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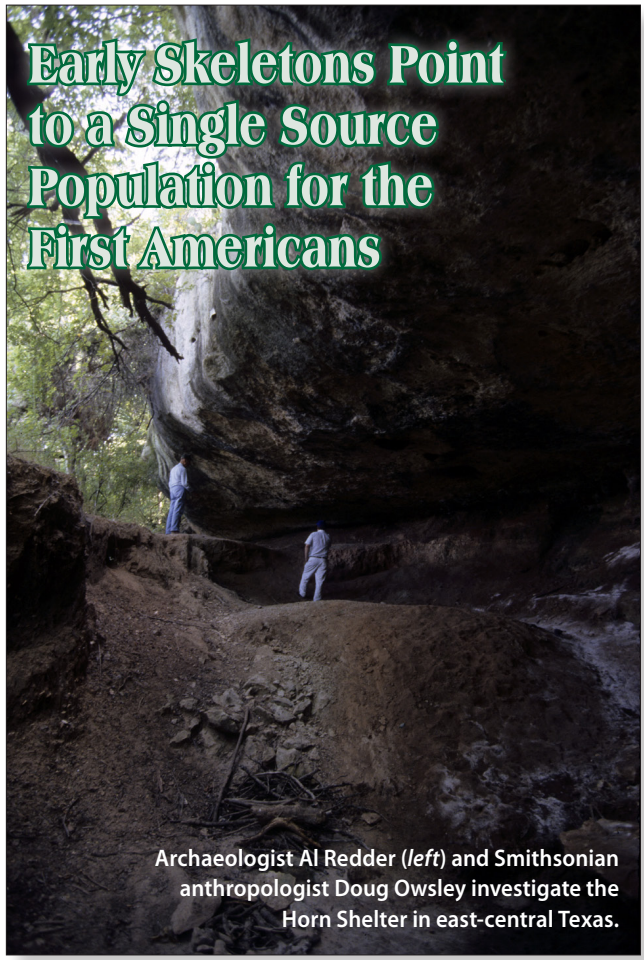
Early Skeletons Point to a Single Source Population for the First Americans

STONE TOOLS and butchered mammoth bones are important clues to solving the question of how and when the Americas were peopled, but the only way to gain insights into the people themselves is by studying their physical remains—their skeletons and their ancient DNA that is sometimes recoverable from their bones and from human coprolites.

Benjamin Auerbach, a biological anthropologist at the University of Tennessee in Knoxville, has studied a set of the most complete human skeletons from North America dating from 10,000–8000 RCYBP to better understand the physical variation among the earliest preserved inhabitants of North America. His study has implications for the origins of their ancestors and the migratory route they followed.

His results, published in the December 2012 issue of *American Journal of Physical Anthropology,* confirm the basic model developed by geneticists of a single source population, most likely located in the high latitudes of eastern Asia, as "the ancestor for all of the colonizers of North America" at a date no earlier than about 15,000 years ago.



Archaeologist Al Redder (*left*) and Smithsonian anthropologist Doug Owsley investigate the Horn Shelter in east-central Texas.

CHIP CLARK, NATIONAL MUSEUM OF NATURAL HISTORY, SMITHSONIAN INSTITUTION

The First Americans

Auerbach selected for analysis the five most complete and most ancient male skeletons in North America: Wizard's Beach from Nevada, dating to about 9515 RCYBP; Horn Shelter burial 2 from Texas, about 9500 RCYBP; Spirit

INSIDE

Cave Man, also from Nevada, about 9415 RCYBP; Kennewick Man from Washington, about 8370 RCYBP; and Gore Creek from British Columbia, Canada, about 8250 RCYBP. Dr. Auerbach chose these male skeletons because the most complete female skeletons dating to the early Holocene have either been reburied (Gordon Creek) or are taphonomically distorted (Wilson-Leonard Woman).

Although none of these skeletons date to the period of the initial discovery and colonization of the Americas, which occurred between about 20,000 and 11,000 RCYBP, Auerbach argues, based on other studies of change in body shape and size among colonizing human groups (such as in Europe or Japan), that these five individuals likely "retain the morphological traits of their colonizing ancestors."

LIBBY COWGILL

Auerbach in the Smokies, 2009.

Of course these skeletons have been studied before, but the focus of most previous work has been on the crania, or skulls. Independent studies have concluded that the skulls of these early individuals differ significantly from those of modern Native American populations. One aspect of those differences has especially important implications for understanding the area of origin of the first Americans and the time of their arrival in this hemisphere.

Cranial differences in early Americans

The skulls of early-Holocene Americans don't exhibit the characteristics of the skulls of modern populations living around the world in high-latitude cold environments, the kind of environment thought to have been occupied by the ancestors of early Americans. The skulls of later-Holocene Americans, however, do show these traits. Surprisingly, even the skulls of skeletons found in lower-latitude warmer climatic zones exhibit characteristics that suggest their ancestors came from high-latitude cold environments.

According to some scholars, this suggests an early and rapid migration of people into America that originated in the lower latitudes of Asia and apparently passed through northern Asia, but the people didn't dwell there for enough generations to develop physiological adaptations to the colder environments. They

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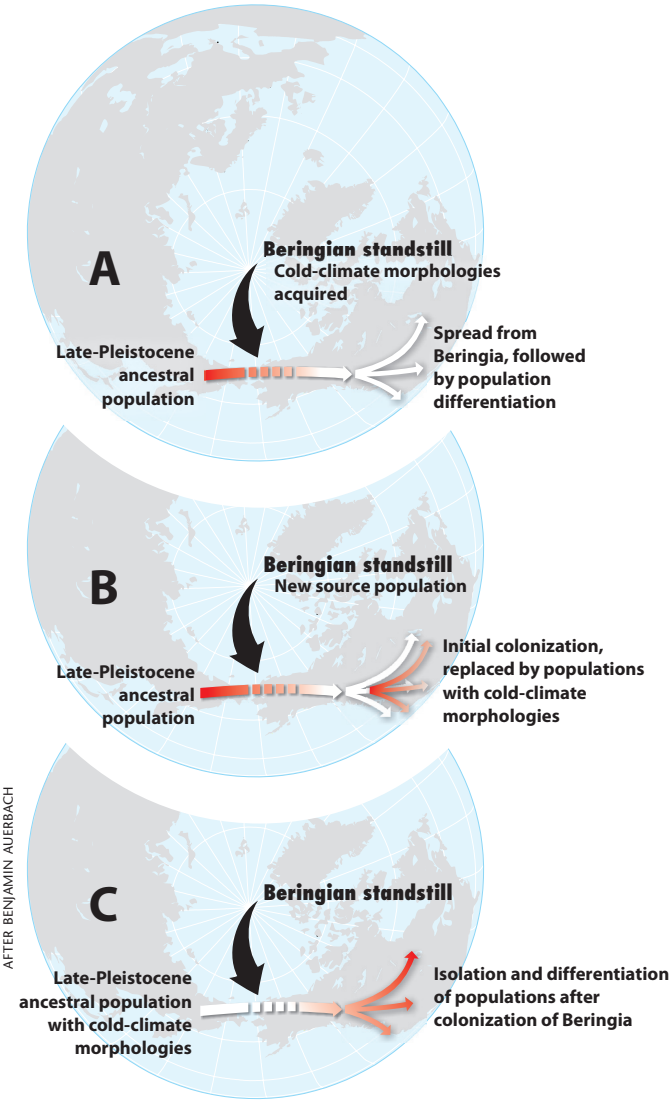
Mammoth Trumpet, Statement of Our Policy

Many years may pass between the time an important discovery is made and the acceptance of research results by the scientific community. To facilitate communication among all parties interested in staying abreast of breaking news in First Americans studies, the **Mammoth Trumpet,** a science news magazine, provides a forum for reporting and discussing new and potentially controversial information important to understanding the peopling of the Americas. We encourage submission of articles to the Managing Editor and letters to the Editor. Views published in the **Mammoth Trumpet** are the views of contributors, and do not reflect the views of the editor or **Center** personnel.

–Michael R. Waters, Director

became the ancestors of early-Holocene North Americans. Later, these scholars theorize, a second migration of Asians who had lived in the northern latitudes long enough to develop those adaptations came into America, possibly in larger numbers, and replaced the descendants of those earlier people. The members of this latter wave of migration became the ancestors of the later-Holocene North Americans.

An alternative explanation for the differences in the skulls of early- versus later-Holocene Americans is that those differences are the result of a single migration of people from Asia, which broke up into separate populations that then evolved different cranial characteristics through gene flow and genetic drift. Gene flow is the addition or subtraction of genetic variants in a population due to the movement of genes or people from one group to another; groups isolated from gene flow might develop differences that set them apart from other groups. Genetic drift refers generally to the random change in the range of genetic variants in a population over time; this has greater effects in smaller populations. A small group that leaves a larger population during colonization—which results in a founder effect—doesn't encompass the full range of genetic variation present in the original population. Owing to reduced genetic variation, lack of gene flow, and the influence of genetic drift, the daughter group will necessarily differ in some ways from its parent. The differences become more pronounced over the course of subsequent generations.



Auerbach's alternative hypotheses for origins and temporal patterns of morphological variation in North America. In A, the initial migration of the ancestral population from Asia acquires morphologies associated with cold climate during high-latitude isolation (the "Beringian standstill"), followed by migration, dispersion, and differentiation among descendant populations into the Americas. In B, the initial migration of ancestral populations from Asia results in more than one colonizing group; earlier groups do not develop cold-climate morphologies and are eventually replaced or bred out by later groups possessing cold-climate morphologies. In C, ancestral groups in Asia already possess a suite of cold-climate morphologies, which undergo further change during and after the initial colonization of Beringia.

Auerbach's study fails to support the hypothesis shown in B. Although it supports both A and C, it cannot determine which is more plausible. Note that Auerbach does not make arguments for the exact route of migration (e.g., coastal versus inland).

Studies of DNA from modern Native American groups (**MT 23-2,** "Largest-ever Survey of Native American Genes Sheds Light on First Americans") as well as ancient DNA recovered from early and later Holocene skeletons found in the Americas (**MT 22-2,** "Ancient DNA in Canada Reveals New Founding Lineage of Native Americans") strongly support a single migration followed by genetic changes due to gene flow and genetic drift.

Accounting for cranial differences

Auerbach proposes three alternative hypotheses to resolve the conundrum of early people with skulls distinctively different from those of later people. Perhaps the early-Holocene skeletons represent groups that separated early from a source population in Asia or Beringia that already had developed the basic genetic variations that typify all North American populations—ancient and modern. Subsequent genetic drift operating on the small groups migrating across the vast geography of North America produced the differences exhibited by the early- and later-Holocene crania.

Alternatively, if the changes in the crania of later-Holocene skeletons in fact reflect adaptations to a cold environment, as some believe, then these adaptations must have been absent from the original source population at the start of their migration. The source population must have remained isolated, in either northeast Asia or Beringia, long enough for its people to evolve cranial adaptations to cold climate. A secondary migration of now cold-adapted people from the original source population then continued the journey into North America.

Finally, it's also possible that the source population in northeastern Asia possessed the cold-adapted cranial characteristics of the later-Holocene groups. When the ancestors of the

In Memoriam
JOSEPH L. CRAMER
1919–2013

ARCHAEOLOGY lost a great friend and patron when Joseph L. Cramer passed away April 3, 2013.

Joe was born August 8, 1919, in Clovis, New Mexico, and grew up in Wichita, Kansas. From 1937 to 1941 Joe was trained as a geologist at the University of New Mexico. During the Second World War, Joe was employed by the Boeing Airplane Company on the B-29 bomber program. Joe followed B-29s wherever they went in the Pacific, even to the island of Tinian in 1945. After the war, he was employed as a geologist by Standard Oil of Indiana. From 1954 to 1969 he operated as an independent oil explorationist with offices in Denver. He retired in 1969 from active exploration and spent the next 44 years as an investor and supporter of archaeological research.

