lake  82
coyote (*Canis latrans*)  82, 176
Coyote Spring  82
cremation  123–124
Crescent Lake  92
crescent  36, 92, 129
Crowfield  32
Crow Spring  40–41
cryoturbation  6, 30, 73
*Chironomus*  See tuco-tuco
Cueva Bautista  95–96
Cueva del Tigre site  126
Cueva Huenul  154–155
Cumberland River  67
cumulic  132–133
Cupressaceae  See cedar
Curculionidae  See weevil
Cuvieronius  107, 173–174
Cyanochloronta (blue-green algae)  142
Cynomys niobrarius churcherii  See white-tailed prairie dog
Daisy Cave  36
DB site  132
Debert site  32
deer (Odocoileus sp.)  16
Denali National Park  25, 29–31
diatoms  20
Dietz site  40
diptera chironomidae  163
Diuktai  6
Doedicurus  See gomphothere
dog (Canis sp.)
C. familiaris  See domestic dog
C. latrans  See coyote
dolomite  85, 110
Dolores Formation  99
domestic dog (Canis familiaris)
166–167, 176
Donnelly glacial interval  76
Double Mountain  19
Drake Cache  84–85
Dry Creek site  31, 77
duck (Anatidae, Anseriformes,
Anas)  42
Duluth  65, 141
dung  95
Dyuktai  See Diuktai
Dzhebash River  16
eastern hemlock (Tsuga canadensis)
186
Eastern Highland Rim  67
eastern red cedar (Juniperus virginiana)
186
Eckles site  47–48

