

MAMMOTH TRUMPET



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Bonnie Pitblado

In Pursuit of Paleoamericans

Pitblado collecting an obsidian biface, charcoal fleck, and OSL sample in a trench adjacent to an ice cave, Soda Springs, Idaho, 2009.

JAMES MAYER

SCAN A LIST of Bonnie Pitblado's publications, excavations, education, exhibitions, and other contributions to archaeology and you'll wonder when she finds time to sleep. Read closer and you'll find that the enormous volume of her work hasn't detracted from the quality. Currently Dr. Pitblado, associate professor at Utah State University, is the director of their Anthropology program. Oh, and she's also director of the USU Museum of Anthropology. The energy she puts into any one of these efforts would be a full-time job for most, yet she goes full throttle in many directions making mammoth strides.

Pitblado's broad geographical focus is the southern and central Rocky Mountains, particularly high-altitude sites. Originally she concentrated on Colorado as she evaluated how Paleoamericans utilized resources and progressed across the region. Of the sites she excavated there, Chance Gulch is particularly noteworthy because it was at this site that she became acutely aware of the urgent need for a tool missing from the archaeologist's kit, a technique to source quartzite, and she set about to develop it. Her lab work in this ambitious undertaking is ongoing, and as it unfolds she has begun a complementary field research

INSIDE

6 Death at an early age in New Mexico 10,000 years ago

Not past her teens when she died, she was laid to rest on a hill overlooking Arch Lake. Today her remains shed light on her lifestyle and environment.

11 Don't sell endscrapers short—they have a lot to tell us

Two use-wear analysts reveal the wealth of information we can learn about camp life by closely examining these ubiquitous Clovis tools.

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We can tell from their by-products—and mistakes—the step-by-step procedure they followed to convert a hunk of stone into a tool or fluted point: Part II of lithics analyst Charlotte Pevny's series.

program focused on Paleoindian sites in southeastern Idaho and northern Utah, USU's backyard. Pitblado's work chronicling the virtually unknown Paleo past in this region shows extreme attention to detail, but don't think for a second she has ignored the bigger picture of the peopling of the Americas. Her new paper "A Tale of

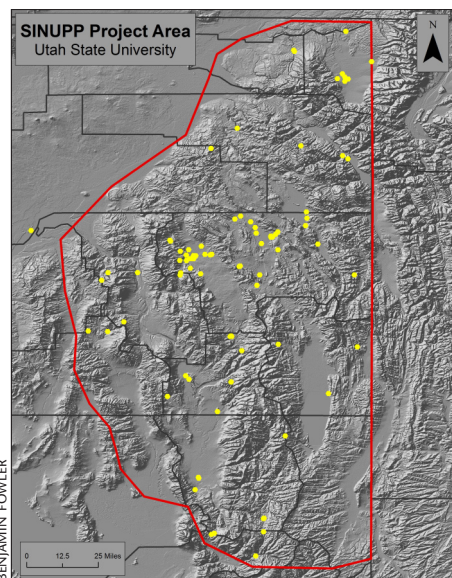
Two Migrations” brings her brainpower to bear on how those first travelers reached the Americas and their possible pathways through it.

Her accomplishments are jaw-dropping, and she does it all with a hearty dose of good humor and a refreshing dash of humility. Once, however, she was just a green grad student like so many others, which is as good a place as any to start.

Bonnie 101

Like many graduate students in the University of Arizona Department of Anthropology, Bonnie Pitblado’s sights were set on the Southwest, but that was before she took a seat in C. Vance Haynes’s Paleoindian course.

“Hooked” is the word she uses.



Paleoamerican sites recorded to date in Idaho and Utah.

Hooked forever, not by the amazing artifacts or the recent discoveries, but by the questions. What enticed Pitblado wasn’t what we had learned about Paleoamerican life, but what we still didn’t know. (What better sign of a true scientist?) She still loves the Southwest and its fabulous archaeology, but from that time on it had to cede that special place in her heart. She recalls the day she burst into Dr. Haynes’s office with what she describes as a naïve lack of protocol and made an announcement to the effect of “Great news! I love this Paleoindian stuff, and so I think I should work with you!”

Fortune favors the bold. Haynes must

have glimpsed the future go-getter beneath the exuberant veneer because Pitblado was on her way. She completed her M.A. and Ph.D. (the latter with a commendation for an outstanding dissertation and defense) and dug, literally and figuratively, into Paleo archaeology.

Rocky Mountain fever

Although Pitblado has focused most of her energy recently on the Rocky Moun-

tains, mostly within Colorado, in graduate studies her field experiences encompassed neighboring states. It’s a measure of her warmth and caring nature that when recounting sites she remembers the people she worked with as much as the archaeology. At the Lehner Clovis site in Arizona she worked for a week with Haynes and Dr. Bruce Huckell from the University of New Mexico (“we didn’t find anything,” she says cheerfully, “but it was

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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

great to have tried”). She really cut her Paleoamerican teeth during a three-season stint as field director of the Hell Gap site in Wyoming. And, sitting at the treeline one night at the Caribou Lake site west of Boulder, she was treated to the spectacle of the Perseid meteor shower; it was an experience that she says was “as beautiful as the mind can conjure”—yet what she remembers most fondly is that it was a site her beloved mountain mentor, the late Dr. James Benedict, who passed away only last month, had once excavated. If there were baseball cards for archaeologists, Pitblado would have a shoebox full of the greats, like Benedict, under her bed.

Today Paleo archaeology in the Rockies is steaming along, thanks in no small part to Pitblado’s early work. The aggregate of her experiences there through the late 1990s is distilled into her comprehensive book *Late Paleoindian Occupation of the Southern Rocky Mountains*. Her objective was to track the movement of Paleoamericans across the Rockies in Utah and Colorado, and the method she chose was to intensively analyze some 600 projectile points. She ultimately identified three distinct patterns of Paleoamerican use of the mountains, and she drew conclusions about what we might expect of settlement strategies associated with those three patterns of use. Her conclusions have given direction and energy to her own future investigations and to those of other scientists.

We’ve already seen a payoff from her bulldog tenacity when grappling with a troubling bit of science. While analyzing those 600 points, Pitblado found her efforts hampered because existing typology for points of this age originated from occupations in the Plains, yet the mountain Paleoamerican spear points were an entirely different animal. So, following Kreiger’s Typological Method, she described two new point types (or rather, she defined in a new way two previously named and poorly understood types) and showed how they can be statistically distinguished from each other. Pitblado dubbed the types Angostura and Jimmy Allen, and she

details the unique characteristics of each in chapter 10 of the book she edited with Dr. Robert Brunswig, *Frontiers in Colorado Paleoindian Archaeology: From the Dent Site to the Rocky Mountains*.

This is classic Bonnie Pitblado. She lays it on the line: This is what I have. This is what I think it means. What do you think? She doesn’t shy away from peer review (or apparently anything else), but encourages it. She has no fear of a challenge or taking a chance.

Chance it

The Chance Gulch site, located southeast of Gunnison on the

Two books that have made Pitblado a recognized authority in studies of Rocky Mountain Paleoamericans.

west slope of the Rockies, has been picked over by Pitblado with a fine-toothed trowel. As intriguing as this multiple-component site is, what is even more interesting is the ambitious project it spawned.

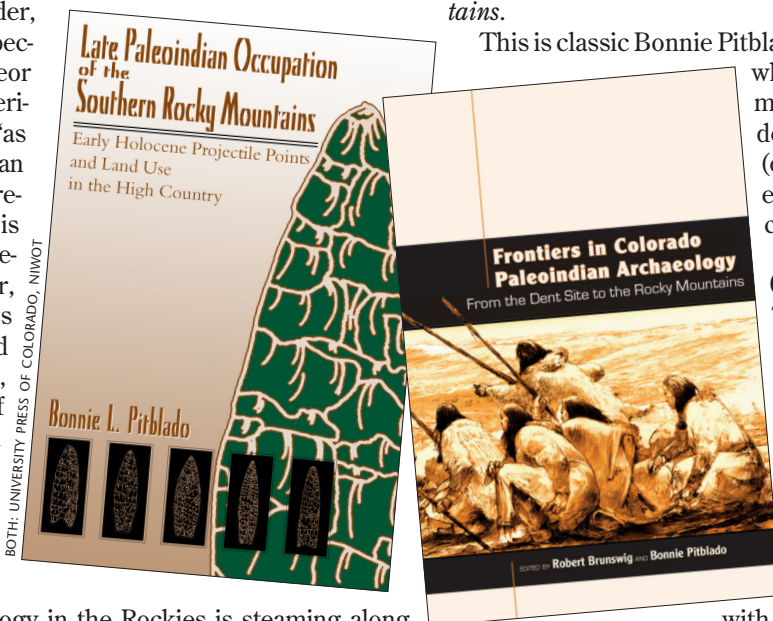
Chance Gulch, like many Paleo sites Pitblado has investigated in that region, has lithic assemblages composed chiefly of quartzite. In fact, the area is surrounded by quartzite sources that probably drew early Americans to that locale. For Pitblado, though, “probably” isn’t good enough. She wants to prove it, and the only way to do that is to match quartzite to its source. The science already exists for tracing obsidian toolstone to its quarry by analyzing trace elements (MT 24-2, “Following the Obsidian Trail”). If quartzite could be sourced like obsidian,

then she could deduce the mobility strategies of the people who used it. “So, I figured,” she says, and you can almost see her giving a nonchalant shrug, “if the tools don’t exist, let’s just step back and see if we can’t make them.”

Paleoamericans made tools. Pitblado set about to make tools for sourcing tools.

The first step was to as-

Pitblado with student Amy Gardner at the Chance Gulch Paleoamerican site, Gunnison Basin, Colorado, 2002.