Joe was particularly passionate about the first people to colonize the Americas. He read everything about the subject and communicated with archaeologists around the country. This passion led Joe and his wife, Ruth, to create and finance six permanent research endowments. These include the North Star Archaeological Research Program (Texas A&M University); Argonaut Archaeological Research Fund (University of Arizona); Quest Archaeological Research Fund (Southern Methodist University); Sundance Archaeological Research Fund (University of Nevada); Odyssey Archaeological Research Fund (University of Kansas); and Keystone Archaeological Research Fund (Oregon State University). Much has been learned about the first Americans through the many excavations and surveys that these funds made possible.

Ruth and Joe Cramer

Joe was also passionate about educating young archaeologists and geoarchaeologists. Through the field projects sponsored by these funds many students have gained valuable field experience. This level of commitment to our field is unprecedented, and it is unlikely there will be another philanthropic endeavor of this magnitude. The field of First American studies will be forever indebted to the generosity of Joe and Ruth Cramer. Joe and Ruth's vision has led to many discoveries and insights about the first Americans, and new discoveries will continue in perpetuity. Every discovery and every student helped by these funds celebrates Joe's life and legacy. Joe, we will miss you, and we thank you for your everlasting gift to the field of archaeology.

–Michael Waters, Director, CSFA

early-Holocene groups migrated into Beringia, however, they became isolated for a time (a period known as "the Beringian standstill") and developed their distinctive cranial characteristics. Later migrations of people from this Beringian population retained the cranial shape of their ancestors.

Auerbach notes that crania are sometimes susceptible to relatively rapid changes in shape due to natural selection, genetic drift, and other factors. "However minor their effect," he says, "teasing apart these factors has complicated the interpretations of cranial diversity" between and among the early- and later-Holocene North American skeletons. His approach is to focus instead "on morphologies hypothesized to be stable over long temporal periods, namely the shape and proportions of postcranial morphology." In other words, Auerbach believes that studying overall body size and shape and the proportions of arm and leg bones provides a more reliable window on the peopling of the Americas than studying crania. The reason is that there is a clear and well-documented relationship between the postcranial skeletal morphology of a population and the climate to which it is adapted. Human bodies, like those of all warm-blooded animals, have been shaped by natural selection over millennia to efficiently conserve heat in cold environments and dissipate heat in hot environments.

Bergmann's and Allen's Rules

The influence of climate on body shape has been codified in two biological rules: Bergmann's and Allen's rules. According to Bergmann's Rule, bodies of warm-blooded animals in cold environments tend to be larger (absolutely wider bodies in the case of humans) because this minimizes the amount of surface area across which body heat can be lost. Conversely, the bodies of warm-blooded animals in warm environments tend to be smaller (absolutely narrower bodies among humans), thereby maximizing the amount of surface area for dissipating excess heat. Allen's Rule, which is really just a special case of Bergmann's Rule, states that the extremities of warm-blooded animals tend to be shorter in cold environments and longer in warm environments so the body can more efficiently retain or dissipate heat.

These rules are subject to qualifications and exceptions. Nonetheless Auerbach states categorically that humans living for millennia in the highest (and therefore the coldest) latitudes predictably exhibit the morphological extremes dictated by Bergmann's and Allen's rules. Moreover, "the patterns of human postcranial morphological variation documented in Europe, Africa, and Asia correspond with climatic factors" also correspond to the predictions of Bergmann's and Allen's rules. Therefore we can confidently apply these rules to the body proportions of ancient skeletons to determine whether the individuals were adapted for warm or cold climates.

The body shapes of early-Holocene Americans

Auerbach compared the sample of five early-Holocene American skeletons with a sample of 1,300 late-Holocene male skeletons from 13 sites across North America and an additional skeleton from South America. In addition, he compared these American skeletons to a sample of 162 male skeletons from Africa, Eurasia, and Australia.

The five early-Holocene American male skeletons exhibit a range of body types, which Auerbach describes as "a mosaic of morphologies." All five nevertheless lie "within the range of variation found in later-Holocene indigenous American groups" and are generally wider bodied than males from the Old World. Kennewick Man and Spirit Cave Man have exceptionally wider bodies than the average of the indigenous American groups, with the exception of groups from high-latitude arctic regions. This suggests their ancestors were physiologically adapted to cold environments.

The mosaic pattern of body shapes is best shown by comparing the Wizard's Beach and Spirit Cave skeletons. These two men were buried within 100 miles of each other and are only about a century apart in age, yet they differ surprisingly in body mass, height, and limb proportions. Although Auerbach cannot precisely account for the reasons underlying this variability, he argues that such differences have important implications for "the influence of environmental factors and population history on human morphology after the colonization of the Americas."

Every early-Holocene male skeleton Auerbach examined has a wide body and high body mass. He therefore concludes that natural selection or genetic drift (or both) must have been responsible for the presence of these characteristics "in all the colonizers of North America." In other words, either the ancestors of the early-Holocene Americans dwelt in extremely cold environments long enough to become subject to Bergmann's and Allen's rules and so became physiologically adapted; or the source population for the colonizers included individuals already possessing those characteristics, inherited from ancestors who had lived in and become adapted to cold environment, and by chance those individuals were disproportionately represented in the colonizing population.

The fact that both the early-Holocene and later-Holocene skeletons have a wider body and higher body mass than the sample of Old World skeletons suggests to Auerbach that, contrary to what the cranial evidence seems to imply, later Americans were descended from the same source population as the early Americans. Auerbach emphasizes that this conclusion supports the genetic evidence "for a common ancestry for all populations that colonized the Americas." Moreover, he notes that no evidence from the skeletal or molecular datasets precludes the possibility of separate earlier and later colonizing events as long as those migration pulses originated from a single, shared source population.

Auerbach's study is a powerful testament to what can be learned from a study of ancient human remains. The acknowledgments at the end of his paper include thanks to museum curators in North America, Europe, and Japan for access to the collections used in his analyses.

By studying these earliest Americans using new and improved methods, and by investigating new discoveries of even more ancient human remains, archaeologists and physical anthropologists will eventually arrive at a definitive answer to the question, Who were the First Americans?

The locations of the five early-Holocene skeletons analyzed by Auerbach span about 20 degrees of latitude, from the Gore Creek site in the north to Horn Shelter in the south.

– Brad Lepper

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Suggested Readings

Auerbach, B. M. 2012 Skeletal Variation among Early Holocene North American Humans: Implications for Origins and Diversity in the Americas. *American Journal of Physical Anthropology* 149:525–36.

Auerbach, B. M., editor 2010 Human Variation in the Americas: The Integration of Archaeology and Biological Anthropology. Center for Archaeological Investigations, Occasional Paper No. 38. Southern Illinois University, Carbondale.

Walker, S. M., and D. W. Owsley 2012 *Their Skeletons Speak: Kennewick Man and the Paleoamerican World.* Carolrhoda Books, Minneapolis.

The BIG Picture!

PALEOAMERICAN ODYSSEY SANTA FE 2013

Here is what's waiting for you in Santa Fe—the complete slate of speakers and their presentations, and the inventory of the once-in-a-decade display of artifacts. Be there!

Thursday, October 17

8:00–8:30 Conference Introduction

The Archaeology of Late-Pleistocene Beringia

8:30–9:00 Yana RHS site, earliest occupation of Siberia ***Vladimir Pitulko, Pavel Nikolskiy, Aleksandr Basilyan, and Elena Pavlova***

9:00–9:30 Human technological and behavioral adaptation to landscape changes before, during, and after the Last Glacial Maximum in Japan ***Masami Izuho***

9:30–10:00 Late-Pleistocene Siberia: Setting the stage for the peopling of the Americas ***Kelly Graf***

10:00–10:30 Break

10:30–11:00 Technology and economy among the earliest prehistoric foragers in interior eastern Beringia ***Ben Potter, Chuck Holmes, and David Yesner***

11:00–11:30 Biface traditions of northern Alaska and their role in the peopling of the Americas ***Heather Smith, Jeff Rasic, and Ted Goebel***

11:30–12:00 Discussion—Q&A period with all presenters

12:00–1:30 Lunch

Drowned caves in Yucatán

FOTO: EUGENIO ACEVEZ /PA-XPLOR /INAH

Late-Pleistocene Migration Routes and the Origins of the First Americans

1:30–2:00 After Clovis-First collapsed: Reimagining the peopling of the Americas ***Jon M. Erlandson***

2:00–2:30 Searching for Pleistocene–age submerged archaeological sites along western North America's Pacific Coast: Current research and future needs ***Quentin Mackie, Loren G. Davis, Daryl Fedje, Duncan McLaren and Amy E. Gusick***

2:30–3:00 The Chesapeake bifaces: Evidence for an LGM occupation of the mid–Atlantic region of North America? ***Dennis Stanford, Darrin Lowery, Margaret Jodry, Bruce Bradley, Marvin Kay, and Robert J. Speakman***

3:00–3:30 Vectors, vestiges, and Valhallas? Rethinking the Corridor ***John W. Ives and Duane Froese***

3:30–4:00 Break

4:00–4:30 Three-stage colonization model for the peopling of the Americas ***Connie Mulligan and Andrew Kitchen***

4:30–5:00 A genomic sequence of a Clovis individual ***Eske Willerslev***

5:00–5:30 The initial human colonization and settlement of interior North America ***David G. Anderson***

5:30–6:00 Discussion—Q&A period with all presenters

Friday, October 18

The Clovis Archaeological Complex

8:00–8:30 Clovis across the continent: Distribution, chronology, and climate ***Vance T. Holliday and Shane Miller***

8:30–9:00 Clovis technology: A beautiful complexity ***Bruce A. Bradley and Michael B. Collins***

9:00–9:30 Clovis–era subsistence: Continental patterning and regional variability ***Gary Haynes***

9:30–10:00 Break

10:00–10:30 Clovis caches: An update and consideration of their role in the colonization of new lands ***David Kilby and Bruce Huckell***

10:30–11:00 The Younger Dryas Boundary (YDB) cosmic impact hypothesis, 12.9 ka: A review ***James P. Kennett, Allen West, Ted Bunch, and Wendy Wolbach***

11:00–11:30 Pleistocene extinctions: The state of evidence and the structure of debate ***Nicole M. Waguespack***

11:30–12:00 Discussion—Q&A period with all presenters

12:00–1:30 Lunch

Late-Pleistocene Achaeology of Western North America and South America, and the Biological Evidence for the Peopling of the Americas

1:30–2:00 The increasing complexity of the colonization process: A view from the North American west ***Charlotte Beck and George T. Jones***

2:00–2:30 Bioarchaeological biographies of ancient Americans ***Douglas W. Owsley***

2:30–3:00 The first humans in the Yucatán peninsula found in drowned caves: The days of the late-Pleistocene/early-Holocene in a changing tropic ***Arturo H. Gonzalez Gonzalez, A. Terrazas, M. Benavente, J. Avilés, C. Rojas, J. M. Padilla and E. Acevez***

3:00–3:30 Break

3:30–4:00 Rethinking early objects and landscapes in the Southern Cone
Nora Flegenheimer, Laura Miotti and Natalia Mazzia

4:00–4:30 Late-Pleistocene economic and cultural diversity in north Peru
Tom D. Dillehay

4:30–5:00 The first colonization of South America eastern lowlands: Brazilian archaeological contributions to Settlement of America models
Adriana Schmidt Dias and Lucas Bueno

5:00–5:30 Early human occupation of Lagoa Santa, central Brazil: Implications for the dispersion and adaptation of early human groups in South America ***Mark Hubbe, Walter Neves, Danilo Bernardo, André Strauss, Astolfo Araujo, and Renato Kipnis with Neves***

5:30–6:00 Discussion—Q&A period with all presenters

Schaefer, a pre-Clovis megafauna butchering site

Saturday, October 19

The Older–Than–Clovis Archaeological Record of North and South America

8:00–8:30 Adaptations along the ice margin: Analysis, interpretation and implications of four pre–Clovis megafauna butchery sites in the western Great Lakes Region ***Daniel J. Joyce***

8:30–9:00 Paisley Caves: 14,500 years of human occupations in the northern Great Basin ***Dennis L. Jenkins***

9:00–9:30 In search of the First Americans: What the Friedkin site, Texas, and Manis site, Washington, tell us about the First Americans
Michael Waters

9:30–10:00 Break

10:00–10:30 The ones that still won't go away ***J. M. Adovasio and D. R. Pedler***