Ecuador  114
El Rechuelos  50
elephant (Proboscidian)  116, 173–174, 187–189
Elephas tiliensis  See pygmy elephant
Eligmodontia  See silky desert mouse
elk  See wapiti
Elko  45
Elliott’s Island  134–135
elm (Ulmus)  138
El Sombrero site  113
endscraper  2, 6, 17, 48, 87, 179
Equus (Amerhippus)  107–109, 117, 147–148, 171, 176
E. asinus  148
E. burchelli  148
E. caballus  148
E. complicatus  148
E. conversidens  148
E. francisci  148
E. fraternus  148
E. hemionus  148
E. lambei  148
E. mexicanus  148
E. niobrarensis  148
E. occidentalis  148
E. simplicidens  See American
zebra
E. tau  148
E. zebra  148
Eremotherium laurillardi  See giant
ground sloth
ermine (Mustela erminea)  180
Euneomys  See Patagonian rat
Falconiformes  See hawk
feldspar  136
Fell’s Cave  106, 113
Fenn Cache  84–85
fir (Abies)  186
Firstview  20
fisher (Martes pennanti)  180
Fishing Bridge Point site  58–59
flat-headed peccary (Platygonus
compressus)  179–180, 185–186
Flattop Butte  47
Florida  91, 177, 183
flotation 164
fluoride 185–186
fox (Vulpes sp.) 82
Fox Mountain 82
France 80, 121
frog (Rana spp.) 177
Gainey complex 62–63
Garfield Hills 41
gastropods (Succinea) 103, 122
Gault site 53
Geomys See pocket gopher
Gerstle River site 74
giant beaver (Castoroides ohioensis) 179–180
giant ground sloth (Megatherium) 110, 153, 171
giant tortoise (Geochelone crassiscutata) 93
Glacial Lake Agassiz 149
Glacial Lake Ahtna 138
Glacial Lake Duluth 141
Glacial Lake Nemadji 141
Glass Buttes 70
Gloeotrichia-type 142
glyptodont (Neotheracophorus) 153
gomphothere (Doedicurus) 153, 171, 173–174
Gomphotheriidae 171
goose (Branta) 36, 42
Graham site 48, 159, 180, 185
Gramineae See grasses
Grants Ridge 50
grasses (Gramineae) 95, 133, 143–144
grasslands 38, 59, 126, 144, 176
graver 6, 51, 56–57, 87, 179
Great Basin 39–40, 45, 69, 81–82, 89
Great Lakes 32, 66
Great Plains 60, 132, 148
Greece 187
green algae See Chlorophycophyta
Green River 84
grinding stone 102
ground sloth 110, 153
ground squirrel (Spermophilus sp.) 166–167
groundstone 98
Gruta de Candonga site 118
guanaco (Lama glama guanicoe) 102–103, 108, 158
Guano Valley 82
hackberry (Celtis) 177
hammerstone 11
Hand Hills 166
Hanging Rock Shelter 81–82
hare (Lepus) 42, 176–177
Harny Basin 89–90
hawk 82, 177
Hawks Valley 82
Healy Lake Village site 76
hearth 2, 20, 73–74, 76–77, 102
heather vole (Phenacomys intermedius) 180
Herman stage 150–151
Hesperotestudo 176
Highland Rim 67
Hippidion saldiasi 171
Hiscock site 55–56
Hixton silicified sandstone (HSS) 62
Hokkaido 1, 3, 12–14
Holcombe 32, 62–63
Horace Mesa 50
hornfels 12
horse (Equus sp.) 93, 107–109, 117, 147–148, 171, 176
HSS See Hixton silicified sandstone
Huventelauqué Complex 102–103, 121
Hydrolagus macrophthalamos 122
Ichetucknee River 183–184
Idaho 71
ignimbrite 95
interglacial period 153
iron oxide 9, 121–122
Irvingtonian 173–174, 177
ivory 73–74
masked shrew (Sorex cinereus) 180
Massachusetts 86–87
Massacre Lake 82
mastodorn (Mammut americanum) 72, 93, 107, 116
Matros site 15–16
Mazama O tephra 69–70
Mead site 73–75, 169
Megalonyx See ground sloth
Megalatherium cf. M. americanum See giant ground sloth
Meleagris gallopavo See turkey
Mendoza site 113, 181
Menza River 9, 11
Mesa site 38, 50
microblade 1–3, 5–7, 9, 12, 14, 17, 29–31, 42, 73, 75–76
Microcavia australis See cavy
microcore 7, 17
Microtis xanthognathus See yellow-checked vole
midden 35, 134
Mill Creek 48
Minas de Callorda site 99–100
Minnesota 62, 64–66, 141–142, 149–150, 161
Miocene 170
Miracinonyx 176–177
Mississippi 67
Mixotoxodon laensis 182
mole (Scalopus) 147–148, 177
mollusk 102–103, 122, 164
Mongolia 3, 5
Mono Glass Mountain 41
Montana 58
Monte Verde site 163
Montezuma Range 41
Moore site 120
moose (Alces alces) 16
moraine 65
Mount Hicks 41
Mount Majuba 41
Mount Taylor 50
mouse (Peromyscus sp.) 155–156
mouse opossum (Thylamys pallidior) 155–156