BRANSON REYNOLDS

semble a multidisciplinary team of scientists, and Pitblado joined forces with the best: USU geologist Carol Dehler; Hector Neff of the IIRMES lab at California State University–Long Beach; geochemist Steve Nelson of Brigham Young

All for Archaeology *and* Archaeology for All

BONNIE PITBLADO isn't dedicated solely to tracing Paleoamericans across the Rockies and into the neighboring states of Utah and Idaho. She has a second and equally important mission: To work closely with members of the communities she operates in so she can learn from them and share what she infers from their data in return. From both local European-American settlers and Native Americans, the people who call these lands home today, Dr. Pitblado knows she can get valuable clues on the location of possible Paleoamerican sites. After all, who knows the land better than those who live close to it? In return, she shares with them what she learns and enriches their knowledge of their home. The result is a giant leap in Paleoamerican archaeology. For all Americans.

A little local insight

Before Pitblado and her students started poking around, there was little information available about the Paleo prehistory of southeastern Idaho and northern Utah, but not for lack of potential. "Southeastern Idaho and northern Utah have it all," she tells us, "if you make your living by hunting and gathering, as all Paleoindians did." Their first season of fieldwork in 2008

University; and geographer-archaeologist Molly Cannon, director of the new USU geospatial lab. They undertook testing different analytical techniques, starting with the most promising, acid-digestion inductively coupled mass spectrometry (AD-ICP-MS). AD-ICP-MS, however, requires pulverizing a sample of the material. As every archaeologist and museum curator knows, pulverizing pieces of ancient artifacts is frowned on. Pitblado didn't frown, she turned to Hector Neff for a solution: laser ablation-ICP-MS (LA-ICP-MS). This method uses a laser to blast a minuscule sample ("a few tens of microns in diameter") from the surface of the artifact. With a few ablations LA-ICP-MS gives results comparable to AD-ICP-MS, and with virtually no harm done to the specimen.

It's premature to say that quartzite sourcing is an up-and-running proven method. The studies are moving along apace, with petrographic analysis and experiments with x-ray fluorescence unfolding as we go to press. Pitblado emphasizes



Pitblado checking artifacts at a roadshow in Victor, Idaho

Photograph by Holly Andrew,
USU Museum of Anthropology,
July 23rd, 2010

proved her correct: They identified and documented 50 new Paleo sites and predicted the likely location of other sites.

How do Pitblado and her students succeed in unearthing new sites as if by magic? They recruit lots of help. Pitblado is an archaeologist extraordinaire, and one way she got there was by listening to people. Her team is making giant strides today precisely because she is listening, and not just to archaeologists and other experts. She listens to the local people of southeastern Idaho and northern Utah. If we can't talk to the ancient inhabitants of this region, we can talk to those who live there today. And they have plenty to say.

To kick off their search Pitblado's crew held "prehistoric roadshows" in the communities of Logan, Utah, and Soda Springs, Idaho, where folks turned up in droves, enthusiastic and helpful. In many cases old hands were willing and able to lead Pitblado to the precise spot where they had found ancient artifacts.

Voilà! In a single summer Pitblado's database swelled with 50 new Paleo sites. Archaeology benefited twice over: Pitblado gained an enormous increase in knowledge about ancient people who once dwelt here, and she repaid today's citizens with insight into the prehistory of their land. What's more, she has amassed an army of outdoor enthusiasts in the region to work with her team of scientists and students. The phenomenal success of the first few roadshows made Pitblado's decision easy. It's now a regular event at the USU Museum of Anthropology and in communities across her study area.

that much more work must be invested in other experimentation—a crucial step is to run tests on quartzite from additional localities—but the outlook is promising. Success will be worth the work and frustration because, as Pitblado explains, "the fact that quartzite is the most ubiquitous rock type in the world, used to make everything from chipped-stone tools . . . to Egyptian statues means that if we succeed in developing sourcing strategies, we will help a lot of archaeologists (and other earth scientists, actually) with a wide range of research problems."

Uncharted territory

As problems go, you wouldn't consider a shortage of Paleoamerican sites in a certain region much of a problem. A bystander might simply shrug and assume there wasn't much there. But when Pitblado looked at southeastern Idaho and northern Utah she saw an ideal range for Paleo hunter-gatherers.

Returning the favor

The USU Museum of Anthropology is itself another of Pitblado's outreach projects. She uses this teaching museum to educate and encourage the public to get involved with archaeology—responsibly. Pot-hunting, she emphasizes, is taboo. Plans are underway to move the bulging museum and at the same time, in the true spirit of archaeology, save a historic campus building. The USU Art Barn, which was condemned, will be restored to become the new home of the USU Museum of Anthropology. Restoration starts in 2012, so she is spearheading a fundraising drive to complete the work. In December she won a \$500,000 National Endowment for the Humanities grant that has the mission well on its way. Pitblado also coordinates Barn research by a team of history, folklore, and landscape architecture graduate students who are gathering every detail imaginable about the Barn and its 90 years of human stories. She keeps everyone updated with her entertaining barn blog <http://usubarn.blogspot.com>



MARY KAY GABRIEL

Here we see a key to Bonnie Pitblado's success. Always the educator, she eagerly shares information with everyone who cares—or whom she can make care. You can check progress of the Utah State University Southeastern Idaho & Northern Utah Paleoindian Research Program (SINUUP) by viewing the newsletters she produces each spring via links at her USU faculty web profile, <http://www.usu.edu/anthro/faculty.html#pitbladot>. The newsletter highlights such program activities as the founding of a new spin-off CRM company, USUAS, Inc., which renders archaeological services while giving students valuable field experi-

ence; future roadshows; and picnics with archaeologists. Picnics are another opportunity for the general public to chat with Pitblado and crew, try their Aggie ice cream, and even get some practice throwing the atlatl. Who among us doesn't need that!


A page of the newsletter is a wanted poster with illustrations of Paleo lithic artifacts—points and crescents—and a plea to anyone who finds something that looks like these to notify Pitblado. She may be the only archaeologist to put out an APB on ancient American artifacts.

Leave archaeology to the professionals, some say, but not Pitblado. She learned from the greats like C. Vance Haynes, George Frison, Dennis Stanford, and Pegi Jodry that a sure way to find Paleo sites is to talk to the people who call the land home today. And while the locals enlighten her about the ancient lay of the land, she educates them about archaeology and thereby gives them knowledge and instills a sense of ownership and responsibility toward evidence

Here's how you enlist the help of every reader of your newsletter in finding new sites!

of ancient people. Owners like to conserve what is theirs, not destroy it.

Give some, get more

Through education and cooperation Dr. Pitblado gets the support she needs to practice her science, and in the process she nurtures a symbiotic relationship. Both sides gain, though the scale may be tipped a bit in her favor. She gets leads on possible Paleo sites without the cost in time and money to survey the entire 9-county area; the community learns about the people who walked the land thousands of years before them. They also get a bird's-eye view of archaeology and how it works. 

—K. Hill



JARED THAYNE

This region is where the Great Basin, Central Rockies, Great Plains, and Columbia Plateau all reach toward each other. There's a bounty of plants, animals, and fish, ice caves to store that food, abundant water resources including hot, cold and mineral springs, materials for making stone tools, and rockshelters for lodging. What more could an early American want?

Pitblado wanted sites, and she found them, 50 in that

Pitblado (*center*) with students Shannon Saxton (*left*) and Barbara Wilson, testing the Fox late-Paleoindian site, Thatcher, Idaho, 2009.

first field season in 2008, plus 7 that had been previously documented. All the sites were at least 8,000 years old, some reaching as far back as 12,000 years.

continued on page 9

ONCE A SHALLOW LAKE that teemed with life, today a large dry playa, Arch Lake in New Mexico lies about 10 miles south of Blackwater Draw and about 20 miles southeast of Locality 1. Blackwater Draw, which extends eastward for 100 miles into western Texas, is hallowed ground for American archaeology: Locality No. 1 is the type site of the Clovis culture and a National Historic Landmark.

Ten thousand years ago a young woman died here. She was laid into a grave atop a hill overlooking the lake and buried with a few of her possessions.

In 1967 amateur archaeologists spied her remains, which had become exposed in the bank of a road cut. The bones were excavated and donated to the Blackwater Draw Museum at Eastern New Mexico University, where they were exhibited from 1969 to 1985. In 1990 the late-Pleistocene age of the skeleton was confirmed when the Research Laboratory for Archaeology at Oxford University reported a preliminary OSL date of $13,100 \pm 2450$ CALYBP as well as two AMS radiocarbon dates of 10,700 and 9250 RCYBP. Inexplicably, these results were never published, and no serious effort was made to uncover this woman's life story until Dennis Stanford, director of the Smithsonian Institution Paleoindian/Paleoecology Program, became aware of the discovery during a visit to the museum in 1998.

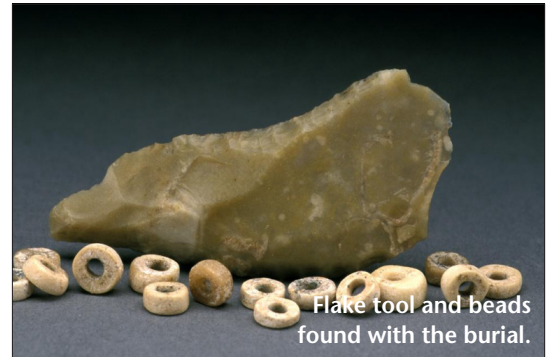
In 2000 Dr. Stanford and his colleague at the Smithsonian, physical anthropologist Dr. Doug Owsley, set out to reopen this coldest of cold cases to see what new information this discovery could provide "on the people and burial practices of ancient North America." For expert support they assembled an interdisciplinary dream team: Smithsonian archaeologist Dr. Margaret Jodry; geochronologist Dr. Tom Stafford, who owns and directs Stafford Research Laboratory; and Dr. C. Vance Haynes, Regents Professor Emeritus of Anthropology at the University of Arizona.