10:30–11:00 Topper, an early-Paleoamerican site in South Carolina
Albert C. Goodyear, Douglas A. Sain, Megan Hoak King, Derek T. Anderson, and M. Scott Harris

11:00–11:30 The Mammoth Steppe hypothesis: The mid-Wisconsin (OIS 3) peopling of the Americas ***Steven R. Holen and Kathleen Holen***

11:30–12:00 Discussion—Q&A period with all presenters

12:00–1:30 Lunch

1:30–2:00 The Pleistocene human occupation of Piaui: An unacceptable reality? And nevertheless they are old! ***Eric Boëda***

2:00–2:30 North America before Clovis: Variance in temporal/spatial cultural patterns, 24,000 to 13,000 BP ***Michael B. Collins, Dennis J. Stanford, and Darrin L. Lowery***

2:30–3:00 Fingerprinting stone tool production processes: Toward identifying human artifact characteristics ***William Andrefsky, Jr.***

3:00–3:30 A geoarchaeological approach to the search for pre–Clovis sites in North America: An example from the Central Plains
Rolfe D. Mandel

3:30–4:00 Geochronology, stratigraphy, and taphonomy as the foundations for pre–Clovis research ***Thomas W. Stafford, Jr.***

4:00–5:30 Panel discussion summarizing the Conference ***Bonnie Pitblado, Luis Alberto Borrero, Robert L. Kelly, Dennis H. O'Rourke***

5:30–6:00 Closing statements

Banquet 7:00 **Occupying new lands: Global migrations and cultural diversification with particular reference to Australia**
Peter Hiscock

Artifact Exhibits

Clovis

Artifacts—including projectile points, bifaces, blades, blade cores, overshot flakes, endscrapers, channel flakes, and other tools—will be on display from the following sites:

Blueberry Hill, Virginia ■ Cactus Hill, Virginia ■ Carson-Conn-Short, Tennessee ■ Crook County Cache, Wyoming ■ De Graffenried Cache, Texas ■ Eckles Clovis site, Nebraska ■ Fenn Cache, Plains ■ Friedkin, Texas ■ Gault, Texas ■ Hogeye Cache, Texas ■ Jake Bluff, Oklahoma ■ Jefferson Island, Maryland ■ Johnson, Tennessee ■ Little River Complex, Kentucky ■ Mochorn Island and Pearsall site, Virginia ■ Mockingbird Gap, New Mexico ■ Rimrock Draw Rockshelter, Oregon ■ Sage Hen Gap, Oregon ■ Shawnee-Minisink, Pennsylvania ■ Sheep Mountain, Oregon

Western Stemmed Tradition

Artifacts—including projectile points, bifaces, scrapers, knives, bone tools, and perishable artifacts—will be on display from the following sites:

Bonneville Estates, Nevada ■ Paisley Caves, Oregon ■ Rimrock Draw Rockshelter, Oregon ■ Sage Hen Gap, Oregon ■ Sheep Mountain, Oregon ■ Cooper's Ferry, Idaho

These Western Stemmed Tradition points, found along the Salmon River in Idaho, may date to 11,000 years ago

Folsom and Late Paleoindian

Artifacts—including points, channel flakes, endscrapers, knives, and other tools—will be on display from the following sites:

Badger Hole, Oklahoma ■ Cooper, Oklahoma ■ Jake Bluff, Oklahoma ■ Shifting Sands, Texas ■ Friedkin, Texas ■ Phil Stratton, Kentucky

South America

Special display of Clovis-like bifaces, points, overshot flakes, and blades from the El Cayude site, Venezuela; El Jobo and Fishtail points from Pedregal Valley and the Caribbean coast of Venezuela; and early artifacts from Vale da Pedra, Brazil.

Pre-Clovis

Artifacts and other evidence—including projectile points, bifaces, blades, bladelets, bladelet cores, burins, scraper, knives, bone points, human coprolites,

ARTIFACTS!

Fenn Cache ◀

A remarkable collection of 56 projectile points, tools, and preforms made by Clovis hunters 13,000 years ago. It was found many years ago in the Plains.

Gault site ▶

This stratified Clovis workshop in east-central Texas, intensively studied for 20 years, has been the classroom for many future scientists.

Carlisle Cache ◀

This cache of Clovis artifacts found in Warren County, Iowa, includes 25 bifaces and 18 flakes that total 9 pounds. Most are made on high-quality Burlington chert.

Friedkin site ▶

Immediately adjacent to the Gault site, this site yielded artifacts below the Clovis level—bifacial like Clovis, but lacking the diagnostic features of Clovis lithic technology.

Schaefer site ◀

A woolly mammoth was butchered here in southern Wisconsin by people 14,500 years ago—1500 years before Clovis. Two artifacts and modified bone were found.

Hogeye Cache ▶

This cache of 52 projectile points, preforms, and bifaces made of Edwards Chert was recently discovered just 75 km east of the Gault site. Clovis hunters cached these weapons 13,000 years ago. This is the second-largest Clovis cache ever discovered in North America.

modified mammoth bone, mammoth bone flakes, butchered mammoth leg bones, and more—will be on display from these key sites.

Blueberry Hill, Virginia ■ Cactus Hill, Virginia ■ Coats-Hines, Tennessee ■ Duewall-Newberry, Texas ■ Friedkin, Texas ■ Gault, Texas ■ Hebior Mammoth, Wisconsin ■ Manis, Washington ■ Meadowcroft Rockshelter, Pennsylvania ■ Miles Point, Maryland ■ Mud Lake, Wisconsin ■ Paisley Caves, Oregon ■ Pearsall site, Virginia ■ Schaefer Mammoth site, Wisconsin ■ La Sena, Nebraska ■ Lovewell, Kansas ■ Topper, South Carolina

Beringia

A special collection of fluted points and artifacts from these key sites in Alaska:

Swan Point ■ Serpentine Hot Springs ■ Owl Ridge ■ Dry Creek

Solutrean

Artifacts from various sites in Europe and laurel-leaf points from the Atlantic shelf of the eastern seaboard of the U.S.—including the Cinmar biface!

Japan

Late microblade and early microblade Upper Paleolithic and Pre-Upper Paleolithic artifacts from these sites:

Kamihoronai-Moi ■ Ogachikato-2 ■ Shimaki ■ Rubenosawa

Our thanks to the following people who contributed artifact exhibits.

Jim Adovasio	Al Goodyear	Dan Joyce
Leland Bement	Kelly Graf	Michael Kunz
Eric Boëda	Carl Gustafson	Mark Mullins
John Broster	Andy Hemmings	Mark Norton
Michael Collins	Matthew Hill	Pat O'Grady
Loren Davis	Steve Holen	Jeff Rasic
Jim Dixon	Charles Holmes	Joshua Ream
Daron Duke	Bruce Huckell	Richard Rose
Dick Eckles	Masami Izuho	Dennis Stanford
George Frison	Dennis Jenkins	Phil Stratton
Joe Gingerich	Michael Johnson	Michael Waters
Ted Goebel	Lee and Cindy Jones	Carl Yahnig

Poster Sessions

At the Odyssey Conference you'll enjoy over 180 poster presentations on the sweeping array of topics related to the First Americans listed below. Posters will be available for viewing for a four-hour block of time, and presenters will be at the posters for part of this time to discuss their presentations and answer your questions. Count on this to be an exciting and stimulating part of the conference!

Session 1 Paleoindians of the Plains and Rockies

Organized by Tom Jennings and Bonnie Pitblado
Coronado/DeVargas, Thursday morning

Brendon P. Asher, Jack L. Hofman
Testing Clovis and Folsom ubiquity from the Continental Divide to the plains/woodland border

Kristen Carlson, Leland Bement
Changing Clovis Hunting Adaptations through Stable Isotope Analysis

Carlos Cordova, Ernest Lundelius, William Johnson, Jason Joines
Climate and vegetation change from 17,550 to 2000 cal years BP in south-central Texas: The Hall's Cave record during pre-Clovis and Clovis times

Cody Dalpra, Bonnie Pitblado, Carol Dehler
Geoarchaeological results of petrographic analysis on quartzite sources in the Gunnison Basin, Colorado

Leslie B. Davis, Christopher L. Hill, and Kathryn Krasinski
Evidence for pre-Clovis human activity associated with a mammoth in late-Pleistocene eastern Montana

Andrew Gourd
Radiation and regionalization: Late-Paleoamerican projectile point diversification in Oklahoma

Matthew G. Hill, Thomas J. Loebel, David W. May
The Carlisle Clovis Cache: Land use, technological organization, and faunal exploitation in the midcontinent

Thomas Jennings
The Golondrina assemblage from the Debra L. Friedkin site, Texas

David Kilby, Anthony Aliano, Sarah Griffith, Jordan Taher, Ethan Ortega
Postcards from the Pleistocene: A new look at ancient environments encountered by the first explorers of the Southern High Plains

Marcel Kornfeld, Mackenzie Cory, Mary Lou Larson
Are they Clovis? Two central Rockies caches

Jason M. LaBelle, Chris Johnston
The long shot and the close-Up: Evaluating the visual landscape of the Lindenmeier Folsom site in northern Colorado

Jason M. Labelle
An afternoon at Benedict's Rock (5BL232), a small Scottsbluff site in the Colorado mountains

Neil Lopinot, Jack Ray
Pre-Clovis evidence from the Big Eddy site

Maxine McBrinn, Craig Lee, Steve Holen, Nathan Boyless, E. James Dixon
The Lamb Spring Archaeological Preserve: Past, present and future

Brooke Morgan, Brian Andrews
Mountaineer: A Folsom residential occupation in the Rocky Mountains

Bonnie L. Pitblado, Holly Andrew, Ben Fowler, Richard Shipley
Paleoindian occupation of southeastern Idaho and northern Utah

Kenny Resser
Projectile points and knives of the Central Great Plains

Linda Scott Cummings, R. A. Varney
What you see is what you get, or is it?

Fred Sellet, Robert Brunswig, Rolfe Mandel
The Paleoenvironmental and archaeological context of the late-Pleistocene/early-Holocene transition at the KibRidge site

John Taylor-Montoya
The entangled bank: Can we detect cultural lineages in lithic technology and what, if anything, does that tell us about the Paleoamerican Odyssey?

Tom Westfall, Gayson Westfall, Rick Miller
Evidence of Clovis occupation in the South Platte River valley in eastern Colorado

Don Wyckoff, Nick Czaplewski, Sam Noble, Brian Carter
Investigating Mid-Wisconsinan deposits in Oklahoma: The Burnham and Powell Farm sites

Session 2 Greater Beringia

Organized by Brian Wygal
Lamy/Peralta, Thursday morning

John Blong, Frank Gonzalez
Human colonization of the central Alaska range

Ian Buvit, Karisa Terry, Masami Izuho
Nomads of the Archipelago: Paleolithic Japan and the Pleistocene peopling of the Americas

Sam Coffman
Rhyolite sourcing in eastern Beringia

John P. Cook, Tom Gillispie
Healy Lake Village site: New data and analysis

Kelly M. Derr, Philip E. Higuera
Human-environmental interactions during the late-Pleistocene/early-Holocene transition: A multi-proxy approach in the Alaskan Arctic

Lyndsay M. DiPietro, Steven G. Driese, Kelly Graf
The Dry Creek site: A geological perspective on site formation and stratigraphic integrity in central Alaska

Norman Easton, Michael Grooms, Jordan Handley, Rudy Reimer, Vance Hutchinson, David Yesner
Analytical approaches to interpreting the Little John site (KdVo6), a late-Pleistocene occupation in Yukon's Beringia

Philip Fisher
Human response to regional Younger Dryas climatic and environmental variability in Alaska

Yan Axel Gomez Coutouly
The Yukon River Hypothesis: a possible migration route from Alaska to British Columbia for microblade-bearing populations of Beringia

Angela K. Gore, Kelly E. Graf
A diachronic Investigation of technological activities at the Owl Ridge site, Central Alaska

P. Gregory Hare, Christian D. Thomas, Ruth M. Gotthardt, Claire Alix
Ancient throwing dart technology in subarctic Canada—an analogue for Pleistocene hunting darts

Jun Hashizume
Study of bifacial-point breakages to reconstruct hunting behavior in terminal-Pleistocene eastern Japan

Charles Holmes
The early archaeological sequence at Swan Point, central Alaska

Akira Iwase
Use-wear analysis of chipped-stone tools from microblade assemblages with wedge-shaped microblade cores in Japan

Michael Kunz
On the origins of terminal-Pleistocene lithic assemblages in eastern Beringia: Who was where when and where did they come from?