Mozharov Uval site 15
Mud Lake 39–41, 45–46
mud/musk turtles (Kinosternidae) 177
Murray Springs site 23, 38
Musée de l’Homme 78–80
mussel 35–36
Mustela ermita See ermine
Mustela nigripes See black-footed ferret
Mylodon sp. See ground sloth
Mylodontidae See sloth
Mylothys nasutus See long-nosed peccary
Myrmecophaga tridactyla 158
Mytilus californianus 35
Nannippus peninsulatus See three-toed horse
nanodiamond 179
Narragansett Basin 86, 88
Nebraska 47, 60, 174
Negro River 98–100, 126
Nemadji 141
Nenana complex 7, 30–31, 42–43, 143
Neotheracrophorus See glyptodont
Nevada 39–41, 45, 81–82
New Mexico 23, 37–39, 49–50, 60, 79–80, 174
New York 55	nonsiliceous algae 141–142
North Dakota 149–150
northern bog lemming (Synaptomys borealis) 180
Northern Channel Islands 36
North Fork 19
North Plains 53–54, 59
North Slope 6
Norton Bone Bed site 67–68
Notoungulata 181
Novoselovo site 17
Nye site 161–162
oak (Quercus) 162
Oakes 173
obsidian  1, 12–14, 39–41, 45–46, 49–51, 58–59, 69–70, 72, 75, 81–82, 84, 89–91, 96, 103
Obsidian Butte  41
obsidian hydration dating  1, 70, 90
ocher  2
Odocoileus sp.  See deer
Ogallala formation  20
Ogmodontomys poaphagus  See vole
Ogonky site  13–14
Ohio  179, 185
Ojo Opache site  171
Okhotsk, Okhotsk Sea  6, 13
Oklahoma  22, 27
Olympia site  13
Onondaga escarpment  57, 87
Ontario  65
opal  126
opal phytolith  143–144
optical stimulated luminescence (OSL) dating  43, 136–137, 149–151
Oregon  40, 69, 81–82, 89
orthoclase  9
orthoquartzite  38
Oshetna tephra  30
OSL  See optical stimulated luminescence dating
Osprey Beach site  58
Otofuke River  1
outre passé  See overshot flake
overshot flake (outre passé)  67
Pacific Coast  107, 121
painted turtle (Chrysemys cf. picta)  176
Palaeolama  107–109
paleosol  30, 35, 73, 76, 134
palm (Acrocomia)  87
pampa  112, 119, 153
Panama  114
Panthera onca  See jaguar
Paraguay  157–158
Paralichthys microps  122
Paramylodon  See ground sloth
Paso del Puerto site  99–100
Paso Otero site  106, 112
Patagonia  119, 154
Patagonian rat (Euneomys)  155–156
Paul site  19
Pavo Real site  53
Pearson site  42, 114
peat  20, 134, 141
peccary  157, 176, 179–180, 185–186
Pediastrum sp.  See green algae
pedogenesis  133, 137
Pembina River  150–151
pendant  6–7
penguin (Spheniscus)  122
Peoria loess  132
Perissodactyla  See tapir
Permian  28, 48
Phenacomys intermedius  See heather vole
Phyllostis  See leaf-eared mouse
phytolith  Seeopal phytolith
Picea  See spruce
pig (Sus scrofa)  122
pigment  122
pigmy shrew (Sorex hoyi)  180
pine (Pinus)  62, 64, 141, 180, 186
pine martin (Martes americana)  180
Pinto Peak  82
pine (Pinus)  62, 64, 141, 180, 186
P. banksiana  See jack pine
P. resinosa  See red pine
Pine City Phase  62, 64
pine martin (Martes americana)  180
Pinus  See pine
plains pocket gopher (Geomys bursarius)  177
Plainview  53
planktonic green algae  See Chlorophyceae
Platygonus compressus  See flat-headed peccary
playa  49, 129–130
pluvial lake  36, 45
Poaceae  See grasses
pocket gopher (Geomys)  177
point
Alberta  166–167
Allen  19
Barnes  32
Beaver Lake 67–68
Black Rock Concave Base 70
Bull Brook 86–87
Cody 53
concave-base 32–33, 40, 62–63, 70, 81
Cormier 87
crescent 36, 92
Crowfield 32
Cumberland 67–68, 79
ey Archaic 58, 92
Elko 45
Fell 98–99, 105, 113–114
Firstview 20
Fishtail 98–100, 104–105, 113–114, 118–119, 134–135
Great Basin Stemmed Series 45
Hi-Lo 87
Hixton 62–63
Holcombe 32, 62–63
lanceolate 30, 87, 102, 105, 110, 119
Michaud 32
Neponset 32
Nicholas 32, 35
Permian 28, 48
Pinto 82
Plainview 53
Quad 67–68
stemmed 36, 39–41, 45, 69–70, 81, 102–103, 113–114
Suwannee 91–92
West Athens Hill 33, 86
pollen 59, 77, 141–142, 156
pond turtle (Chrysemys picta) 176
pondweed (Potamogeton) 142
pooid grasses (Pooidaeae) 143
poplar (Populus) 186
Populus See poplar
Portage River Channel 141–142
Potamogeton See pondweed
pottery 123