The results of their studies—analysis of the skeleton, associated artifacts, and the burial site—are found in *Arch Lake Woman: Physical Anthropology and Geoarchaeology*, the first vol-

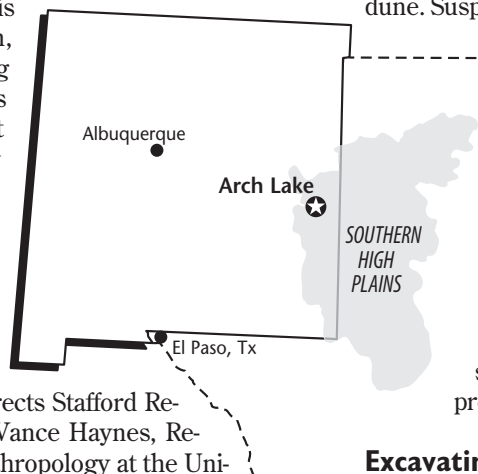
ume in the Center for the Study of the First Americans Peopling of the Americas Publications published by Texas A&M University Press. (See the rear cover of this issue for ordering information.)

ARCH LAKE WOMAN

A Fleeting Life on the Southern High Plains



Flake tool and beads found with the burial.



The discovery

In May 1967 Cecil and Linda Clark, accompanying avocational archaeologist Gregg Moore, noticed evidence of a human burial exposed in the bank of a road cut through a late-Pleistocene sand dune. Suspecting the remains might be of a great antiquity, they

notified James Warnica, president of the El Llano Archaeological Society of Portales, New Mexico.

A visit to the site the following day convinced Warnica of the significance of the burial, and he

contacted Dr. F. Earl Green of Texas Tech-

nological College. They agreed that it was

imperative to excavate the burial immedi-

ately lest the remains became lost to vandal-

ism or continued slumping of the road cut.

Fortunately they made detailed notes on the burial and its stratigraphic location and photographed the skeleton before removing it. These records later proved invaluable to Owsley and Stanford.

Excavating the burial

Most of the skeleton was found in place about $2\frac{1}{2}$ m below the modern surface. The grave, about 32 cm wide and 1 m beneath the late-Pleistocene surface, had become covered over the millennia by about $1\frac{1}{2}$ m of windblown sand.

In the process of uncovering the bones, Green and the others found a chipped-stone tool. Green, realizing it could be a Paleoindian artifact, wisely decided that he and his team weren't equipped to deal with a discovery of this potential significance. Taking care not to disturb the bones, they excavated around them, encased the entire burial in a plaster-and-burlap jacket supported by a wooden frame, and removed the entire burial in a

of the new book. It contains a wealth of new information about the life, times, and untimely death of this young woman.

Age of the burial

AMS dates on a chemically purified sample of bone tell Stafford that the "more accurate and best estimate" of the age of Arch Lake Woman is 11,950–11,200 years CALYBP (10,020 ± 50 RCYBP). Although no projectile points were found with the remains, this age indicates that Arch Lake Woman lived during the late-Paleoindian period and could have belonged to the Plainview, Agate Basin, or Hell Gap cultures.

The bare bones

Arch Lake Woman is a remarkably complete skeleton. Features of her pelvis and skull reveal her sex. Her teeth and other details of bone development indicate she was between 17 and 19 years of age at death. A few small pieces of the cranium are missing, including most of the bones of the left side of her face and most of the lower jaw (mandible). The portion of the mandible that survives had become



The full skeleton of Arch Lake Woman.

single block of sediment matrix. The monolith, with the untold story of a young woman's brief life that it contained, was taken into the collections of the Blackwater Draw Museum of Eastern New Mexico University.

CSI à la Blackwater Draw

The new investigation was initiated February 2000 at the Blackwater Draw Museum. After inspecting the bones and sediment matrix, the team members cleaned the exposed bones, took sediment samples for later analysis, and extricated the cranium, lower left ribs, and limb bones so they could be closely examined and measured.

As part of the re-study, Haynes and Stafford returned to the discovery site to see if enough of the geological context of the burial had been preserved to reveal new insights. Although there was no trace of the original excavation, the general stratigraphy was preserved in the road cut. Consequently they were able to study the layers, collect sediment samples, and search for additional human evidence.

The hard-won results of these various studies form the core

disarticulated from the skull.

Arch Lake Woman's postcranial skeleton (the portion below the skull) is missing the right lower arm bones (radius and ulna), the right hand and all but a few finger bones from the left hand, much of the left lower arm, and most of the bones of her feet. Traces of recent gnawing on the mandible suggest that burrowing rodents attacked the skeleton after the road cut exposed it, which probably accounts for some of the missing bones.

The remaining skeleton is sufficiently complete to reveal that Arch Lake Woman is somewhat unusual, compared both with her few known contemporaries and with more recent Native Americans. For one thing, at 166.5 cm (5 feet 5½ inches) in

height she was taller than nearly all modern Native Americans except the Blackfeet. She also has a low face and eye orbits and a relatively large cranial vault, features that clearly distinguish her from all modern Native Americans but which she shares with nearly all well-studied skeletons of her antiquity. On the other hand, Arch Lake Woman differs from most ancient skeletons in having a relatively short and wide cranium.

Her teeth also reveal important differ-

Excavating the burial, May 1967.



F. EARL GREEN

ences between her fellow Paleoamericans and modern Native Americans. Her incisors show little of the "shoveling" characteristic that is so pronounced in modern Native Americans and their

Asian cousins as to be nearly diagnostic. A cluster analysis of other dental traits tells Owsley that she doesn't show "close affinities to any recent Native Americans." Either there has been a significant amount of evolutionary change over the last 10,000 to 6,000 years, or Arch Lake Woman and many of her contemporaries aren't closely related to modern Native Americans.

Looking toward the north bank of the road cut where the burial was located, February 2000. ►

Haynes describing the stratigraphic column along the north bank of the road near the location of the burial pit. ▼



Postcranial bones

For Owsley and his team, the most striking feature of Arch Lake Woman's postcranial bones is the absence of platymeria, the flattening of the upper part of the shaft of the femur caused by repetitive activity that stresses the bone and so alters its growth. This flattened profile of the bone in cross section, commonly seen in the femora of recent Native Americans, is strangely absent in Arch Lake Woman.

In spite of Arch Lake Woman's somewhat greater than usual height, her upper arm bones are both shorter than the average for all comparative groups and greater in circumference. An enlarged humerus usually indicates prodigious exercise of the upper arm muscles. Professional athletes such as tennis players, for example, that favor one arm in regular strenuous activity develop an enlarged humerus in that arm.

The levels of stable carbon and nitrogen isotopes in an organism's bones reveal the kinds of food in its diet and characteristics of its environment. Based on the nitrogen content of Arch Lake Woman's bones, Stafford concludes that her diet included a high proportion of meat and that her environment was commensurate with

Members of the investigating team at work (clockwise from left): Jodry, Joanne Dickenson, osteologist Rebecca Kardash, conservator Carolyn Rose (with brush), Owsley, and osteologist Kari Bruwelheide.



our ecological model of the Texas Panhandle in the early Holocene.

Burial offerings

Arch Lake Woman was buried with only a few artifacts. A necklace of 19 talc beads 5–7 mm in diameter formed an arc about 15

cm wide across her chest. The closest available source of talc is about 325 km to the southwest in southern New Mexico.

Photographs taken at the time of the excavation show some sort of bone tool placed near her ribs. Although it's now missing from the collection, it had one rounded end and appears to have been made from a large mammal bone (likely bison).

A flake tool found near her waist on her left side is a multi-purpose tool 51.2 mm long whose edge is suitable for cutting, scraping, and chiseling.

The toolstone is Edwards chert, which is found 200–250 km to the southeast in west central Texas.

A mass of red ocher about 65 mm wide, 75 mm long, and 55 mm thick was located along her left side between her lower arm and the upper part of her leg. This suggests to the scientists that rather than ocher having been deposited with the body as part of a burial ritual, it was placed in a leather bag tied to her waist; as the leather decayed over the centuries, the ocher diffused over the adjacent

bones. The flake tool, which was recovered in the same area, may also have been in the pouch or in another sheath that has disintegrated.

While excavating the sediment block the team also noticed some pink staining of the white sand, suggesting that red ocher was lightly sprinkled over the body as part of the burial ceremony.

What can we say about Arch Lake Woman?

She was young, not yet 20 years old, but tall and strong. Her large upper arm bones betray recurrent strenuous labor. Owsley and his team suspect she may have put in many hours scraping bison hides, an activity that would coincide with a diet rich in high-quality protein as indicated by the nitrogen stable isotope value measured in her bones.

The cause of her death is unknown. Whatever she died from left no traces on the bones that have survived.

Certainly death at her young age was a tragedy for her social group—her parents, siblings, friends, husband and children she may have had. Those who grieved Arch Lake Woman's untimely death selected for her gravesite the most

prominent hill overlooking Arch Lake. They dug the pit large enough to accept her body comfortably, and they dug carefully and deliberately, keeping the sidewalls remarkably straight and even. Her body was laid into the grave supine but slightly off center, with her left side resting against the sidewall and her head tilted to the right. Her left hand lay across her abdomen; her right arm had apparently slid off to the side.

They buried her with her few possessions, perhaps either because they believed she would need them in the next world or because they believed these personal things if retained might draw her spirit to them. It appears they dusted her body with red ochre before filling in the grave. If they ever wished to return to the gravesite to pay their respects, its location on the hilltop ensured they could find it again.




A debt of gratitude acknowledged

At the conclusion of *Arch Lake Woman: Physical Anthropology and Geoarchaeology*, the authors commend the original discovery team for their farsightedness in protecting the remains and

recovering them with much of the enclosing sediment intact: "Their recovery notes and effort to preserve the skeleton enabled the present study, allowing us in 2000 to examine these ancient remains as if we were part of the original team." Equally important, the staff of Blackwater Draw museum deserve credit for faithfully discharging their duty to preserve and maintain the remains so they could be studied by future scientists with new tools and methods. Hopefully the museum will continue to care for the remains so that some-

A frontal view of the Arch Lake Woman skull.

day a new generation of scientists, with even newer and better methods of analysis, can add chapters to this incomplete biography of one of the earliest known Early Americans. 

—Bradley T. Lepper

Suggested Readings

Boldurian, A. T., and J. L. Cotter 1999 *Clovis Revisited: New Perspectives on Paleoindian Adaptations from Blackwater Draw, New Mexico*. University Museum, University of Pennsylvania, Philadelphia.