Joshua Lynch
Experimental testing of composite projectile points

Pavel Nikolskiy, Vladimir Pitulko
And yet they hunted mammoths: Evidence from the Yana Palaeolithic site

Vladimir Pitulko, Elena Pavlova
Environmental changes in western Beringia during the LGM as human habitation factor

Heather L. Smith
An analysis of fluted-point technology at Serpentine Hot Springs, Alaska

Brian T. Wygal
By land or sea? Human colonization of southern Alaska

David Yesner
Changes in faunal exploitation patterns across the Younger Dryas Boundary, eastern Beringia

Angela Younie, Thomas Gillispie, Lyndsay DiPietro, Christine Fink
Lithic technologies and adaptations to Beringian environments at the Linda's Point site, Healy Lake, Alaska

Session 3 Paleoindians of the Great Basin and Far West

Organized by Daron Duke
Coronado/DeVargas, Thursday afternoon

Jesse Adams
Paleoarchaic occupations in the eastern Great Basin: Results of GIS predictive modeling for identifying paleoarchaic sites in southern Nevada

Mark E. Basgall
Late-Pleistocene/early-Holocene archaeology of the Lake China Basin

Fred E. Budinger, Jr., Theodore M. Oberlander, James L. Bischoff, Lewis A. Owen
The Calico site: Age, context, and the artifact/geofact issue

Thomas Connolly, Dennis L. Jenkins, Catherine S. Fowler, Pat Barker, Eugene M. Hattori, William J. Cannon
Boundaries in space and time: Paleo-period textiles in the northern and western Great Basin

Julie Crisafulli and Kelly E. Graf
Sediment and paleoenvironment at Bonneville Estates Rockshelter, Nevada, during the Pleistocene-Holocene transition

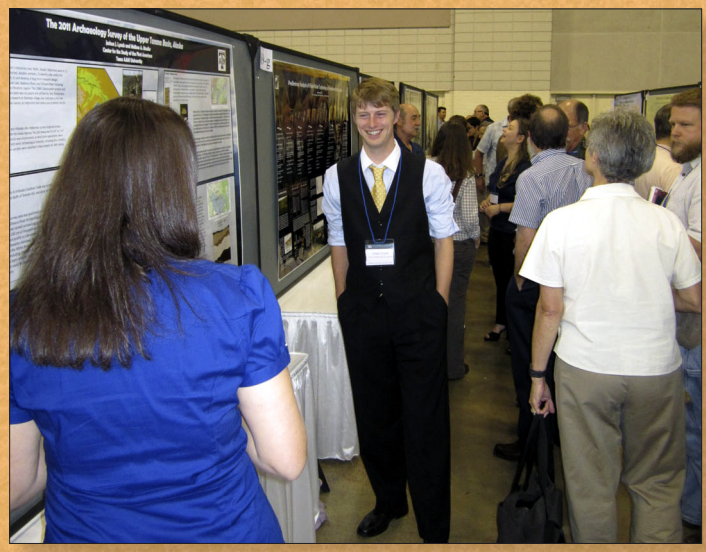
Jennifer DeGraffenried, Joshua Trammell
Analysis of 42TO3974 Rattler Ridge: An upland fluted-point site in the Cedar Mountains, Utah

Jaime Dexter
Paleoethnobotanical analysis at the Paisley Cave: An evaluation of late-Pleistocene/early-Holocene plant use in Cave 2

Daron Duke, D. Craig Young
Haskett points of the Old River Bed Delta, Utah: Early Western Stemmed Tradition spear weaponry

Jerry Galm, Stan Gough, Fred Nials, Kari M. Mentzer, Tiffany Fulkerson
Paleoindian/Late Paleoindian–point complexes in the intermountain West: Western Stemmed–Windust revisited

John Johnson, Thomas W. Stafford, Jr., G. James West, Thomas K. Rockwell, Don P. Morris
Six field seasons at Arlington Springs: An investigation of paleoenvironmental change on Santa Rosa Island, California



Joshua Keene, Mayra Gracia
Preliminary lithic and spatial analysis of the Adams gravel source Haskett site (10BT1227)

Philippe LeTourneau
Recent Paleoindian finds in western Washington

Katelyn McDonough, Mark E. Swisher, Dennis L. Jenkins, Patrick W. O'Grady, Frances J. White
An analysis of artifact, bone, and coprolite distributions in Paisley Caves Younger Dryas (Botanical Lens) and underlying Pleistocene deposits

Daniel Meatte
A use-wear analysis of beveled bone rods from the East Wenatchee site (45DO432), Douglas County, Washington, USA

David Page, Daron Duke
Paleoindian toolstone gyre and convergence on the Old River Bed Delta megapatch

David Rhode, Allise Rhode, Alvin McLane
Western Fluted and Clovis blades: An intriguing assemblage from western Nevada

Torben Rick, Courney Hofman, Andreanna Welch, Jon Erlandson, Jesus Maldonado, Robert Fleischer
Marine mammals, ancient DNA, and paleocoastal subsistence on California's Northern Channel Islands

Michael F. Rondeau, John Pryor, Roger La Jeunesse
Clovis technology at the Skyrocket site, California

Chantel Saban
Palynological perspectives on late-Pleistocene to early-Holocene human ecology at Paisley Caves (35LK3400), Cave 2

Zach Scribner, Nathan Nelson
Reconstructing the hydrological system of a paleoarchaic complex in central-western Utah

Scott Thomas, Mike Rondeau, Patrick O'Grady
Filling the void: Clovis spear points and diagnostic artifacts in the far northern Great Basin

Alexander Yarnell, Danny Welch, and Ted Goebel
Obsidian transport to Bonneville Estates Rockshelter, Nevada: Implications for mobility

Robert M. Yohe II, Jill K. Gardner, Chirstopher A. Duran, Beau DeBoer
More pieces to the Paleoamerican puzzle: A new cluster of Clovis points from the ancient shores of Lake China, California

David Zeanah, Robert G. Elston, Brian F. Codding
Resource use, patch residence time and the sexual division of labor among Great Basin foragers during the Pleistocene-Holocene transition

Session 4a Latin America: Early Prehistory and Paleoenvironments

Lamy, Thursday afternoon

Guillermo Acosta-Ochoa, Laura Beramendi, Galia González, Iran RIvera, Patricia Pérez
Chiapas, tropical environments, radiocarbon dating, Clovis

Thomas Amorosi, Michael Waters
New AMS dates, ground sloth dens, and horse meals at Fell's Cave and Pali Aike Rockshelter, from the Magallanes of southern Chile

Ciprian Ardelean
Hunter-Gatherer archaeology, the Pleistocene-Holocene transition, and the first human occupation in northeastern Zacadecas, Mexico

Eric Boëda, María Farías Gluchy
Approximation to the technical diversity of the systems of production of the Catalán Chico site

Gianfranco Cassiano, Anna Maria Alvarez Palma
Clovis and Plainview occupations in central Mexico

Manuel Enrique Cueto
Lithic technology and initial ways of working during early occupation of Patagonian extreme south

Nora Viviana Franco
Early peopling of the southern part of the Deseado Massif: Evidence from La Gruta and Viuda

José Jiménez, Meggan Bullock, Eva Salas
A multiple burial from 7233 BP

Christelle Lahaye, Eric Boëda, Michel Fontugne, Gisele F. Daltrini, Antoine Lourdeau, Anne-Marie Pessis, Niéde Guidon, Sirlei Hoeltz, Marina Pagli, Sibeli Viana, Amélie Da Costa, Mario Pino
"Oldies but Goodies": A chronological approach to the Pleistocene occupations in the Serra da Capivara, Piauí, Brazil

Greg Maggard
Fishtail and early Paiján: Perspectives on the early settlement of western South America

Kary Stackelbeck
Domestic architecture of the terminal Pleistocene to early Holocene in the central Andes

Charles Stern, Alfredo Prieto, Jordi Estévez
The peopling by littoral hunter-gatherers of the Fuego-Patagonian fjords

Emma Toole, Silvia Gonzalez, David Huddart, Alex Brasier, Darren Mark
Humans, megafauna and Quaternary environmental change, Tequixquiac, northern basin of Mexico

Session 4b Biological Perspectives on the First Americans

Organized by Mark Hubbe
Peralta, Thursday afternoon

Alessandro Achilli, Ugo A. Perego, Hovirag Lancioni, Anna Oliveri, Francesca Gandini, Baharak Hooshiar Kashani, Vincenza Battaglia, Viola Grugni, Norman Angerhofer, Mary P. Rogers, Rene J. Herrera, Scott R. Woodward, Damian Labuda, David Glenn Smith, Jerome S. Cybulski, Ornella Semino, Ripan S. Malhi, Antonio Torroni
Reconciling migration models to the Americas with the variation of North American Native mitogenomes

Benjamin Auerbach
Thinking broadly about colonization: Phenotypes of the early Holocene and the peopling of North America

Pedro Da-Gloria, Clark Spencer Larsen
Health and lifestyle of Paleoamericans from a tropical perspective: The case of Lagoa Santa, Brazil

David Echeverry, Beatrix Dudzik, Frankie Pack
Revisiting population history for the Eva site: A combined craniometric and ancient DNA approach

Brianne Herrera, Kanya Godde
Concordance of skeletal and molecular data and their applications toward peopling of the New World

Susan Kuzminsky
Craniofacial variation among Pacific Rim populations: A test of the Coastal Migration Hypothesis Using 3D laser scanning and geometric morphometric methods

Barbara O'Connell, James L. Jones, Jr., Bruce Thomas
The Minnesota ancients: Browns Valley and Pelican Rapids

Karl Reinhard, Adauto Araujo, Elizabeth Racz, Scott L. Gardner
Paleoamerican parasitism: Infections that signal the origin and route of migration

Andre Strauss, Pedro Da-Gloria, Rodrigo De-Oliveira, Danilo Bernardo, Domingo Carlos Salazar Garcia, Caroline Wilkinson, Sue Black, Sahra Talamo, Philipp Gunz, Mike Richards, Mark Hubbe, Astolfo Araujo, Renato Kipnis, Jean-Jacques Hublin, Walter Neves
The oldest case of decapitation in the New World

Session 5a Paleoindians of the American Southeast

Organized by Ashley Smallwood and Randy Daniel
Coronado, Friday morning

Derek Anderson
Lithic refitting at the Topper site: Spatial, technological, and geoarchaeological

John Broster, Mark Norton
Paleoindian studies in Tennessee

Philip J. Carr, Gregory A. Waselkov
Paleoindians in the Tennessee Valley: Applying an organization of technology model

I. Randolph Daniel, Jr., Albert C. Goodyear
Clovis macrobands in the Carolinas

Richard Gramly, Dennis Vesper, O. Kirk Spurr
The prismatic blade industry of the middle-stage Cumberland Tradition Phil Stratton site

Michael Johnson, William A. Childress
Beyond Cactus Hill

Christopher Moore, Mark J. Brooks, Larry R. Kimball, Margaret Newman, Brian P. Kooyman
Use-wear and protein-residue analysis of an in situ Clovis assemblage from a Carolina bay in the coastal plain of South Carolina

Charlotte Pevny, William Barse
Late-Pleistocene/early-human adaptation in northern Florida

Erika Shofner, Meg Gaillard, Helena Ferguson, Tom Pertierra
Presenting paleo: Sharing our past

Jesse Tune
Defining Cumberland lithic technology: Preliminary results of a morphological variation and land-use study

Jesse Tune, Judith A. Melton
Interpreting activity areas and Cumberland lithic technology at the Stratton site, Kentucky

Session 5b Geology and Geochronology of the First Americans

DeVargas, Friday morning

Jared Beeton, Steve Holen
Soils, stratigraphy, and the search for early humans at the Scott Miller and Villa Grove mammoth sites, San Luis Valley, Colorado

Joshua Feinberg, Marcy Nadel, Michael Waters, Albert Goodyear III
The rock magnetic record across the 12.9 ka Younger Dryas Boundary: Evidence for impact?