preform 9, 30, 36, 50–51, 66–67, 71–72, 76, 86, 113–114
pressure flaking 63, 70, 114
prairie dog (Cynomys sp.) 166–167
Proboscidean See elephant
Prodipodomys centralis See kangaroo rat
pronghorn antelope (Antilocapra americana) See antelope
pygmy elephant (Elephas tiliensis) 187–188
pygmy shrew (Sorex hoyi) 180
pygmy skunk (Buisnietus breviramus) 176
quarry 5, 51, 68–69, 126, 174
quartz, quartzite 9, 12, 16, 20, 38, 62–63, 74, 84–85, 87, 110, 118, 126, 136, 150
Quaternary 15, 19, 28, 130
Quebrada Cascabeles 121
Quero site 107
rabbit (Leporidae, Sylvilagus sp.) 176, 183–184
radiometric dating 107
Rainy lobe 65
Rana spp. See frog
Rancho La Brea, Rancholabrean 176–177, 183
Rangifer tarandus See caribou rat 156, 177
Ravenscroft site 27–28
red deer 16
red pine (Pinus resinosa) 141
reindeer See caribou
Reithrodon auritus 155–156
Republican River 47
resharpening 63–64, 92, 110, 113
rhea (Rheidae) 171
Rhode Island 86
Rhychotherium 173
rhyolite 50, 87–88
<table>
<thead>
<tr>
<th>Location/Species/Genus</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rimrock Spring</td>
<td>90–91</td>
</tr>
<tr>
<td>Rincón del Bonete</td>
<td>99–100</td>
</tr>
<tr>
<td>Rio Grande</td>
<td>37, 49–51, 104–106</td>
</tr>
<tr>
<td>Rio Negro</td>
<td>98, 100</td>
</tr>
<tr>
<td>Rockies</td>
<td>59, 72</td>
</tr>
<tr>
<td>rockshelter</td>
<td>123, 125–127, 185</td>
</tr>
<tr>
<td>rodents (Rodentia)</td>
<td>36, 73, 95–96, 102, 154</td>
</tr>
<tr>
<td>roe deer (<em>Capreolus capreolus</em>)</td>
<td>16</td>
</tr>
<tr>
<td>Roland Springs Ranch locality</td>
<td>176</td>
</tr>
<tr>
<td>Rolling Plains</td>
<td>52, 176</td>
</tr>
<tr>
<td>Russia</td>
<td>3, 8, 11, 16</td>
</tr>
<tr>
<td>Russian Far East</td>
<td>16</td>
</tr>
<tr>
<td>Ryan site</td>
<td>53</td>
</tr>
<tr>
<td>Sadmat</td>
<td>45</td>
</tr>
<tr>
<td>sage (<em>Artemisia</em>)</td>
<td>89–91</td>
</tr>
<tr>
<td>Sage Hen Gap site</td>
<td>89–91</td>
</tr>
<tr>
<td>Sakhalin Island</td>
<td>11–14</td>
</tr>
<tr>
<td>Salado River</td>
<td>171</td>
</tr>
<tr>
<td>Saline Ridge</td>
<td>41</td>
</tr>
<tr>
<td><em>Salix</em> (Salicaceae)</td>
<td>See willow</td>
</tr>
<tr>
<td>Salto Chico site</td>
<td>113, 126</td>
</tr>
<tr>
<td>San Gregorio de Polanco</td>
<td>100</td>
</tr>
<tr>
<td>San Ramón site</td>
<td>113, 121–122</td>
</tr>
<tr>
<td>Santa Fe</td>
<td>37, 92</td>
</tr>
<tr>
<td>Santa Fe River</td>
<td>92</td>
</tr>
<tr>
<td>Santa Lucía</td>
<td>113</td>
</tr>
<tr>
<td>Santa Rosa Island</td>
<td>35, 189</td>
</tr>
<tr>
<td>Sartan Glaciation</td>
<td>8–9, 11</td>
</tr>
<tr>
<td>Sawmill Ridge</td>
<td>41</td>
</tr>
<tr>
<td><em>Scalopus</em> See mole</td>
<td></td>
</tr>
<tr>
<td>scanning electron microscopy (SEM)</td>
<td>164</td>
</tr>
<tr>
<td><em>Scelidotherium</em> sp.</td>
<td>See ground sloth</td>
</tr>
<tr>
<td><em>Scenedesmus</em></td>
<td>142</td>
</tr>
<tr>
<td>Sciuridae</td>
<td>See squirrel</td>
</tr>
<tr>
<td>scraper</td>
<td>2, 6–7, 9, 11, 30, 45, 66, 70, 86–87, 96, 98, 102, 117, 179</td>
</tr>
<tr>
<td>seal</td>
<td>12</td>
</tr>
<tr>
<td>Sea of Okhotsk</td>
<td>See Okhotsk</td>
</tr>
<tr>
<td>Selenga River</td>
<td>3</td>
</tr>
<tr>
<td>SEM See scanning electron microscopy</td>
<td></td>
</tr>
<tr>
<td>Semenovsky Ruchey site</td>
<td>15</td>
</tr>
<tr>
<td>Shawnee-Minisink site</td>
<td>32</td>
</tr>
<tr>
<td>sheep</td>
<td>16, 30–31, 69–70, 95</td>
</tr>
<tr>
<td>Sheep Mountain site</td>
<td>69–70</td>
</tr>
<tr>
<td>Sheriden Cave</td>
<td>179–180, 185–186</td>
</tr>
<tr>
<td>Shifting Sands site</td>
<td>53–54</td>
</tr>
<tr>
<td>Shimaki site</td>
<td>1–3</td>
</tr>
<tr>
<td>shrew (<em>Sorex</em> sp.)</td>
<td>180</td>
</tr>
<tr>
<td>Siberia</td>
<td>1, 8, 15–16</td>
</tr>
<tr>
<td>sidescraper</td>
<td>2, 6, 17, 30, 45, 87, 110–111</td>
</tr>
<tr>
<td>Sigmodontine</td>
<td>156</td>
</tr>
<tr>
<td>Sigurtup site</td>