Holliday, V. T. 1997 *Paleoindian Geoarchaeology of the Southern High Plains*. University of Texas Press, Austin.

Owsley, D. W., M. A. Jodry, T. W. Stafford, Jr., C. V. Haynes, Jr., and D. J. Stanford 2010 *Arch Lake Woman: Physical Anthropology and Geoarchaeology*. Texas A&M University Press, College Station.

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Bonnie Pitblado

continued from page 5



Some of these sites show potential for "buried Paleoindian occupation surfaces." When Pitblado and her crew plotted the sites on a map a pattern emerged: All 57 sites are within about a half mile of not one, but two water sources. This is one of the clues that will help the team predict where they might find future sites.

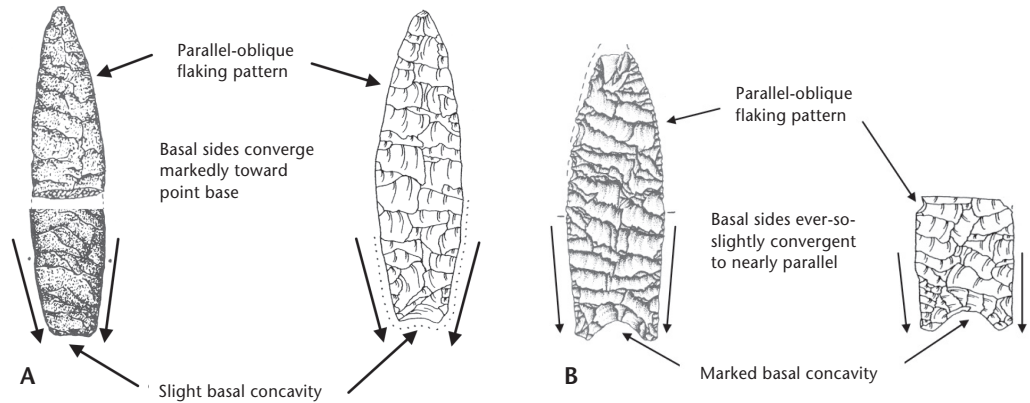
Last summer her team turned their attention to Utah and upped the tally of recorded Paleoamerican sites to 92. It will take some doing, but perhaps Pitblado and her students will eventually gather enough information to write a companion volume to *Late Paleoindian Occupation of the Southern Rocky Mountains*, tracing Paleo movement across this fascinating region as well.

A Tale of Two Migrations

Tracing the movement of the First Americans is what makes Pitblado tick. It was only a matter of time before she applied her skills to the big picture. Already online

Pitblado at 13,000-ft elevation amid blocks of Saguache Formation quartzite, Fossil Ridge Wilderness, Gunnison Basin, Colorado, June 2009.

Characteristics of Rocky Mountain point types Angostura (A) and Jimmy Allen (B) as defined by Pitblado (2007:316, 319).



(DOI 10.1007/s10814-011-9049-y) and appearing later this year in the *Journal of Archaeological Research* is her hypothesis about the arrival of the first immigrants and the peopling of the Americas. Titled *A Tale of Two Migrations*, it theorizes that the first colonizers from Northeast Asia likely followed a coastal route along Beringia in watercraft approximately 16,000–15,000 CALYBP. A second migration followed 1,000 years later after the appearance of the Ice-free Corridor. Supporting her theory with evidence from genetics and archaeology, she takes the reader from Siberia across Beringia and along possible routes through the Americas. She points out weaknesses and potentially contradictory evidence—and encourages other scientists to accept them as challenging research opportunities. Despite a few extra pieces to the puzzle that don't quite fit anywhere, her theory makes sense of our stumbling efforts over the better part of a century to figure out how and when the Americas were settled. It reads with an ease that belies the monumental research that made it possible, and it leaves the reader better informed of the possibilities of Paleoamerican research, Pitblado's first love.

What's next?

The reputation that precedes Bonnie Pitblado is one of approachable, friendly brilliance coupled with a lot of hard work, and it's dead on. Whether scaling the Rocky Mountains (physically or mentally), tracking Paleoamericans, or developing new field methods, she does it all with the right balance of seriousness and good humor.

Pitblado practicing her second love, scuba diving, at Cozumel, Mexico, 2010.



JOSEPH DUJIN

Suggested Readings

- Brunswig, R.H. and B.L Pitblado (editors) 2007 *Frontiers in Colorado Paleohindian Archaeology: From the Dent Site to the Rocky Mountains*. University Press of Colorado, Niwot.
- Pitblado, B.L., C.M. Dehler, H. Neff, and S.T. Nelson 2008 Pilot Study Experiments Sourcing Quartzite, Gunnison Basin, Colorado. *Geoarchaeology* 23(6):742–78.
- Pitblado, B.L. 2011 A Tale of Two Migrations: Reconciling Biological and Archaeological Evidence for the Pleistocene Peopling of the Americas. *Journal of Archaeological Research* (DOI 10.1007/s10814-011-9049-y).

Will we next find her scuttling up north to locate some of the earliest sites that today may lie underwater? Among her list of activities we find scuba diving. She deems herself “capable of diving in the places I think we should be looking without dying of hypothermia.” But she also confesses to a love of the soft life. “I like my diving tropical, my drinks utterly *frou frou* and with umbrellas, and my attire decidedly skimpier than what I’d need to wear to sleuth out peopling sites where I think they’re likeliest to be. Hardy graduate students and polar bears, take note!”

Both would be lucky to work with Dr. Pitblado. 

–K. Hill

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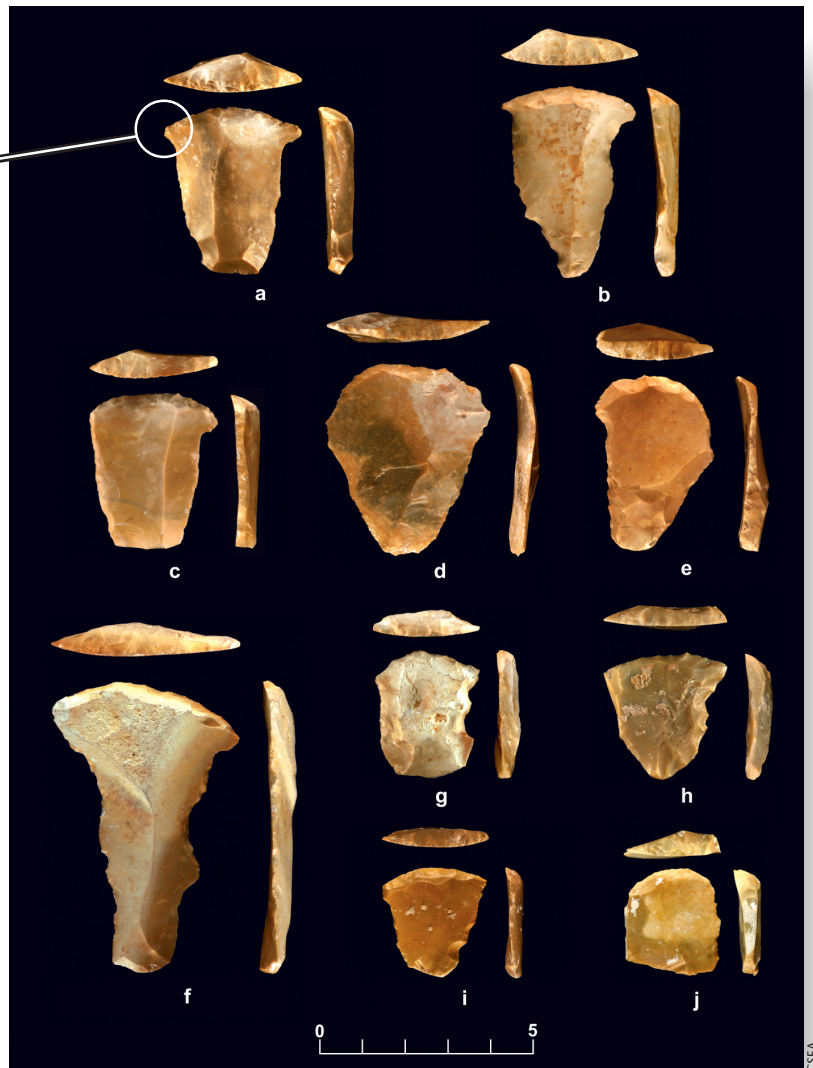
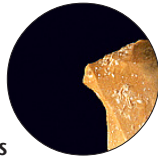
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OVER THE PAST HALF CENTURY the fluted point has basked in the full sunshine of Clovis research while the humble endscraper has languished in the shadows.

Numbers don't account for this disparity in attention—at most sites endscrapers vastly outnumber fluted points. If not

with the fluted point. What it does superbly, though, is illuminate details of Paleoamerican life—mobility, residential patterns, migratory habits, and soft technology. Through microwear analysis Loebel teases out information about the day-to-day activities of Paleoamericans and in the process en-

Endscrapers from the Gault site in Texas. Spurs found on endscrapers, likely the result of repeated resharpenings, sometimes show use wear, suggesting exhausted endscrapers were used as graters or burins.



Endscrapers

Paleoamerican Workaday Tools

numbers, then what? Anthropologist Thomas Loebel of the CAGIS Archaeological Consulting Services at the University of Illinois at Chicago believes an atavistic response is triggered in a primitive recess of our psyche by the sight and feel of a sleek killing instrument, the Clovis fluted point. Most of the early Clovis sites, Dr. Loebel reminds us, were discovered not because of initial finds of artifacts but because they were associated with deposits of bones of extinct large animals. “As a result, the record has been biased toward kill sites,” he points out, resulting in a male-centered emphasis in archaeological research on hunting camps and projectile points.

The endscraper can't compete in the glamor department

riches his database. The key, he says, is recognizing that “there is a lot of information encoded in what was previously considered a very secondary artifact class.”

Getting acquainted with endscrapers

Like many stone tools, endscrapers are categorized morphologically and their use is deduced by ethnographic comparisons. Though irregular specimens are occasionally found, endscrapers tend to be triangular in shape, with the working edge oriented opposite the striking platform where the tool would be either held or hafted.