John Ferguson, Terry Ferguson, Emily Hinz
Geophysics and the geoarchaeological characterization of the Topper site, South Carolina

Edward Herrmann, G. William Monaghan
Geoarchaeology of Paleoindian-age landforms: Geomorphological influences from the midcontinent

Isabel Israde-Alcantara, Silvia Gonzalez, James L. Bischoff, Allen West, Gabriela Domínguez-Vazquez, Richard B. Firestone, Ted E. Bunch, James Kennett, Wendy Wolbach
Extraterrestrial impact in Mexico at the onset of the Younger Dryas (YD) and its effects on the environment

Lionel Jackson, Laurence D. Andriashek, Fred Phillips
Multiple and successive ice-free corridors during middle-Pleistocene glaciations in the interior plains of southern and central Alberta and adjacent areas

Brian Kooyman, Michael R. Waters, L. V. Hills, Thomas W. Stafford, Jr.
Refined dating of the horse and camel kills at the Wally's Beach site, Canada

Mark E. Swisher, Dennis L. Jenkins, Lionel E. Jackson, Jr., Fred M. Phillips
A reassessment of the role of the Canadian Ice-Free Corridor in light of new geological evidence

David Thulman, Michael Faught
How long did Clovis last? A re-assessment of the Clovis and other Paleoindian occupations using Bayesian statistics

Sarah Walters, Sean Cary von Gunter, Albert C. Goodyear
The secret life of carbonized plant remains: A guide to dating in the age of Clovis

Session 6a Paleoindians of the American Northeast

Organized by Joseph Gingerich
Lamy/Peralta, Friday morning

Richard Boisvert, Heather Rockwell, Bruce Rusch
Settling into the late-Pleistocene landscape: The Potter site, a multicomponent Paleoindian site in New Hampshire

Nigel Brush, P. Nick Kardulias
The rich record of Paleoindian activity in Coshocton and Holmes counties in north-central Ohio

Kurt Carr
An update on research at the Shoop site (36da20) including the results of XRF analysis

Joseph Gingerich
Evidence of Paleoindian social organization at Shawnee-Minisink

Robert Goodby
Paleoindian household organization at the Tenant Swamp site (27CH187), Keene, New Hampshire

Brian Jones
A new collection from the DEDIC site, Deerfield, Massachusetts

Nathaniel Kitchel
After the ice: Colonization behavior and process in the recently deglaciated Northeast

Thomas Loebel
Exploring early-Paleoindian adaptations through microwear analysis

Jonathan Lothrop, Graydon Ballard
Green-Pauler: Two probable Paleoindian caches in the upper Susquehanna Valley, New York

Darrin Lowery, Dennis Stanford
Paleoamericans on the coastal plain: A perspective from the middle Atlantic and the Delmarva Peninsula

Brian S. Robinson
Large and highly structured: Refining spatial patterns at Bull Brook

Francis "Jess" Robinson, John G. Crock, Wetherbee Dorshow
Through the mountains to the sea: An analysis of Champlain Sea shorelines, site patterning, and travel corridors in the eastern Champlain basin

Mark Seeman, Garry Summers
The fluted points from Nobles Pond, an early-Paleoindian site in northeastern Ohio: Manufacturing and typological considerations

Zachary Singer
Ohomowauke: An early-Paleoindian site in southeastern Connecticut

Session 6b Paleoindians of the American Southwest

Peralta, Friday morning

Jesse Ballenger, Mary Prasciunas
Arizona Paleoindian projectile-point survey

Stacey Bennett
A bison trap at the Clovis site, Blackwater Draw Locality 1

George Crawford, Stacey Bennett
The Clovis site: Inheriting 80 years of research

George Crawford, Stacey Bennett
Back to basics, analyzing the Paleoindian assemblage at the Clovis site

Robert Dello-Russo
The Water Canyon Paleoindian site—a multi-component site at a focal wetland resource in west-central New Mexico

James Hartley
Environmental causes of the extinction of the Pleistocene megafauna in the desert Southwest

Guadalupe Sanchez, Vance Holliday, Joaquín Arroyo, Natalia Martinez, John Carpenter
El Fin del Mundo, Sonora, Mexico: Where Clovis people hunted gomphotheres

Jeffrey Saunders, Gennady Baryshnikov, Kevin Seymour
Evolution of an Arizona Paleoindian landscape

Anastasia Steffen, Heather R. Evans, Jeremy Decker
Discovering the earliest prehistory of the Valles Caldera

David Yoder, Joel Janetski, Mark Bodily
Paleoarchaic to Archaic transitions on the Colorado plateau

Session 7a Taphonomic Perspectives on the First Americans

Organized by Kathryn Krasinski
Coronado, Friday afternoon

Joaquín Arroyo-Cabrales, Eileen Johnson
Megacarnivores, large carnivores, and people in the North American late Pleistocene

Joaquín Arroyo-Cabrales, Ramón Viñas-Vallverdú, Irán I. Rivera-González, Xosé Pedro Rodriguez
Recent findings in the Chazumba locality, Oaxaca, Mexico

Chrissina Burke
Bison bonebeds and carnivore use of carrion: Implications for human-carnivore interactions

Barbara Crass, Jeffery A. Behm, Charles E. Holmes
The taphonomy of experimental bone-fueled hearths

María Gutiérrez, Daniel J. Rafuse, Agustina Massigoge
Leave your mark! Late-Pleistocene bone modification from South America

Kathleen Holen
Bone notches: Differentiating dynamic and static loading on large prey-animal limb bones

Kathryn E. Krasinski, Gary Haynes
Understanding taphonomic histories of proboscidean remains through bone-breakage analyses

Fabiana María Martin
Early human occupation in southern Chile: Recent results

Chelsea Reedy
Practice makes paleo

Óscar Torres-Solís, Patricia Ochoa-Castillo, Michael R. Waters, Joaquín Arroyo-Cabrales
Recent findings in the Hueytlaco site, Puebla, México

Session 7b Submerged Paleoindian Landscapes: Preservation, Paleoenvironments, Potential

Organized by Jessi Halligan
DeVargas, Friday afternoon

Diego Carabias, Isabel Cartajena, Patricio López
GNL Quintero 1 (GNLQ1): First evidences from the Pacific coast of South America of a final-Pleistocene drowned terrestrial site

James C. Chatters, Pilar Luna Erreguerena, Dominique Rissolo, Victor Polyak, Douglas Kennett, Patricia Beddows, Eduard Reinhardt, Shawn Collins, Brian Kemp, Thomas W. Stafford, Roberto Chavez Arce
The Hoyo Negro project: Recent investigations of a submerged Paleoamerican Cave site in Quintana Roo, Mexico

Jorie Clark, Jerry Mitrovica, Jay Alder
Regional variability in latest-Pleistocene and Holocene sea-level rise across the Oregon-Washington and Bering Sea continental shelves

Lauren Cook, Neil Puckett
Sourcing redeposited projectile points at McFaddin Beach, TX

Loren G. Davis, Alex J. Nyers
Reconstructing paleolandscapes and potential submerged site locations on the Pacific outer continental shelf from the Last Glacial Maximum to 10,000 RCYBP

Ryan Duggins
An investigation in offshore survey methodology: A GIS approach to submerged landscape reconstruction and site distribution on Florida's continental shelf

Jessi Halligan, James S. Dunbar, Brendan Fenerty, Ed Green
Submerged Paleoindian sites in the Aucilla River of northwestern Florida: New geoarchaeological and archaeological research

Jacob Hooge, Jon C. Lohse, Frederick H. Hanselmann
Underwater geoarchaeological research at Spring Lake, San Marcos, Texas

Ashley K. Lemke, John M. O'Shea, Elisabeth Sonnenburg
Late-Paleoindian and early-Archaic Caribou hunters underneath Lake Huron

Kelly Monteleone, Andrew Wickert
Investigating the potential for archaeological sites on the submerged southern Beringian archipelago

Morgan Smith, David Selmo, Steve Cushman
A pre-project overview of the Wakulla 3 project: An archaeological survey of a spring and deep underwater cave

Dennis Stanford, Darrin Lowery, Bruce Bradley, Marvin Kay, Jeffery Speakman, Margaret Jodry, Thomas Stafford
The Cinmar discovery: Evidence for an Ice Age occupation of the middle Atlantic outer continental shelf

Andrew D. Wickert, Kelly R. Monteleone, Jerry X. Mitrovica, Robert S. Anderson
Reconstructing the paleogeography of Beringia

Session 8a Paleoindian Technology

Lamy, Friday afternoon

Jacob Adams, Tyler Retherford
What about the cracks? An examination of cultural and natural fracture patterns on brittle solids

Metin Eren, Robert J. Patten, Michael J. O'Brien, David J. Meltzer
Refuting the technological cornerstone of the Ice Age Atlantic Crossing Hypothesis

Robert Lassen
Exploring typological and technological variability in Folsom-age projectile points: A comprehensive perspective

Tyler Retherford, William Andrefsky, Jr.
Using lithic debitage to distinguish between geofacts and artifacts: An experimental approach

Andrew Richard
Clovis in a kiln: A projectile-point use-breakage study

Alan Slade
Clovis: What's the point?

Charles Speer
Source determination of Edwards Plateau chert using LA-ICP-MS

Robin Gay Wakeland
Lithics near Madrid, Spain 20,000–15,000 B.P., Museo de los Orígenes, Spain EU

Kristina Wiggins, William Andrefsky, Jr.
Analyzing population data to recognize human and natural fracture properties in brittle solids

Justin Williams, William Andrefsky, Jr.
An image is worth 1000 measurements: Using images to analyze paleo-period artifacts

Session 8b New Perspectives on the Peopling of the Americas

Peralta, Friday afternoon

David G. Anderson, Thaddeus G. Bissett, David Echeverry, D. Shane Miller, Douglas A. Sain, David K. Thulman, Stephen J. Yerka
PIDBA (Paleoindian Database of the Americas): Site and artifact distributions in late-Pleistocene North America

German Dziebel
The demographic isolation of Amerindians and back migrations to the Old World in the late-Pleistocene/early-Holocene: From the history of ideas to contemporary scientific realities

J. Christopher Gillam
Paleoamerican origins and migration: A cultural and bio-physical geographic perspective

Alvah Hicks
Interpreting archaeological signatures before Clovis

John W. Ives, B. Sunday Eiselt
Paleoindian social landscapes: Thought models for kinship in unique demographic settings

Margaret Jodry
All my relations, Paleoamerican spiritual connections in hunting and healing

Lucy Johnson
The Peopling of the Americas

Jessica Metcalfe, Fred Longstaffe
Seasonal dietary variations of North American proboscideans

Jessica Phillips
Fingerprinting our past: A dermatoglyphic study at the Topper site (38AL23)

Evening Sessions—Presentations

On Thursday and Friday night, come hear a series of presentations about new discoveries and interpretations.