<td>15</td>
</tr>
<tr>
<td>silicates</td>
<td>12, 47, 62–63, 65, 143</td>
</tr>
<tr>
<td>siliceous argillite</td>
<td>12</td>
</tr>
<tr>
<td>silicified limestone</td>
<td>126</td>
</tr>
<tr>
<td>silky desert mouse (<em>Eligmodontia</em>)</td>
<td>155–156</td>
</tr>
<tr>
<td>siltstone</td>
<td>62</td>
</tr>
<tr>
<td>Silver Peak</td>
<td>41</td>
</tr>
<tr>
<td>sink hole</td>
<td>179, 183</td>
</tr>
<tr>
<td>Sipfa tephra</td>
<td>1</td>
</tr>
<tr>
<td>skunk</td>
<td>176</td>
</tr>
<tr>
<td>Slavnaya site</td>
<td>14</td>
</tr>
<tr>
<td>sloth (<em>Mylodontidae</em>)</td>
<td>110, 153</td>
</tr>
<tr>
<td>Southern Cone</td>
<td>104, 106, 113, 118–120</td>
</tr>
<tr>
<td>Smoky Hill Jasper</td>
<td>48</td>
</tr>
<tr>
<td>Snake River</td>
<td>62, 64, 72</td>
</tr>
<tr>
<td>snapping turtle (<em>Chelydra serpentine</em>)</td>
<td>179</td>
</tr>
<tr>
<td>Sokol</td>
<td>14</td>
</tr>
<tr>
<td>Sora River</td>
<td>95</td>
</tr>
<tr>
<td><em>Sorex cinereus</em> See masked shrew</td>
<td></td>
</tr>
<tr>
<td><em>Sorex hoyi</em> See pygmy shrew</td>
<td></td>
</tr>
<tr>
<td>Southern High Plains</td>
<td>19–20, 22, 50, 52–53, 176</td>
</tr>
<tr>
<td><em>Sparganium</em>-type See bur-reed</td>
<td></td>
</tr>
<tr>
<td><em>Spermophilus</em> sp. See ground squirrel</td>
<td></td>
</tr>
<tr>
<td><em>Spirogyra</em>-type</td>
<td>142</td>
</tr>
<tr>
<td>spruce (<em>Picea</em>)</td>
<td>141, 143, 162, 186</td>
</tr>
<tr>
<td>squirrel (<em>Sciuridae</em>)</td>
<td>166</td>
</tr>
<tr>
<td>Starodubskoye site</td>
<td>14</td>
</tr>
<tr>
<td>St. Croix phase</td>
<td>65</td>
</tr>
<tr>
<td>Stegomastodon</td>
<td>173–174</td>
</tr>
<tr>
<td><em>Stephanidiscus</em> Centrales See diatoms</td>
<td></td>
</tr>
<tr>
<td>St. Johns River</td>
<td>91–92</td>
</tr>
</tbody>
</table>
Strangaliodes 163–165
Strigiformes 96, 154
Strombus gigas See conch
Succinea See gastropods
Sugarloaf Mountain 41
Sun River 77, 144
Surveyor Spring 82
Sus serofa See pig and boar
Susitna River 25, 136, 138
Suwannee 41
Swan Point site 31, 73, 75, 77
Sylvilagus palustris See marsh rabbit
Sylvilagus sp. See cottontail
Synaptomys borealis See northern bog lemming
Synaptomys sp. See bog lemming
Synodontis violacea 122
taconite 65–66
taguá See Chacoan peccary
Taimyr 9
Tanana Flats 42–43
Tanana River 73, 143–144
Tangara pumice 1
tapir (Tapirus spp.) 159–160
T. californicus 187, 189
T. haysii 160
T. veroensis 160
Tapirus See tapir
Taxodium sp. See cypress
Tayassuidae 157
Tecovas 20
Teklanika West site 29–31
Tempiute Mountain 41
Tennessee 67–68, 160, 168
tephra 1, 30, 69–70, 90, 137
Testudines 176
Teton Valley 71–72
Tetraedron 142
tetrapods See amphibians
Texas 19, 23, 52, 174, 176
thermoluminescence dating (TL dating) 157
Third Lake 65–66
three-toed horse (Nannippus peninsulatus) 176–177
Thuja occidentalis See white cedar
Thylamys pallidior See mouse opossum
TL dating See thermoluminescence dating
Tolbor cache 4–5
toolstone 12, 32–33, 40, 45, 80–83, 85
tortoise 93, 176
toxodont 181–182
Trachurus symmetricus 122
Transbaikal 6, 8–9
Trapper Creek Overlook site 136–137
Tsuga canadensis See eastern hemlock
tuco-tuco (Ctenomys) 155–156
tuff 12
tundra 180
turkey (Meleagris gallopavo) 177
turtle (Kinosternon sp.) 176–177, 179
tusk 116, 173
Typha latifolia See cattail
Tyto alba See barn owl, Strigiformes, Tytonidae
Tytonidae (Tyto alba) 96, 154
Uguisu pumice 1
Ulmus See elm
ultrathin 52–54
unifacial 48, 51, 67–68, 70, 92, 110, 126
Upper Kolyma 6
Upward Sun River site 76–77, 144
Uruguay 98, 100, 106, 113–114, 119, 125–126, 157–158
Ushki 6–7
Ustinovka I site 7
Ust’-Menza-14 site (Lagernaia) 9–11
Utah 71, 84–85
Valle Grande 50–51
Valles Caldera 50–51
Valle Grande 50–51
Venator 81–82
Venezuela 182  
Veracruz 181–182  
vicugna (*Lama gracilis*) 153, 171  
Villa Hidalgo 116–117  
volcanic rock 71  
vole (*Ogmodontomys poaphagus, Microtus sp.*) 177, 180  