In the case of endscrapers from the Gault site in central

Texas (MT 20-1, -2, "Assault on Gault"), microwear analysis shows evidence of hafting. It's this hafting that probably accounts for distinctive spurs that project beyond the lateral edge. "When you find them," says Jim Wiederhold, CSFA microscopist and authority on microwear analysis (MT 19-2, "Use Wear: A Hands-on Study"), "it's a sign it's a Paleoamerican site." Loebel agrees with Wiederhold that spurs are most likely a by-product of resharpening hafted endscrapers and aren't intentional. Their presence probably signals that the tool was nearing the end of its useful life. Any use detected by microwear analysis therefore must have occurred after the scraping edge was ex-

Endscrapers knapped and hafted by Wiederhold after the style of Paleoamericans. The haft on the right is about 8 inches long.



JAMES E. WIEDERHOLD

hausted and the tool unhafted, making the spurs a tool of opportunity rather than design. Wiederhold has in fact found microscopic evidence that discarded spurred endscrapers were used as graving or scoring tools.

Resharpen one last time, then good-bye

An endscraper is exhausted when, after repeated resharpenings, the edge angle becomes too steep to scrape hides or the body becomes too small to support hafting. "A very interesting pattern that I've been able to pick up after studying a number of these sites," Loebel says, "is that when endscrapers are discarded, often they don't have a lot of wear on

Loebel (left) at the Ambler Clovis site (11L5981) in northern Illinois with students Hector Quintero (center) and Greg Bower.



THOMAS J. LOEBEL

them. That tells me they've attempted to resharpen it one last time before they discarded it." At this point the tool might be recycled and used on other materials. Wiederhold's analysis of Gault endscrapers confirms that although they may have started as hide-working tools, "before they were discarded they were used to work harder materials like antler, wood, and bone."

Loebel cautions against accepting at face value what appears to be wood polish. Some endscrapers found at the Nobles Pond site in Ohio, the Gainey site in Michigan, and the Hawk's Nest site in Illinois exhibit wood polish and striations indicative of a scraping or planing motion, but only along small areas of the lateral edges. Closer examination of the distal edges, however, shows little or no wear. What appears to be use wear is actually damage caused by failed resharpening. "Retouch takes a lot of that microwear polish off the edge," he explains, "and what you are left with is an endscraper with a steep distal edge with a lot of edge damage." An observer might interpret that as contact with a very hard material and deem the tool a woodworking implement, but high-powered microscopy reveals no evidence of wood polish and, in fact, little polish of any sort on that edge. These scrapers show heavy bit damage from resharpening but little use wear. Loebel suggests that when they were no longer suitable as endscrapers to work hide, they were unhafted and used as sidescrapers to whittle wood. "But occasionally you'll catch a little facet of that edge that was not resharpened off," Loebel says, "and what you tend to find there is more developed hide wear. It isn't something you'll see with the naked eye or even with a low-powered microwear approach, but you'll catch it with the high-powered approach."

Wiederhold's extensive analysis of endscrapers from the Gault site gives him a slightly different interpretation from Loebel's. The wear Wiederhold observes on Gault scrapers consists of stacks of step fractures. He doubts that the edge damage on the scrapers he has examined is the result of a last effort to get a usable edge before discard. "I wonder," he says, "if Clovis people would waste time trying to rejuvenate an edge knowing this would likely be the result." He considers it more likely that an exhausted scraper was subsequently put to use as an expedient tool. This, he says, "would produce edge damage with a lack of polish, which is consistent with what Loebel describes and what I saw."

It's worth noting that Gault was a site blessed with abundant

high-quality toolstone, whereas the sites that Loebel investigates are sometimes found hundreds of kilometers from sources of toolstone. Loebel notes that his work at multiple sites “clearly shows a pattern of last-ditch attempts to get one more use out the tool before discard.” Such peculiarities as undetached resharpening flakes and irregular fresh edges next to areas of heavier older wear are signs to him of toolmakers working under stress. Gault toolmakers, it appears, indulged in wasteful practices that simply weren’t options for most Clovis people.

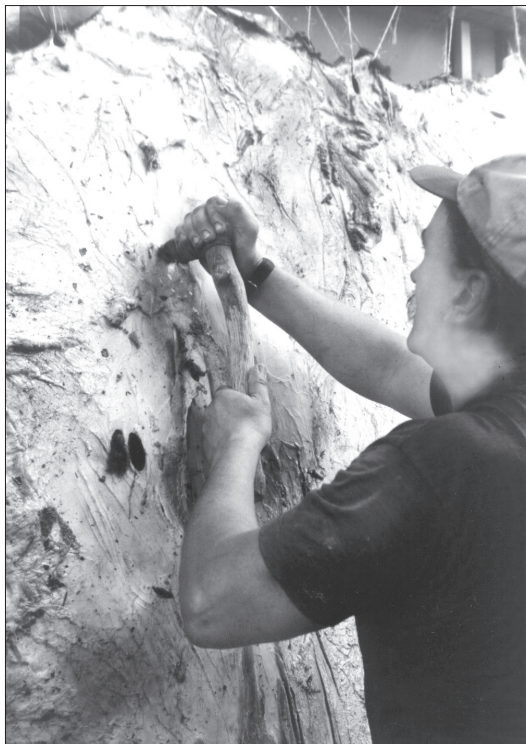
What it takes to be a microwear analyst of the caliber of Loebel or Wiederhold is first-class equipment, years of experience, and the ability to resist the urge to rush to judgment.

A window into Paleoamerican life

Endscrapers, like other lithic tools, are a permanent record of Paleoamerican travels across the landscape. By studying the mineral makeup of a stone tool, scientists can often pinpoint the quarry where the knapper obtained the toolstone. Correlating the source of the raw material and the location where the tool was eventually discarded gives the scientist a road map of Paleoamerican migrations and trade routes, which may cover astonishing distances, sometimes hundreds of kilometers.

Endscrapers speak volumes about social organization as well. Their principal use was in working hides. Wiederhold, who has scraped many hides of bison and other large animals using stone endscrapers, speaks from experience when he describes it as a two-handed operation that takes a lot of muscle. “It’s hard work,” he says, “very labor intensive,” and adds drolly, “which is why it was usually relegated to women.” The very presence of endscrapers therefore identifies a working camp rather than a hunting campsite. “Now we’re talking about the movement of not just a hunting party, but women, children, and elderly as well,” says Loebel. “It’s a more accurate reconstruction of not just

the technological organization of what these guys are doing on the hunt, but the social organization of Paleoamericans, and that’s a very understudied area.”



CHARLOTTE PEVNY

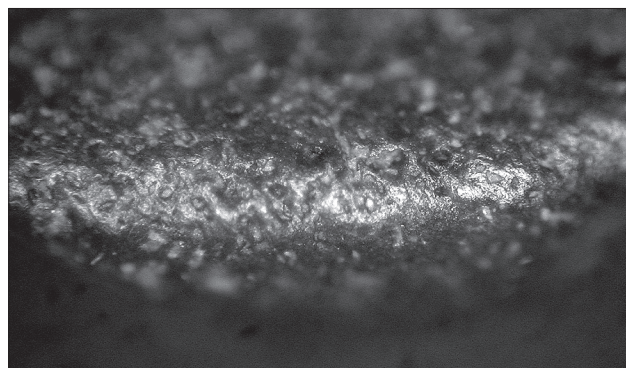
A proxy for organic preservation

Studying endscraper microwear reveals details of everyday Paleoamerican activities that simply can’t be fathomed by other means, given the paucity of organic materials from the Clovis culture. With rare exceptions, stone tools are the only artifacts that have survived. Fortunately for us, the ubiquitous endscraper records in the distinctive polish on its edge how it was put to use, particularly in working hides. There are different stages of hide work, Loebel explains, early-stage work, called grease hide, and middle- to later-stage work, called dry hide. Working hides at each of these stages leaves a unique polish on an endscraper. By identifying the kind of polish, the archaeologist can infer the season when a site was occupied.

If an archaeologist is lucky, seasonality at a site can be inferred from such evidence as the presence of fetal bones, pollen profiles, and plant re-

Wiederhold scraping a bison hide with a hafted endscraper.

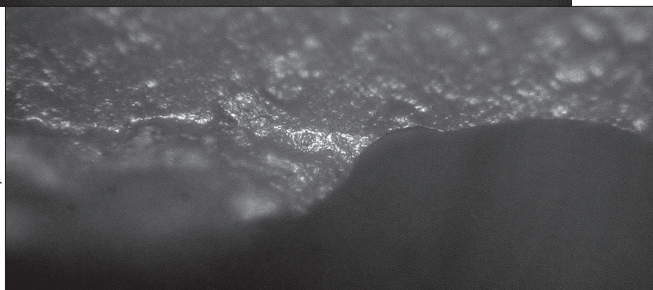
mains. Most of the time, however, Clovis-age sites lack these telltale organic clues. But now we’re learning how to get this information from stone tools, especially endscrapers. “It’s a way,” says Loebel, “of getting around our poor record of organic preservation.”



The hides of game animals, particularly caribou, are best when taken in late summer and early fall. That’s when there would be a frenzy of hide processing to build

◀ An endscraper edge exhibiting heavy dry-hide wear.

▼ An endscraper edge that has been recently resharpened but with older heavy hide wear visible to left.



BOTH: THOMAS J. LOEBEL

up a stockpile to satisfy the group’s needs at least until the next spring. A fresh hide must be stabilized as quickly as possible by scraping and letting it dry. Once scraped and dried, the hide is protected from rot-

ting and is also considerably lighter to transport. This first stage of scraping, the grease-hide stage, requires a very sharp endscraper. Wiederhold, speaking from experience, notes that

working large hides, particularly bison, requires a sharp scraper also in later stages to remove hair and to thin the hide. To avoid damaging the hide, however, he notes that the edges must be rounded in plan view.

For the later stage of hide working, the dry-hide stage, where thinning and dehairing aren't required, a steep-angled, sharp-edged endscraper is undesirable because it might tear the hide. An endscraper with a more rounded edge is a better tool for softening and stretching the hide. Microwear analysis of polish confirms whether the tool bears a dry-hide or a grease-hide signature and therefore the activity that was taking place when the tool was discarded.