Session 1 October 17 (Thursday evening)

7:00–7:15 Tracing human movements across Siberia and into the Americas: New insights from mitochondrial DNA and Y-chromosome data ***Theodore G. Schurr***

7:15–7:30 Climate reconstruction: Modeling examples of rapid vacillations for the pre-Clovis and Clovis eras ***Linda Scott Cummings and R. A. Varney***

7:30–7:45 Paleoindian sites in the Basin of Mexico: Stratigraphy, tephrachronology and radiocarbon dating during the late-Pleistocene/early-Holocene transition ***Silvia Gonzalez, David Huddart, Isabel Israde Alcantara, Gabriel Dominguez Vazquez, and James Bischoff***

7:45–8:00 The Clovis colonization of Middle America: New data from southern Mexico ***Guillermo Acosta Ochoa and Patricia Pérez Martínez***

8:00–8:15 Arroyo Seco 2, new research at the end of the Pleistocene in the Pampas ***Daniel J. Rafuse, María A. Gutiérrez and Gustavo Politis***

8:15–8:30 The South American Paleoindian record viewed from a theoretical standpoint: Cultural transmission theory and the variability of the lithic industries ***Astolfo Gomes de Mello Araujo***

8:30–8:45 Early Preceramic lithic industries in northern Costa Rica ***Luis Hurtado de Mendoza***

8:45–9:00 Un sitio Paleoindio (10450 a 10040 A.C) (a Paleoindian site [10,450 to 10040 B.C.]) Limón, Costa Rica ***Marta Lucía Chávez Montoya***

Session 2 October 18 (Friday evening)

7:00–7:15 New evidence supports the North Pacific Rim Migration Hypothesis ***E. James Dixon, Kelly Monteleone, and Mark R. Williams***

7:15–7:30 Blade cores, blades, blade tools, and Clovis points from the Powars II Paleoindian Red Ochre Quarry 48PL330, Platte County, southeast Wyoming ***George Frison, Marcel Kornfeld, Dennis Stanford, George Zeimens, and Danny Walker***

7:30–7:45 The Anzick Clovis burial, a single-depositional event ***Juliet E. Morrow***

7:45–8:00 Tephra traps and projectile points: An exploration of volcaniclastic and cultural chronologies at Rimrock Draw Rockshelter (35HA3855), Harney County, Oregon ***Janice Bernadette Wood and Patrick Warren O'Grady***

8:00–8:15 Early Paleoindians in northeastern Minnesota ***Susan C. Mulholland and Stephen L. Mulholland***

8:15–8:30 The resurrection of Owl Cave: Recent investigations regarding the association of fluted points and mammoth remains ***L. Suzann Henrikson, Robert M. Yohe II, Gene L. Titmus, and James C. Woods***

8:30–8:45 The presence of Gault–Ft. Hood chert at the Brushy Creek Clovis site (41HU74), Hunt County, Texas ***Wilson W. Crook III and Thomas E. Williams***

8:45–9:00 Pre-Clovis and Bigfoot—the searches converge ***Stuart. J. Fiedel***

Evening Sessions—Discussions and Workshops

On Thursday and Friday night, come and participate in several discussions and workshops.

Session 1 October 17 (Thursday evening)

7:00–9:00 Using serious game design to build a Clovis adaptation knowledge model ***E. S. Lohse, D. Sammons, C. Schou, and K. Weber (Idaho State University)***

Session 2 October 18 (Friday evening)

7:00–9:00 Searching for the earliest Americans at ancient chert quarry/workshop sites ***Barbara A. Purdy (University of Florida) and H. Blaine Ensor (Illinois State Archaeological Survey)***

Session 3 October 18 (Friday evening)

7:00–9:00 The great "Clovis Comet" debate ***Vance T. Holliday (University of Arizona)***

L. G. STRAUS

La Riera Cave, Spain, whose sequence of levels from the Solutrean through the Mesolithic makes it a key site for studying human adaptations to the coastal zone of northern Spain from the Last Glacial Maximum through the Preboreal. Its series of Solutrean levels is particularly long and rich.

Alternative Views of the Solutrean Theory

Part 2 of 2

DENNIS STANFORD, Curator of Archaeology at the Smithsonian Institution, and Bruce Bradley, Associate Professor at the University of Exeter, have proposed a provocative new theory for the origins of the Clovis culture. They see problems with the conventional idea that Paleolithic Asians crossed the Bering Land Bridge to become the ancestors of all Paleoindians. For one thing, no one has ever found evidence for an Asian culture living at the right place at the right time and with a stone-tool technology similar enough to Clovis to make sense as an ancestor. Instead, Stanford and Bradley argue that small groups of people from the Old World Solutrean culture, with a similar lithic technology, paddled their way across the North Atlantic and gave rise to Clovis somewhere in eastern North America.

The Solutrean Theory, however, has been criticized by some archaeologists on both sides of the Atlantic. In this second part of a two-part series on this exciting new idea, we consider the views of the skeptics.

Why do Clovis and Solutrean technologies look so similar?

The late French prehistorian François Bordes, responding to an earlier claim that European Paleolithic cultures, including the Solutrean, strongly influenced America's Paleoindian cultures, anticipated several of Stanford and Bradley's contentions. He asserted that the Solutrean was "really quite different" from the Paleoindian complexes: "The similarities arise from similarities of environment, from the fact that you cannot work flint in 36 different ways, and from a more or less equal level of development."

Archaeologist Gary Haynes at the University of Nevada, Reno, made much the same argument. In his book *The Early Settlement of North America: The Clovis Era,* he writes that the similarities between Clovis and Solutrean technologies "occur throughout all the European Upper Paleolithic and later traditions, and continue into the late Holocene almost around the world." He thinks that Clovis "is not unilineally derived from a later Paleolithic tradition on any one continent or another—but is one member of a global family of contemporaries sharing abilities, experiences, and historical traditions."

Certainly, no Solutrean points are fluted like Clovis points and no Clovis points are shaped like the classic Solutrean

shouldered and laurel leaf–shaped points. David Meltzer, a specialist in Paleoindian archaeology at Southern Methodist University, told *Science* magazine that Stanford and Bradley cherry-picked data suggesting similarities between Clovis and Solutrean technologies, while "glossing over the many differences." Meltzer told me that the theory is "little more than a just-so-story."

Addressing the argument that overshot flaking is a hallmark of both the Solutrean and Clovis technologies, Meltzer asks, "Why aren't Stanford and Bradley spending time showing how it occurs in pre-Clovis assemblages, as it ought to if these are the immediate descendants of Solutrean boat people?" This is a key problem with the Solutrean Hypothesis. To critics who argue that the 5,000-year time gap separating Clovis and Solutrean technologies means that the Solutrean culture cannot be ancestral to Clovis, Stanford and Bradley counter with the argument that this gap is filled by pre-Clovis sites identified in North America. But this riposte leaves unanswered the issue of overshot flaking, the most significant similarity linking the Solutrean and Clovis technologies, which is absent in pre-Clovis assemblages. Even the Cinmar biface, a laurel leaf–shaped biface reportedly dredged up from the continental shelf of eastern North America, for all its supposed antiquity and superficial resemblance to a Solutrean biface, shows no evidence of overshot flaking. To critics like Meltzer, this suggests that overshot flaking was independently developed in America and Europe and therefore cannot be used to support the idea that there was a historical connection between these cultures.

L. G. STRAUS

Straus in the laboratory at El Miron Cave, Spain.

University of Akron archaeologist Michael Shott, in a 2004 review of Stanford and Bradley's research to that time, also questioned whether the presence of pre-Clovis sites in America could be used to support the hypothesis of a Solutrean connection. He argued that Stanford and Bradley "must explain why Solutreans arrived 16,000 years ago or more with foliate bifaces, promptly abandoned them, then returned to them 5,000 years later with the added feature of fluting. In effect, the Solutrean Connection holds that Clovis was descended from something (and someone) long gone by the time that Clovis originated."

ANDREW BOEHM

Meltzer excavating at the Mountaineer site, a Folsom occupation in the Colorado Rockies.

What Solutrean maritime adaptation?

University of New Mexico archaeologist Lawrence Straus, one of the foremost experts on the Spanish Solutrean and, indeed, the scholar Stanford and Bradley most rely upon for much of their understanding of this culture, argues strongly that there is no evidence to support a connection between the Clovis and Solutrean cultures and, furthermore, that there never was a Solutrean maritime adaptation: "They collected shellfish and caught salmon in estuaries and rivers, but there is no evidence of deep sea fishing until the late Magdalenian at around 12,000 RCYBP and that was only in the Mediterranean, not the North Atlantic."

Bordes dismissed the idea that depictions of seals or whales in Paleolithic art could be construed as evidence that the artists were from a seagoing culture: "Seals are often hunted ashore, and whales get stranded." Straus is equally dismissive: "The few representations of seals, auks, and penguins do not trump the archaeology. Sure, they had seen seals, but where are the [faunal] remains in substantial or even meaningful quantities?"

Where is the DNA evidence for Solutrean people in North America?

Perhaps the weakest link in the Solutrean theory is the absence of solid genetic evidence for European DNA in the genome of indigenous North American Indians (**MT 23-2,** "Largest-ever Survey of Native American Genes Sheds Light on First Americans"). Geneticist Michael Crawford of the University of Kansas told *Science* that "the molecular evidence in support of an Asian origin of Native Americans is overwhelming." The DNA of Native Americans is a subset of the DNA of Asians, which, in turn, is a subset of the DNA of Africans. This successive subdividing of the human genome is a clear record of small groups of people leaving Africa for Asia, necessarily carrying in their genes only a subsample of the DNA

CSFA Office Manager
Christel Cooper

Fate, or maybe a kind of cultural magnetism, must have drawn Christel to the position she has mastered so quickly. She entered this world at Cheyenne Wells, Colorado, as a member of the Chickasaw tribe, and grew up in College Station. Her very first college course was Anthropology 101! She didn't get to us by a direct route, though. After graduating from Sam Houston State University with a degree in media communications and aspirations of becoming a sports radio host, she worked for a time at FOX Sports Net in Houston. But that was before she discovered and fell in love with Santa Fe, New Mexico, where she spent a few years in the fundraising department of the Institute of American Indian Arts. For a time her office was in their museum across from Saint Francis Cathedral ("I was spoiled," she admits). She returned to Texas, and after her son, Angelo, was born in 2003, she came back to College Station because this is the right kind of environment for raising a child. There was a stint as substitute teacher in College Station schools before she was "fortunate to get an exciting job." Well, maybe not as exciting as teaching school kids, Christel, but you won't need your chair, whip, and pistol anymore. You'll need plenty of moxie, though, to help us launch the 2013 Paleoamerican Odyssey Conference in—where else? Santa Fe.

–JMC

comprising the original African gene pool. Subsequently, small groups of Asians left eventually to colonize America, carrying in their DNA only a fraction of the genetic variability present in the entire Asian genome. Yet Stanford and Bradley dismiss such "grand schemes" linking the earliest Americans to Asia as "at best only speculation."

Stanford and Bradley argue that the X mitochondrial haplogroup, found both in Europe and America, provides evidence for the Solutrean connection, yet the X2a version of the X haplogroup is only found in Native American populations and is present at a frequency of only about 3%, so it really isn't common. The presence and distribution of the mitochondrial X2a haplogroup in America is still something of a mystery, but a recent study published in the *American Journal of Physical Anthropology* shows that the C4c mitochondrial haplogroup, which is clearly an Asian lineage, is present in the same Great Lakes and Great Plains populations in which X2a is present. This suggests to geneticist Baharak Hooshiar Kashani and his several coauthors that "these two lineages possibly arrived together from Beringia with the same Paleo-Indian group(s) that entered North America from Beringia" at around 18,000–15,000 years ago. Kashani and his coauthors argue that this finding "definitively dismisses the controversial hypothesis of an Atlantic glacial entry route into North America."

If the makers of Clovis points were the descendants of Paleolithic Europeans, then surely their genetic signature would be as widespread as their distinctive and beautiful spear points.

"Completely crazy," or the next renaissance in the search for the First Americans?

Stanford and Bradley acknowledge that the idea that "Clovis may have had a European ancestor" isn't new. Emerson Greenman, for example, made a similar argument in 1963 in the prestigious journal *Current Anthropology*. George Agogino responded to Greenman's claim in a letter to the editor in which he indicated that, while he disagreed with Greenman's ideas, "it was a good thing that he was able to publish in a widely distributed journal. Just because someone would not conform to the accepted belief of the time period does not mean that the views should be kept from the public eye."

At the conclusion of their book, Stanford and Bradley point out that we must "allow the data, in concert with theoretical development, to guide our research." They argue that new lines of research, "even some now considered to be completely crazy, may be just the approaches that will result in the next renaissance in the search for the predecessors of the earliest Americans."

Agogino's and Stanford and Bradley's arguments in favor of disseminating controversial scientific theories are supported by the history of science. The idea of continental drift, for example, once was dismissed as ridiculous, but plate tectonics now forms the bedrock of modern geology.