Walhalla, North Dakota 149–151  
Walker Road site 77  
wapiti (*Cervus canadensis*) 25, 74, 144, 161–162  
Washington 1  
watershield (*Brasenia Schreberi*) 142  
weevil (Curculionidae) 163–165  
Western Pluvial Lakes Tradition 36  
white cedar (*Thuja occidentalis*) 186  
White River Group silicate (WRGS) 47  
White Rock Creek 47  
white-tailed prairie dog (*Cynomys niobrarius churcherii*) 166–167  
Whitewater Draw 81  
Whitewater Ridge 82  
willow (*Salix*) 61, 77, 186  

Wintering Hills 166  
Wisconsin 141, 161–162, 185  
Wood River 43  
woolly mammoth (*Mammuthus primigenius*) 150  
Wyoming 58–59, 84  

Xenarhra 171  
X-ray fluorescence (XRF) 39–40, 50, 81, 90  

Yakutia 3  
yellow-checked vole (*Microtus xanthognathus*) 180  
Yellowhouse Draw 19  
Yellowstone Lake 58–59  
Yenisei River 15–17  
Younger Dryas (YD) 22–24, 29–31, 75–77, 87, 179–180  
Yukon 143  

Zacatecas 116–117  
Zanja del Tigre site 126–127  
Zygnema-type 142
Order back issues of Current Research in the Pleistocene

If you are missing issues to complete your set of Current Research in the Pleistocene or if you want to find out what you have been missing, back issues of some volumes of Current Research in the Pleistocene are available. Quantities are limited.

To purchase, fill out the order form below and mail it with a check or money order to:

CSFA
Department of Anthropology
Texas A&M University
4352 TAMU
College Station, TX 77843-4352

To order by credit card, go to the secure order form on our web site (www.centerfirstamericans.com) and use your credit card to purchase current and back issues of CRP.

Order back issues of Current Research in the Pleistocene

<table>
<thead>
<tr>
<th>Volume Range</th>
<th>Unit Price</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vol. 4–16</td>
<td>$10.00</td>
<td></td>
</tr>
<tr>
<td>Vol. 17–21</td>
<td>$20.00</td>
<td></td>
</tr>
<tr>
<td>Vol. 22–28</td>
<td>$25.00</td>
<td></td>
</tr>
</tbody>
</table>

Subtotal: $ __________

U.S., $5 + $1 each additional volume
Foreign, $10 + $2 each additional volume

S&H: __________

Total __________

Make check or money order payable to TAMU–CSFA.

Ship to (please print clearly):

Name ________________________________

Address ________________________________

City __________________________ State _____ Zip _______

______________________________

e-mail address (in case we have a question about your order)