And we haven't yet teased out all the information these mute stone tools have to tell us. By figuring the ratio

Loebel in the lab.



THOMAS LOEBEL

of dry-hide to grease-hide signatures, together with the ratio of projectile points to endscrapers, we get a fuller picture of the kinds of activities the camp community was engaged in. A lithic assemblage dominated by projectile points and large numbers of manufacturing failures doesn't indicate an active hunting site, but rather a base camp located in a prime location to scout for game and gear up for hunting. Hides being processed would already have received early-stage preparation. Endscrapers therefore would likely bear the dry-hide signature. These clues describe a community workshop, knappers and scrapers hard at work.

If, on the other hand, endscrapers with grease-hide polish and projectile points fractured by use dominate the collection, we're probably looking at an active hunting site, where fresh hides have to be stabilized as quickly as possible.

At the Hawk's Nest site the ratio of dry-hide:grease-hide endscrapers was 2:1 and no finished fluted points were found. At the Gainey site Loebel found the reverse is true; grease-hide endscrapers outnumber dry-hide 2:1, which indicates an active hunting campsite. At the Shawnee-Minisink site in Pennsylvania (MT 22-2, "A Spring That Keeps Flowing—The Shawnee-Minisink Clovis site"), a site respected as a good foraging model, numerous endscrapers were found—and they weren't used to peel vegetables. The grease-hide:dry-hide ratio at Shawnee-Minisink measures 3:1, which tells Loebel that hunters there were successful and numerous—so numerous, in fact, that he predicts that future investigations will recover more discarded weapons at Shawnee-Minisink.


Finishing the scraped hide

The archaeology portfolio currently lacks evidence that Paleoamericans developed skill at tanning hides (hides, like

other perishable materials except a few tools made of bone, would have disintegrated and vanished after 13,000 years). Artifacts in museum collections are ample proof that hunter-gatherers of later cultures mastered the craft. Weiderhold, in fact, stole a leaf from their book and mastered their art of brain-tanning deerskins. In this method, the brain of the animal is kneaded into the hide. Fats and oils from brain matter soften the skin and give it the texture of heavy cotton flannel. This isn't

true tanning, he emphasizes, a fact that becomes immediately apparent if the wearer makes the mistake of getting it wet. Hides can be tanned by smoking or by soaking in a stew of oak bark and leaves.

Abundant ethnographic examples of hide working and use invite us to assume that Paleoamericans knew how to tan the hides they collected in such plentiful quantity. To find a fragment of a moccasin or deerskin garment at a Clovis site is, of course, a stroke of unbelievable luck that no archaeologist would dare hope for. Nonetheless Loebel tells us this is "another very interesting problem I'm working on at the moment." It's a

problem to be solved by building up a database until a pattern emerges, the same way he developed an understanding of endscrapers, these "funny little stone tools" and the men and women who knapped and used them. "To concentrate on the exception rather than the rule is not good science," he explains. "You have to go where the pattern lies to have the most competent confident interpretation." 

—Dale Graham

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Suggested Readings

Shott, M. J. 1995 Curation, Use Rates and the Formation of Scraper Assemblages. *Lithic Technology* 20:53–72.

Weiderhold, J. E. 2004 Toward the Standardization of Use-Wear Studies: Constructing an Analogue to Prehistoric Hide Work. M.A. thesis.



Smallwood with a showpiece biface from the Sinclair site in Tennessee.

What It Means to Be Clovis

TOM PERTIERRA

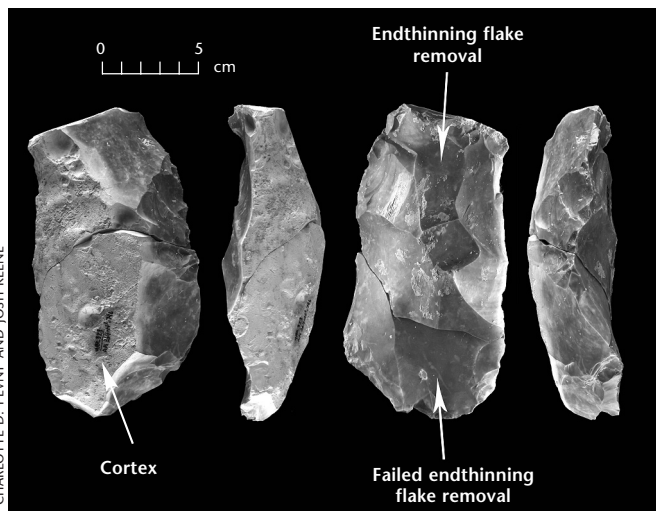
Part II: Reducing Clovis Bifaces

UNTIL ABOUT 10 YEARS AGO, much of what we knew about Clovis technology was gleaned from a handful of kill and kill-related camp sites located from the Plains west, and from cache sites scattered from east of the Mississippi River to the Cascades. Highly used, discarded points and other tools—associated with the re-

mains of Pleistocene prey—shaped our early perceptions of Clovis life. Large “platter-like” bifaces recovered from cache sites kept the focus on biface technology (MT 22-2, “Snapshots in Time: New Insights from Clovis Lithic Caches”). While hunting megafauna was definitely an important aspect of Clovis subsistence (at least in some parts of the country), it’s only one piece of a complex puzzle—a puzzle that we continue to fill in as new pieces are found.

Ashley Smallwood, a doctoral candidate at Texas A&M University (MT 21-4, “Clovis at Topper”; MT 20-1, -2, “Assault on Gault”), has aptly dubbed this viewpoint “kill-centric” because it’s based on a narrow range of site types, which means the toolkits recovered from these locales also are “narrow.” That is, they were used for specific activities most likely related to acquiring and processing game. Smallwood drives home this point by demonstrating that Clovis biface technology in the eastern U.S. embodies greater design flexibility and variation than we ever realized.

Ashley’s story is too interesting not to tell, and we’ll come back to it in a bit. But before we dive into finished tools, we need to understand how a Clovis projectile point—or any other bifacial tool—is actually produced. Where to start? Well, at the beginning is usually best. . . .



CHARLOTTE D. PEVNY AND JOSH KEENE

Early-stage primary biface. It broke in a failed attempt to remove an endthinning flake from the bottom, which resulted in a plunging fracture. Note the thick cross section, (4.6 cm thick, compared with the late-stage preform, 0.98 cm!), remaining cortex, and widely spaced flake scars that carry across the midline.

Looking for rock in all the right places

Being the fickle creature that she is, Mother Nature has ensured there's a lot of variability in geologic formations. This means that rock, in its *au naturel* state, varies across the landscape in size, abundance, and quality. Simply put, some types of stone were more desirable than others. Clovis knappers were savvy. They sought the best-of-the-best toolstone, and they're renowned for traveling distances upwards of 1,000 km to get it to make projectile points and other tools.

What determines how a piece of stone will be used? An obvious important consideration is the immediate need to produce a certain kind of tool, whether a point or scraper or knife.

Primary bifaces. Note the large flake scars that carry across the midline, most obliquely oriented, some perpendicular to the long axis of the biface. Endthinning flake removals are visible on one or both faces of three of these bifaces. Note the remnant bevel on the bottom left biface where two endthinning flakes were removed. One of these endthinning removals terminated in a deep hinge fracture, but didn't break the biface.

The size, abundance, and quality of the toolstone are decisive factors as well. Let's take a moment to define these often employed descriptors of lithic raw material.

Rock comes in many shapes and sizes, sometimes occurring in smaller forms like cobbles and pebbles that were shaped by marine or riverine environments, sometimes occurring as huge outcrops of bedrock that seem little affected by time. Raw material size, **package size** in Lithics Speak, plays an important role in determining the size of a finished tool. And size matters a great deal in some aspects of Clovis technology. Take the bifaces from the East Wenatchee cache in central Washington or the Anzick cache in Montana—many are over 9 inches long and range upwards of 12 inches!

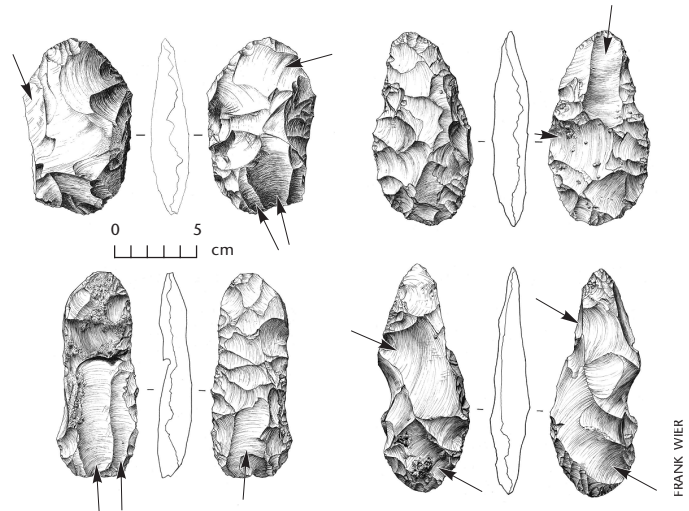
While we don't normally think of stone as a limited resource, some regions of the country just don't have readily available toolstone. Material then has to be transported, hence all those caches of Clovis blades made from high-quality Edwards chert that have been identified on the Southern Plains. In contrast,

Secondary bifaces. Secondary bifaces are thinner in cross section, with less sinuous edges and smaller flake removals compared with primary bifaces (though there are flake removals that occasionally carry over the biface midline). The refit on the left was broken during an attempt to remove an endthinning flake; if successful, the endthinning flake would have removed the thicker portion of the biface. Overshot flakes have been removed from the left biface and both faces of the right biface as shown.

large quarry-related Clovis sites like Gault and Pavo Real are located along the Balconnes Escarpment in central Texas right at the source, where Edwards chert can be found in abundance. Clovis folks returned to this area again and again for rock, as well as water and food.