Some archaeologists appear to appreciate the value of considering (or reconsidering) seemingly crazy ideas. Tom Dillehay, the excavator of the pre-Clovis Monte Verde site, contributed a promotional quote for the back cover of Stanford and Bradley's book. He describes the book as "an ambitious interdisciplinary study of a neglected route of early entry into the Americas that will affect the way the larger narrative of the first chapter of human history in the New World is written."

Other archaeologists, such as Meltzer, Straus and Shott, think the evidence for an Eastern Asian origin for Clovis—including the independent and mutually supportive data from archaeology, genetics, and linguistics—leaves no room in the picture for wayfaring Solutreans.

As a final thought, it's interesting to note that Stanford and Bradley criticize researchers that "continually underestimate the abilities, the vision, and the intelligence of our ancient cousins, whether in the east or the west." In other words, scholars are wrong to dismiss the capability of Solutrean hunters in skin boats to challenge the North Atlantic and survive.

When it comes to the conventional view that Asians crossed the forbidding arctic wastes of Beringia, however, Stanford and Bradley themselves appear to belittle the abilities, vision, and intelligence of these Western folks: "Beringia today, especially

on the Asian side, is one of the coldest and most inhospitable places on earth. Only Antarctica rivals it. Imagine what it must have been like during the even colder and stormier glacial period. And this is where we expect to see intrepid waves of migrants in search of a better place to live?"

Similarly, Stanford and Bradley make frequent appeals to data now hidden beneath the Atlantic Ocean that they are confident will provide the missing pieces of the Solutrean puzzle. That possibility remains to be tested, but it's at least equally possible that sites now submerged below the waters of the Pacific Ocean off the coasts of Asia and western North America might one day fill in the supposed gaps in the conventional theory for Clovis origins. It will be interesting to see what new data are revealed from future investigations of these lost landscapes on both sides of North America.

–Brad Lepper

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Suggested Readings

Baltar, M. 2012 Critics Assail Notion that Europeans Settled Americas. *Science* 335:1289–90.

Meltzer, D. J. 2009 *First Peoples in a New World: Colonizing Ice Age America.* University of California Press, Berkeley.

Straus, L. G. 1992 *Iberia before the Iberians: The Stone Age Prehistory of Cantabrian Spain.* University of New Mexico Press, Albuquerque.

——— 2000 Solutrean Settlement of North America? A Review of Reality. *American Antiquity* 65:219–26.

Straus, L. G., D. J. Meltzer, and T. Goebel 2005 Ice Age Atlantis? Exploring the Solutrean-Clovis 'Connection.' *World Archaeology* 37(4):507–32.

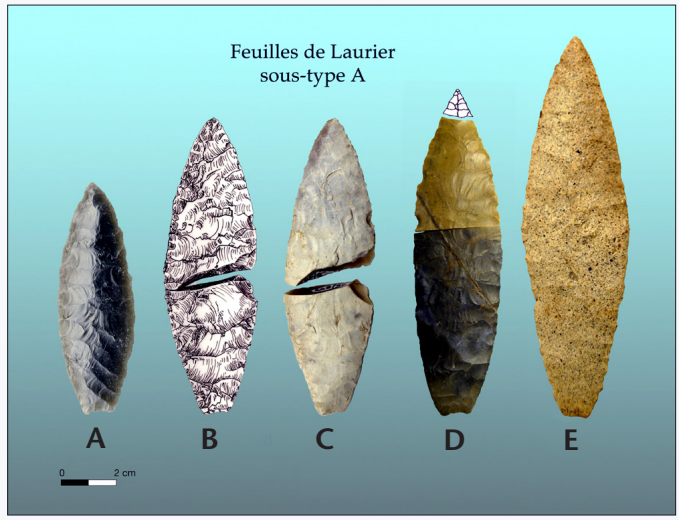
See also Stanford and Bradley's responses to their critics:

Bradley, B., and D. Stanford 2006 The Solutrean-Clovis Connection: Reply to Straus, Meltzer and Goebel. *World Archaeology* 38(4):704–14.

The Solutrean Theory— *Evidence for and against*

Stanford and Bradley cite as evidence for a Solutrean connection these foliate bifaces from the Chesapeake Bay region. A, from South Marsh Island, weathered from the Tilghman Paleosol, unknown raw material. B–C, from Eppes Island; XRF suggests they were made of French amber flint. D, from Gwynn's Island, made of local chert. E, from Spotsylvania County, Virgina, made of local orthoquartzite. This is the famous *Cinmar* laurel-leaf biface, reportedly recovered with mastodon remains from a depth 250 ft below sea level on the outer continental shelf of Virginia. The mastodon remains dated to 22,780 ± 80 RCYBP. ▶

L. G. STRAUS



MARCIA BAKRY, NMNH, SMITHSONIAN INSTI.

◀ **Straus counters with these examples of typical shouldered Solutrean projectile points from La Riera Cave. There is nothing like them in Clovis or pre-Clovis assemblages, yet they are among the most common Solutrean points in France, Spain, and Portugal, along with other types also not found in the Paleoindian period (e.g., stemmed points, rhomboidal points, and laurel and willow leaves).**

NEW BOOK!

"Archaeological science at its best."
–Dean R. Snow, professor, Pennsylvania State University

Late Pleistocene Archaeology & Ecology in the Far Northeast

Edited by Claude Chapdelaine

THE FAR NORTHEAST, a peninsula incorporating the six New England states, as well as New York east of the Hudson, Quebec south of the St. Lawrence River and the Gulf of St. Lawrence, and the Canadian Maritime Provinces, provided the setting for a distinct chapter in the peopling of North America. ***Late Pleistocene Archaeology and Ecology in the Far Northeast*** focuses on the Clovis pioneers and their eastward migration into this region, which was inhospitable prior to 13,500 years ago, especially in its northern latitudes.

Bringing together the last decade or so of research on the Paleoindian presence in the area, Claude Chapdelaine and the contributors to this volume discuss, among other topics, the style variations in the fluted points left behind by these migrating peoples, a broader formal disparity than previously thought. This book offers not only an opportunity to review new data and interpretations in most areas of the Far Northeast, including a first glimpse at the Cliche-Rancourt Site, the only known fluted-point site in Quebec, but also permits these new findings to shape revised interpretations of old sites. The accumulation of research findings in the Far Northeast has been steady, and this timely book presents some of the most interesting results, offering fresh perspectives on the prehistory of this important region.

Says Dr. Jean-Luc Pilon, Curator of Ontario Archaeology at the Canadian Museum of Civilization, "This book provides a much needed update of that incredible story of human adaptation on the very edge of the inhabitable world."

Editor **Claude Chapdelaine**, professor of archaeology at the Université de Montréal, specializes in the prehistory of North America.

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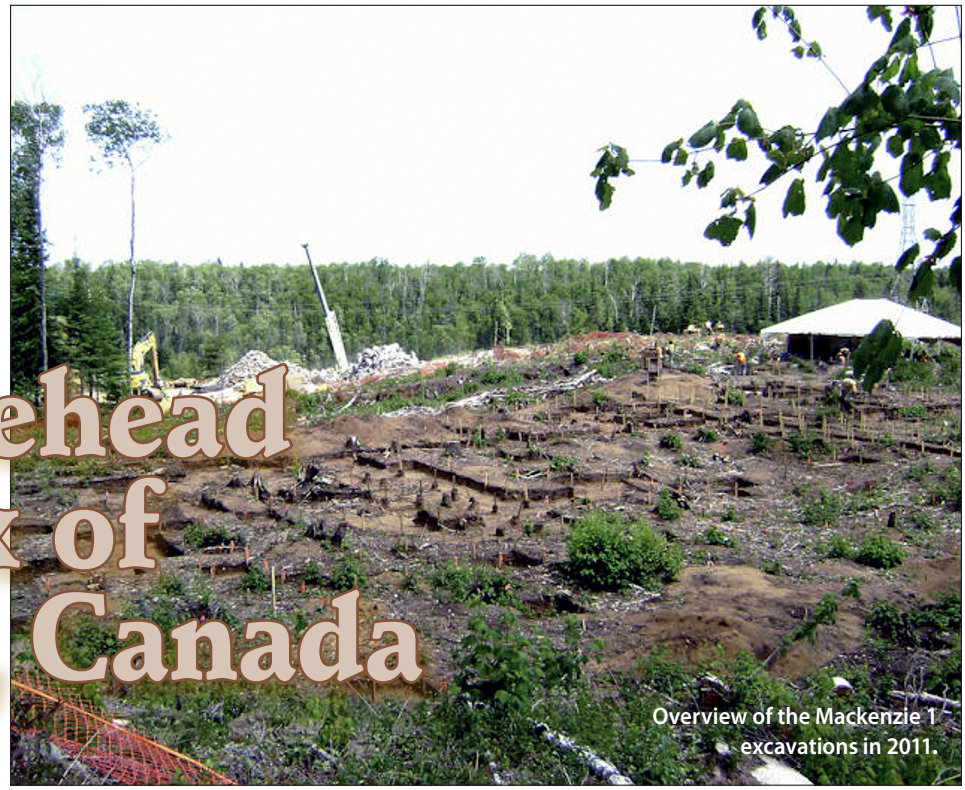
The Last Gasp *of the* Last Ice Age

The Lakehead Complex of Ontario, Canada

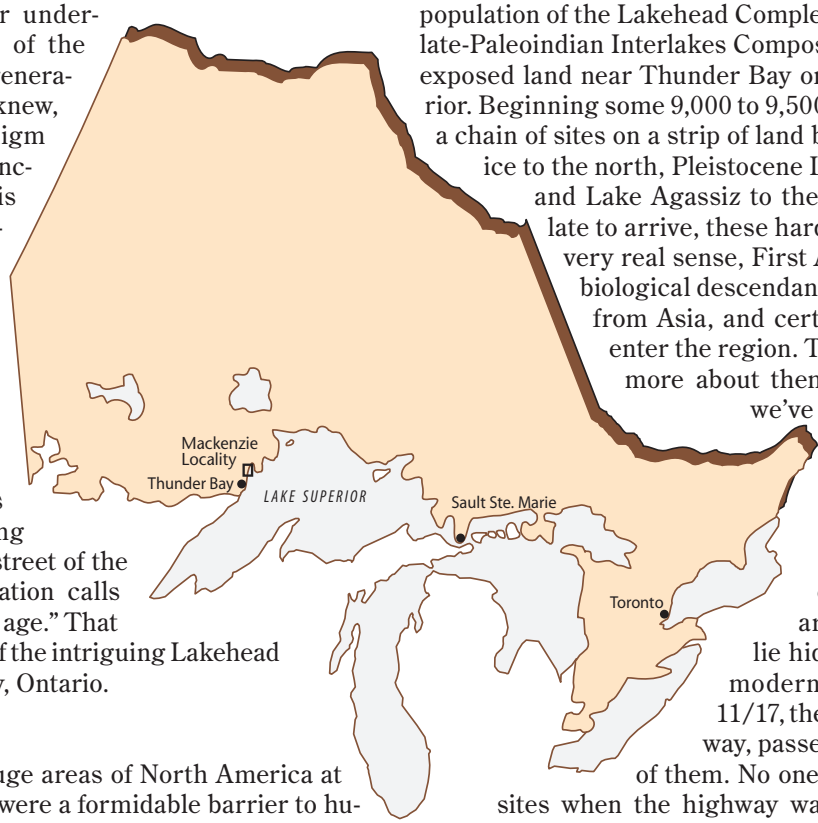


Overview of the Mackenzie 1 excavations in 2011.

GJENDE BENNETT

HOW DO WE DEFINE the term "First American"? This question is becoming increasingly difficult to answer as our understanding of the peopling of the New World deepens. A generation ago we thought we knew, and the Clovis-First paradigm was the result. Then convincing evidence of pre-Clovis occupations on both continents demanded that we consign that theory to the scrap bin of history.

The near end of the Paleoamerican continuum is nearly as blurry: The last of the Llano cultures radiated into a bewildering array of Archaic cultures about 9000 CALYBP, during the period Dr. David Overstreet of the College of Menominee Nation calls "the last gasp of the last ice age." That era also saw the flowering of the intriguing Lakehead Complex near Thunder Bay, Ontario.