Quality refers to the "flakeability" of stone. Some types of

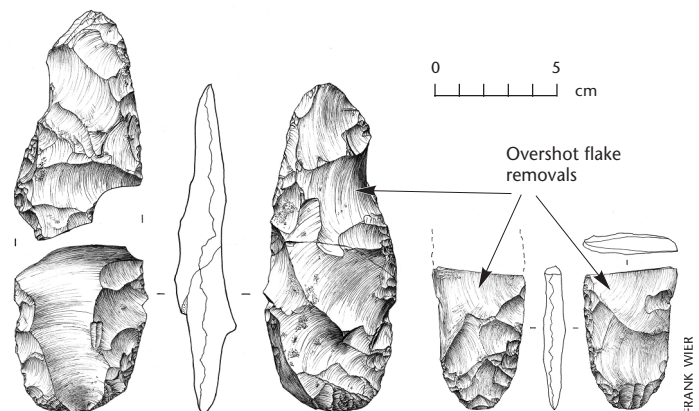
stone (quartzite or basalt, for example) are just harder to work than others like common chert. Three important properties of lithic toolstone not only influence the way material fractures, they also make stone highly desirable for making tools. **Brittleness** refers to how easily lithic material will fracture. A



FRANK WIER

high degree of **elasticity** ensures that a piece of stone is flexible enough not to shatter into small, unusable fragments. Finally, toolstone should be **homogeneous**, or uniform, usually with high silica content (especially glass-like obsidian). Flaws or cracks in the raw material invite knapping grief because they yield unpredictable results when fractured.

That's not to say that Clovis knappers couldn't use their bag of technological tricks to make the tools they needed out of lower-quality, less-desirable stone. They most certainly did. The quality of Edwards chert is renowned, but like other products of nature, it varies between outcrops. The legendary Georgetown variety of Edwards is still desired by modern-day flintknappers. Clovis folks had difficulty making bifaces from the Pavo Real variety, a much grainier, poorer-quality type of stone, but this didn't stop them from using it to produce long, sharp blades.



FRANK WIER

A Clovis technological conundrum

After choosing their toolstone, how did Clovis knappers go about making a biface? Bruce Bradley has maintained since the early '90s that where we're ignorant about Clovis biface reduction is the beginning steps of the whole process. Though we have lots of examples from caches and kill sites,

those bifaces are either finished points or specimens far enough along the trajectory that the initial stages of the reducing sequence are obscured and simply can't be detected. Luckily we've recovered evidence from manufacturing locales that illuminates the strategies Clovis knappers employed in the initial stages when reducing bifaces and blades.

Over the last 10 years, extensive excavations at the Gault site have yielded an enormous lithic assemblage—and I mean *enormous*—over 600,000 artifacts to date from the Clovis component alone! Most of these artifacts consist of debitage, which is the waste or by-products created when making stone tools, resharpening and maintaining tools, and maintaining or rejuvenating a *core*, the stock used to make blades and bifaces. Even though it can be considered waste (it was, after all, discarded at the site), these by-products give us valuable information about how bifaces and blades were made.

Well, it turns out the early stages of reducing aren't quite as clear-cut as we'd like. Both bifaces and blades were produced at the Gault site, and in most instances the by-products associated with each technology are clearly distinguishable. Making blades creates as debitage conical and wedge-shaped cores, crested blades, and core-tablet flakes. Reducing bifaces, on the other hand, creates as debitage rejected bifaces and two kinds of *biface thinning flakes*, *overshot flakes* and *endthinning flakes*.

However, several types of flakes associated with initially reducing the piece of toolstone, preparing the core and platform, and maintaining the core could be debitage from either reducing bifaces or making blades. These ambiguous flake types, sometimes referred to as "normal" flakes (go figure! there's nothing normal about them), have thrown a wrench into our attempts to separate evidence of the earliest stages of two technologies, biface manufacturing and blade manufacturing, because both technologies begin with the same type of locally available chert, which occurs in rectangular to sub-rectangular forms. Clovis knappers had to execute the same steps at the beginning, whether they were making a projectile point or a passel of blades.

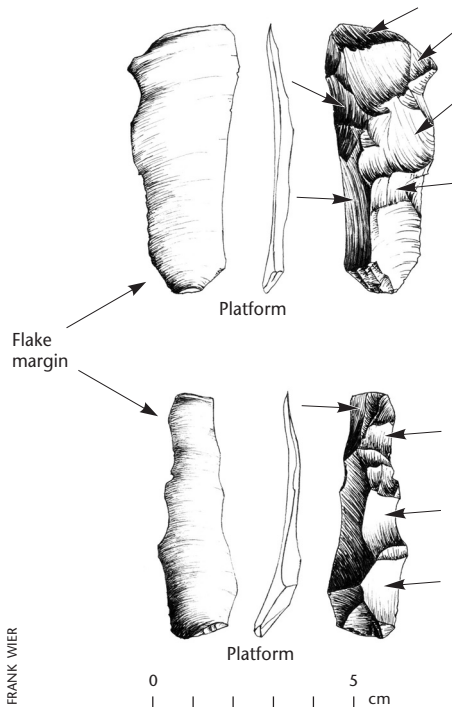
Reducing Clovis bifaces

The good news is, once the toolstone has been initially reduced and a recognizable shape appears (either a biface or a biface core), each technology follows a distinct trajectory and each creates unique by-products. What's even better for us, the total evidence from reducing bifaces found at Clovis sites with good contexts (Gault, Murray Springs, Topper, etc.) generally conforms to a standardized process, though it occasionally varies because of different raw materials and the individual practices of

different knappers. Bifaces are usually divided into three groups depending on the stage of the reducing sequence. *Primary bifaces* occur early on; *secondary bifaces* represent the middle portions of the reducing sequence; *preforms* are bifaces in the final stage of becoming a typical fluted Clovis point.

Primary bifaces are relatively thick and may retain *cortex* (the textured "rind"). They are generally rectangular to ovoid in shape, though some taper towards the distal end and have a straight base. The edges are very sinuous at this stage. *Lateral thinning* of primary bifaces refers to removing large biface thinning flakes. If they extend to the midline or beyond we call them *overshot flakes*. Controlled overshot flakes, on the other hand, traverse completely across the biface and successfully remove either the cortical or flaked edge. The biface is *longitudinally thinned* at this stage by detaching long, narrow endthinning flakes, usually from a bevel at the base of the biface; new *platform* surfaces along the lateral margins of a biface are prepared by removing endthinning flakes close to the lateral edges. This combination of techniques for removing flakes creates the subradial and radial flake scar patterns typical of early-stage bifaces.

Although primary bifaces show little evidence



Endthinning flakes. These are typical specimens that were removed during the middle reducing stages. The arrows show the direction of previous flake removals, which are oriented perpendicular or slightly oblique to the long axis of the flake. The scars are from flakes previously removed from the lateral edges of a biface. Note the parallel lateral flake margins.

of platform preparation, many cortical biface thinning flakes show evidence of extreme abrasion, which can completely obliterate any flake scar facets.

During the initial operations of the reducing sequence, the goal is to maintain desired biface length and width while quickly and efficiently reducing biface thickness. Many bifaces recovered from Clovis sites were rejected because of knapping errors or material flaws, but others were abandoned simply because they weren't long enough to make into projectile points. Conserving biface length during the reducing process produced a point long enough so it could later be reworked if broken when pursuing game.

Secondary bifaces are thinner than primary bifaces, and the cortex has usually been removed by this point. They are lanceolate in shape with a lenticular cross section. Edge sinuosity has been reduced and edges have been refined, prepared platforms are evident in the form of beveled edges, and there are more isolated and abraded platforms on noncortical biface thinning flakes. Lateral flake scars, which commonly terminate short of the midline of the biface, are closely spaced and overlap. Sometimes on secondary bifaces an overshot flake scar extends past the midline, or a controlled overshot is removed, or endthinning flakes are removed.

Once a preform approaches the desired thickness and size, the final flaking sequence removes even smaller flakes. An occasional overshoot flake might be detached, but most large flake removals terminate near or just past the preform midline. After this flaking sequence forms the desired contoured surface, the lateral edges are trimmed to refine the overall lanceolate shape. Preforms have abraded bases or a prepared platform for removing a flute from both faces, but the lateral edges aren't yet ground.

Hot off the press: Clovis biface variability

The Topper site in South Carolina has a rich Clovis component. Having studied 174 bifaces and biface fragments made from locally available Allendale Coastal Plains chert, Ashley Smallwood has blessed us with a minutely detailed description of how knappers reduced bifaces at the site. These bifaces demonstrate that Clovis folks on the East Coast used the same reducing techniques described above, even though not all bifaces were intended to be projectile points. Although sites like Gault have produced a few bifacial tools like Clovis adzes and choppers, there's no solid evidence to date on how they were made. Another elusive piece of the Topper puzzle is 34 bifaces that are actually bifacial cores, choppers, adzes, knives, and wedges. These tools differ in that they aren't lanceolate shaped, nor do they have beveled bases for fluting.

Moreover, even bifaces from Topper that can be classified as preforms on their way to becoming Clovis projectile points vary considerably. Many are quite small, already no larger than extensively reworked Clovis points from other sites. This variation in size appears to be the consequence of a practical consideration: Allendale chert nodules come in all sizes, but not necessarily big enough for the task at hand. Thus variability in package size at Topper is reflected in the final mixed tool

Large cortical overshoot flake. The edge of the biface was removed when this flake was detached. Note the small, isolated platform, the expanding lateral flake margins, and the large flake scars visible on the exterior surface of the flake view to the left.

assemblage: larger preforms like those observed at other quarry-related camp sites, as well as smaller preforms that nonetheless could be made into finished points.