First American roots

The ice sheets gripping huge areas of North America at the end of the Pleistocene were a formidable barrier to human colonists. Entry to many regions was utterly denied until the ice and its frigid meltwaters had receded. Immediately after the ice relinquished its hold, however, the founding population of the Lakehead Complex, a key component of the late-Paleoindian Interlakes Composite, moved into the newly exposed land near Thunder Bay on modern-day Lake Superior. Beginning some 9,000 to 9,500 years ago, they occupied a chain of sites on a strip of land between retreating glacial ice to the north, Pleistocene Lake Minong to the south, and Lake Agassiz to the west. Though somewhat late to arrive, these hardy pioneers were still, in a very real sense, First Americans—spiritual and biological descendants of the original colonists from Asia, and certainly the first humans to enter the region. Today we don't know much more about them than that . . . but then, we've barely begun the steep climb up the learning curve.

Most of the Lakehead Complex sites identified thus far are proof that, even in the 21st century, archaeological riches can lie hidden a stone's throw from modern development. Highway 11/17, the main TransCanada Highway, passes just to the south of most of them. No one really looked for cultural sites when the highway was originally constructed, though a few knapped flakes and an Agate Basin–like pro-

WESTERN HERITAGE

The Mackenzie River project corridor, north of the existing TransCanada Highway (Highway 11/17) and Lake Superior.

jectile point were recorded in the late 1970s along a nearby power-line corridor. William Ross, President of the Canadian Archaeological Association, who served first as Regional Archaeologist and later as Senior Archaeologist for northern Ontario during that timeframe, kept a watchful eye on the Northwestern Great Lakes localities. He was especially curious about the Mackenzie River projectile point. A nearby Lakehead site, Stevens (DdJf-5), also produced a Scottsbluff-like point.

SAMANTHA MARKHAM

Markham at Mackenzie 1 holding one of the complete projectile points recovered there, September 2010.

The real bonanza came to light in 2009, when the Ontario Ministry of Transportation began "twinning" the existing highway lanes. A pre-construction cultural-resources survey recorded four new prehistoric lithic sites along a 13.1-km corridor: Mackenzie 1 and 2 (DdJf-9 and DdJf-10), and Electric Woodpecker 1 and 2 (DdJf-11 and DdJf-12). They also confirmed the existence of a fifth site, Naomi (DcJh-42), about 20 km to the west. Unfortunately, all five sites lay within proposed construction zones, requiring extensive archaeological salvage excavations in advance of the roadwork. Cultural resources management firm Western Heritage began fieldwork in March 2010, soon identifying two more sites within the mitigation area—RLF (DdJf-13) and Electric Woodpecker 3 (DdJf-14). A second previously recorded site near Naomi, Hodder (DcJh-44), was later added to their work order.

Ross defines the six easternmost sites (plus Stevens, which is located 1 km north of Mackenzie 1) as the Mackenzie Cluster of the Lakehead Complex. Naomi and Hodder he defines as a separate cluster, Current River.

The mother lode

It soon became clear that Mackenzie 1, named after a minor river draining south into Lake Superior, was the star of the show. Ultimately, soil was hand-excavated from a total area of about 4,500 m^2, to an average depth of about 30 cm below the surface. At Mackenzie 1 alone, an area of 2,539 m^2 was excavated, all but eradicating the site—though Dr. Terry Gibson, Western Heritage's Senior Manager for the project, suspects a few cultural deposits may remain on the north

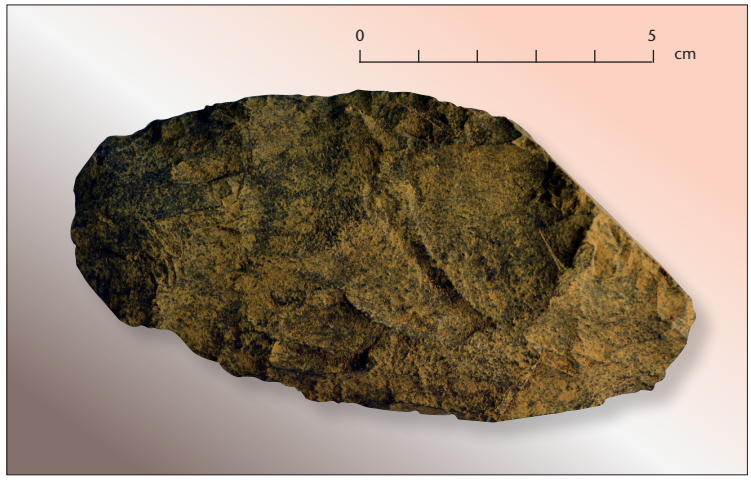
side of the highway right-of-way, "pinched in against the river valley."

Almost all the lithic materials that Western Heritage recovered were made of local taconite, a durable iron-rich chert, although small quantities of exotic toolstones like Hixton silicified siltstone from Wisconsin, Knife River flint from North Dakota, and Knife Lake siltstone from Quetico Provincial Park southwest of Thunder Bay also turned up. Some of these materials came from as far away as 500 km, "over 600 km if one takes into account the fact that these peoples had to travel around the end of Lake Minong," Ross points out. He theorizes that they originated in Wisconsin and Minnesota (possibly with limited connections farther west) and migrated northeast between glacial Lakes Agassiz and Minong as the ice melted and made the land available for occupation. Gibson cites as other possible influences the Southeast, the Southwest, the Great Plains, and eastern Manitoba, directly west of the project corridor.

GJENDE BENNETT

Refitted taconite biface from Mackenzie 1. The pale gray patina is soil residue left intact in case it's needed for later analysis.

Both Ross and Gibson estimate that as many as half a dozen thesis projects focusing on the Mackenzie lithics are currently underway at Lakehead University in Thunder Bay. It's no surprise that several of the lithics analysts are current or former Western Heritage employees. The partnership between Western Heritage, Lakehead University, the local First Nations groups (particularly the Rocky Bay and Red Rock nations), and the Ministry of Transportation has proven unusually fruitful, and their collective findings may well rewrite our understanding of the late-Paleoamerican occupation of the western Great Lakes region.



GJENDE BENNETT

A large biface blank from the Mackenzie assemblage.

Fragile clues

Although the Western Heritage sites displayed little prior human disturbance, both cryo- and bioturbation seriously complicated their stratigraphy. Wind erosion also took its toll. The dating is likewise complicated, for both optically stimulated luminescence (OSL) and accelerator mass spectrometry (AMS) report younger dates than expected on some sediments. The dates and geoarchaeological contexts of the sites nevertheless suggest an occupation lasting thousands of years. "Whether this represents a transition from Paleo through Archaic to more recent times has yet to be determined," says Gibson.

Samantha Markham, who helped excavate the sites as a Western Heritage employee and is currently analyzing the projectile-point assemblage from Mackenzie 1 for her master's thesis, reports that all the diagnostic points from Mackenzie 1 are Paleo. She suspects that the OSL and AMS dates may not represent her "activity of interest"—namely, the Paleoamerican occupation. "There's obviously something going on at the site that we're all unaware of at this point," she says. Whether the anomalous dates derive from site disturbance, unrecognized occupations, or other factors remains uncertain. But late Paleoamericans were clearly present. How long they occupied the site remains to be seen.

"The flaking patterns indicate older groups. Even the raw material selection indicates Paleo," observes Markham's fellow graduate student and Western Heritage employee Gjende Bennett, who began his thesis project on the Mackenzie biface manufacturing process in fall 2011. The earliest occupants of the region favored taconite, especially the Paleoamericans, though Gibson cautions that local Archaic populations probably used it too. As Ross points out, taconite is readily available as a bedrock material, with plenty of surface exposures. "These people seem to really favor bedrock materials," he notes. Much later cultures (notably the Woodland populations) preferred the more amenable Hudson's Bay Lowland chert, which the Mackenzie occupants mostly avoided, probably because the available cobbles weren't large enough for points they needed.

Formal tool density was low at seven of the Western Heritage sites, which is typical of the region. Yet Mackenzie 1 yielded an extraordinarily high number of tools. Western Heritage crews recovered 380 projectile-point specimens there, an average of one per 6.7 m^2 excavated. That's at least an order of magnitude higher than for comparable sites in the region, and doesn't even take into account the hundreds of other tools recovered. The high density of tools at Mackenzie 1 is puz-

SAMANTHA MARKHAM

◀ Four complete or near-complete projectile points from Mackenzie 1. The leftmost is a fishtail variety made of an unidentified siltstone; the other three are made of taconite.

◀ Basal point fragments illustrating the wide range of variability in the Mackenzie 1 assemblage. All are taconite, except for the leftmost specimen, which is Knife Lake siltstone.

zling, given that there are no known quarry sites directly associated with the site. Perhaps it's because, during the early Holocene, the site lay on a beach ridge next to a major drainage, where resources were abundant. Maybe the population density was just higher there than elsewhere and occupations occurred more frequently and for longer periods. Whatever the cause, Mackenzie 1 has produced more stone tools than all the other sites in the western Great Lakes region combined.

A tough rock to crack

Though rare elsewhere in the world, taconite is common in the Lake Superior basin. It varies widely in silica content, texture, and color, but always includes iron in its makeup. Indeed, some of the deposits along the U.S. side of the lake are so iron-rich they're mined for ore. Ontario exposures tend to have higher silica content, varying in consistency from fine-grained to coarse.

The finer the toolstone grain, the easier it is to flake . . . ideally. But not only is Great Lakes taconite very hard, it

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also exhibits a high incidence of internal flaws and quartz veins. Most tools either break before they're completed or develop insurmountable problems. Bennett's study of Mackenzie biface technology indicates that while flintknappers took great care in selecting pieces to work with, they still experienced high levels of early-stage failure. Very careful preparation of a striking platform was crucial in all stages, which considerably complicated the toolmaker's job. Nevertheless, for many centuries taconite remained the toolstone of choice. Meanwhile, tools made on nonlocal materials, like Hixton siltstones, were resharpened repeatedly and worn down to nubs before being discarded, which suggests such material was highly valued.

WILLIAM ROSS

Ross surveying along the shoreline of Lake Superior, 2010. ▲

KRISTA GILLILAND

Gibson in the field in typical forest setting, 2012. ▶

In addition to Bennett's bifaces, tens of thousands of flakes and cores representing every stage of lithic reduction were recovered, as were numerous scrapers, drills, perforators, knives, and adzes. Then there are the 380 projectile-point specimens Markham is studying, all from Mackenzie 1, as well as a handful of others from the Woodpecker sites and Mackenzie 2. Most are made of taconite. "Only" 53 of Markham's points are whole; the rest are basal, medial, and tip fragments. Five have been reworked into scrapers.

Markham isn't trying to categorize Mackenzie 1 points according to known types; instead, she focuses on characteristics like base configuration, flaking style, and frequency and degree of lateral/basal grinding (which aided in hafting) to determine the range of variation among the points. The data are a work in progress, though she's confident about some aspects. For one thing, all the points she's examining appear to be Paleo, with lanceolate shapes typical of late-Paleoamerican types. Moreover, regardless of morphology, 99% exhibit an unusual parallel oblique flaking pattern. Why Mackenzie knappers taxed themselves by using such a challenging flaking technique on a particularly obstinate material is a mystery. Possibly the reason was purely social, something along the lines of, "This is how we've always made our projectile points, and that's that." From the archaeologist's viewpoint, the unvarying lithic-reduction strategy suggests that Mackenzie 1 was occupied for a very long time by the same group.

GJENDE BENNETT

Bennett setting up at Mackenzie 1, 2011.

What's next?

Although the Mackenzie Cluster sites excavated by Western Heritage are gone, the mass of data acquired during the excavations lives on—and researchers like Markham and Bennett have barely begun transforming it into useful information. "The emphasis put on research by Western Heritage is to be commended," notes Bill Ross. "They've made materials available to graduate students at Lakehead University. They've organized sessions at the last two Canadian Archaeological Association Annual Meetings on the materials from this series of sites, and I expect additional sessions to be held."

There's still plenty of detective work to be done, and there are many perplexing questions to be answered before we truly understand what we've tapped into with the Lakehead Complex, particularly with the Mackenzie Cluster. It's our good fortune that so many fine researchers are itching to find out what was going on, there on the relict beaches of ancient Lake Minong.

–Floyd Largent