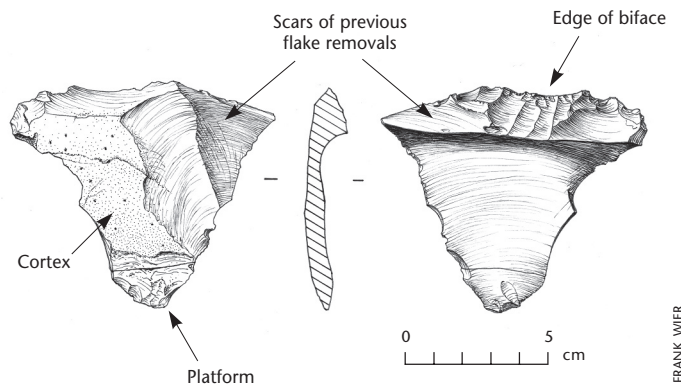
These two deviations confirm what we had learned about Clovis reduction strategies from sites in the south-central and western U.S., namely that Clovis knappers were fully capable of adjusting their techniques of reducing bifaces while still putting their "bag of tricks" to good use.

Lithics Speak: What is a reduction trajectory?

The foundation of debitage studies is the premise that stone tool manufacture is a reducing process and therefore can be modeled into stages. The whole process—from start to finish—is considered reductive in nature and is envisioned as occurring along a continuum or trajectory. **Lithic reduction** refers to the mechanical processes used to make stone tools and associated by-products. The term reduction is used because the methods involved in knapping stone are subtractive and

take away from the original form of the lithic raw material: Start with a whole rock and remove pieces of it to create a tool. A wit once described how to make a fluted point: Get a hunk of rock and chip away everything that doesn't look like a fluted point. Actual practice wasn't quite that easy. A reduction sequence, or **trajectory**, is the series of steps the prehistoric knapper executed to create a lithic product from raw material. Referring to Clovis lithic technology, these products may include such artifacts as bifaces or blades. **Debitage** is the lithic material that's removed when making and maintaining tools. Discarded tools, and the debitage created when making or retouching them, identify various stages or points along this continuum.

No absolute method for inferring a lithic reduction trajectory is known at this time because all the products and by-products of a particular trajectory are rarely found in association at the same site. In fact, implicit in the notion of a linear trajectory is the possibility that different stages of the process occur at different locations. The complete description of a reducing sequence is assembled from bits of knowledge learned by studying contemporary lithic assemblages at various types of sites in a region, such as quarry, workshop, and habitation sites. Thus, certain products or by-products of a reduction sequence that are rare or absent at a quarry site may be found at sites elsewhere in the region. Conversely, relocating chipped-stone tools or flakes to another site for further reducing or use affects our interpretation of what remains at that site.



Although biface reduction is a continuous process, archaeologists sort bifaces into gross categories from their earliest stages of reduction to completed tools. Texas State University anthropologist Michael Collins provided one of the earliest linear reductive models describing the process through which raw material becomes a finished product:

- 1) raw material acquisition,
- 2) core preparation and initial reduction,
- 3) primary trimming,
- 4) secondary trimming and shaping,
- 5) maintenance of the finished tool during its use.

Reduction generally begins with a suitable nodule of lithic raw material. The outer "rind" or cortex must be removed to expose the inner material. Debitage and other debris provide important information on what was reduced or produced at a site even in the absence of cores and bifaces. During primary trimming, the core assumes the general outline of the biface.

Careful attention is paid to maintain the cross section and to shape the edges of the biface. In secondary trimming, edges are straightened and final thinning is completed. The tool is now ready for hafting. Tool maintenance involves resharpening dull tools, reshaping broken tools so they can be used again, and recycling worn-out tools into other tools when necessary.

Lithics Speak: What are cores and bifaces?

A **core** is a piece of toolstone that is shaped by removing flakes. Clovis cores take several different forms and serve two main purposes. A core can be used to make flakes or blades, which may then be made into other tools. A core can also be reduced directly into a projectile point or other bifacial tool. Of course, a compromise between the two is also possible, and in this case a core—usually a biface as described below—can be used to make usable flakes, and the remainder itself can then be made into a bifacial tool.

A **biface** is an artifact flaked on both surfaces or “faces” to create a single edge. This edge serves as the platform to remove flakes. The biface served three primary roles for mobile hunter-gatherers: as a core, providing an efficient source of raw material for flakes; as a tool constructed for long use-life by virtue of edges that can be resharpened; and as a tool shaped to fit

a haft (most notably, a projectile point). A biface first used as a tool in a task such as skinning or butchering game could then be further reduced and made into a projectile point. This flexibility was important to hunter-gatherers who stayed on the move and needed to carry their tools in a light and compact load.

The intended product and the knapper’s skill altered reduction sequences and the technological characteristics of lithic artifacts through time. The form and quality of available raw material, as well as the distance to a quarry and to other critical resources, also contributed to variation.

Clovis projectile points were sometimes made in a single reduction trajectory (for example, a nodule reduced to a biface, which is then reduced to a point). They were also manufactured from very large flakes and blades. Bifaces weren’t reduced exclusively to make projectile points; other tools made from bifaces include such items as knives, adzes, and choppers.

Lithics Speak: The Clovis bag of tricks for reducing

In making blades and bifaces, Clovis knappers used a reper-

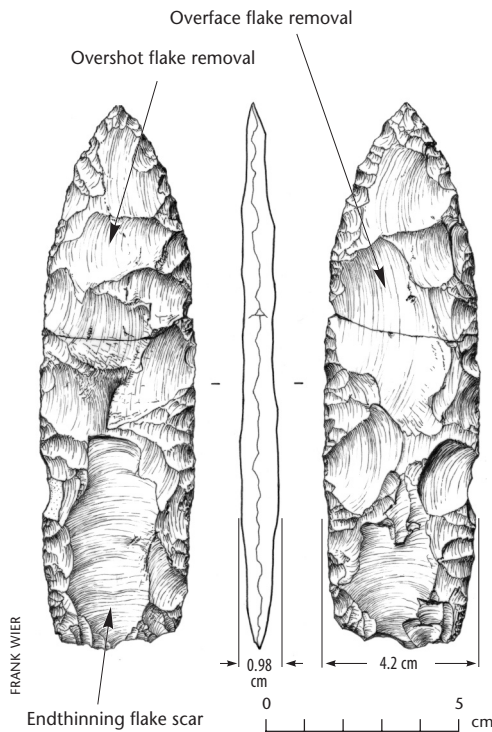
toire of techniques to prepare cores, overcome flaws in raw material, and correct manufacturing errors. These “tricks of the trade” promoted success in removing large flakes and blades. Two of these techniques, isolating and abrading, were methods used to prepare platforms.

In reducing a biface, **isolating** sets the platform apart from adjacent portions of the bifacial margin and provides a more precise target for a hammerstone or billet, thereby decreasing the chance of its hitting another portion of the edge and breaking the biface. **Abrading**, also referred to as **grinding**, thickens and strengthens a platform and creates a textured surface whose increased friction improves contact between the **percussor** (usually a hammerstone or billet) and the platform.

Clovis knappers minimized the risk of biface fracture by preparing well-isolated and -abraded platforms. However, overuse or underuse of either technique could cause problems. An overly isolated platform can yield an overly narrow flake with little mass; insufficient isolation generally produces a shorter, wider flake that may terminate in a **hinge fracture**. A bifacial edge not abraded enough may collapse, or a smaller flake than desired may be produced. If overly abraded, the percussor may be deflected from the platform surface and result in a failed flake detachment. These types of flakes, when found in Clovis assemblages and at large manufacturing sites, are sometimes interpreted as evidence of beginning knappers just learning their trade.

Their skill at successfully removing flakes from a biface, referred to as **biface thinning flakes**, makes

Late-stage preform. This refitted specimen has a thin cross section and scars from overface flake removals that extend across the preform midline almost to the opposite margin. This preform, nearly a finished Clovis point, was obviously made by a skilled knapper. The blow that snapped the tip off must have launched quite a cloud of blue smoke!



Clovis knappers the champions of Paleoindian biface technology. They’re called thinning flakes because that’s what they do: They reduce the circumference of a biface to help thin and shape a piece on its way to becoming a finished tool. Clovis biface thinning flakes are fairly easy to recognize based on a suite of attributes; they are typically large, thin, and curved, with parallel margins (**endthinning flakes**) or expanding margins (**lateral thinning flakes**). Their small, multifaceted platforms are often isolated and abraded. The scars of flake removals are observed on bifaces recovered from the site. These flakes generally extend past the biface midline and often extend to the opposite side of the biface.

Overface flakes are thinning flakes that extend past the midline but stop short of the opposite biface edge. These were desired by knappers because when scars terminate at or near the midline, this results in a thickened cross section that can cause knapping problems. Overface flakes leave a telltale scar on the biface, but they aren’t distinguishable from other lateral thinning flakes.

Two unique types of biface thinning flakes include overshot and endthinning flakes. **Overshot flakes**, also called **outré passé flakes**, were detached to rapidly thin bifaces and to remove problem areas from the lateral (side) margins of a biface. Overshot flakes have lateral margins that flare out or expand from the platform and are longitudinally curved. The platforms are generally small. What makes an overshot flake unique compared with other types of flakes is the way the flake terminates: The fracture travels across the entire face and removes a portion of the opposite biface edge. Removing an overshot flake leaves a distinctive flake scar that extends across the biface and rolls off the edge. An overshot flake, in other words, is just

egy of Clovis knappers. When expertly done, an overshot flake was detached in a controlled manner that removed only a narrow portion of the biface edge. Clovis knappers being human, however, sometimes a larger amount of the biface edge than intended was detached. Oops, another discarded biface.

If the midline mass of the biface is enlarged, the knapper must reduce it before continuing lateral thinning. **Endthinning flakes** reduce the central thickness of a biface without decreasing its width. They thin a biface longitudinally down its length starting from the base, rather like lifting a long splinter from a wooden board with the grain; their exterior surface bears characteristic transverse flake patterns. They have

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Suggested Readings

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an overface flake that extends completely to the opposite edge and removes part of it.

Overshot flakes were removed throughout the entire process of reducing Clovis bifaces, from the earliest stages when they were used to remove cortex right up to the final preform stage. Overshot flaking was an intentional strat-

parallel margins, are generally straight in longitudinal profile, and have small isolated and abraded platforms. Like overshot flakes, endthinning flakes were removed throughout the entire biface reducing process. In the final stages, these flakes become what we refer to as **fluting flakes**. 

—Charlotte Pevny