



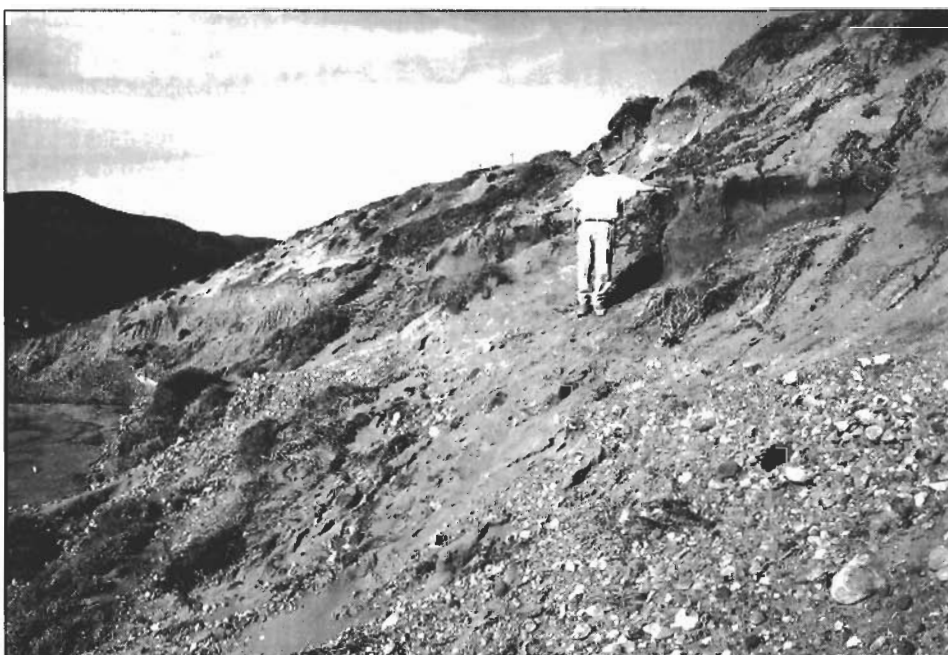
MAMMOTH TRUMPET

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Center for the Study of the First Americans
355 Weniger Hall, Oregon State University
Corvallis OR 97331-6510

Seeking Proof of Pre-Clovis in the West

A prospecting archaeologist points to a buried dune deposit near the coast of Baja California, one of the places in the West where geoarchaeologist Mike Waters suggests looking for archaeological deposits older than Clovis. Our report begins on page 9.



MICHAEL R. WATERS

The Center for the Study of the First Americans fosters research and public interest in the Peopling of the Americas. The **Center**, an integral part of **Oregon State University**, promotes interdisciplinary scholarly dialogue among physical, biological and social scientists. The **Mammoth Trumpet**, news magazine of the **Center**, seeks to involve you in the late Pleistocene by reporting on developments in all pertinent sciences.

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THE NORTH ATLANTIC HYPOTHESIS

Stanford, Bradley Think Technology Holds the Answer

The hypothesis that America's Clovis technology is linked to the earlier Solutrean culture of Europe, presented at the Clovis and Beyond Conference in Santa Fe, N.M., made widespread headlines

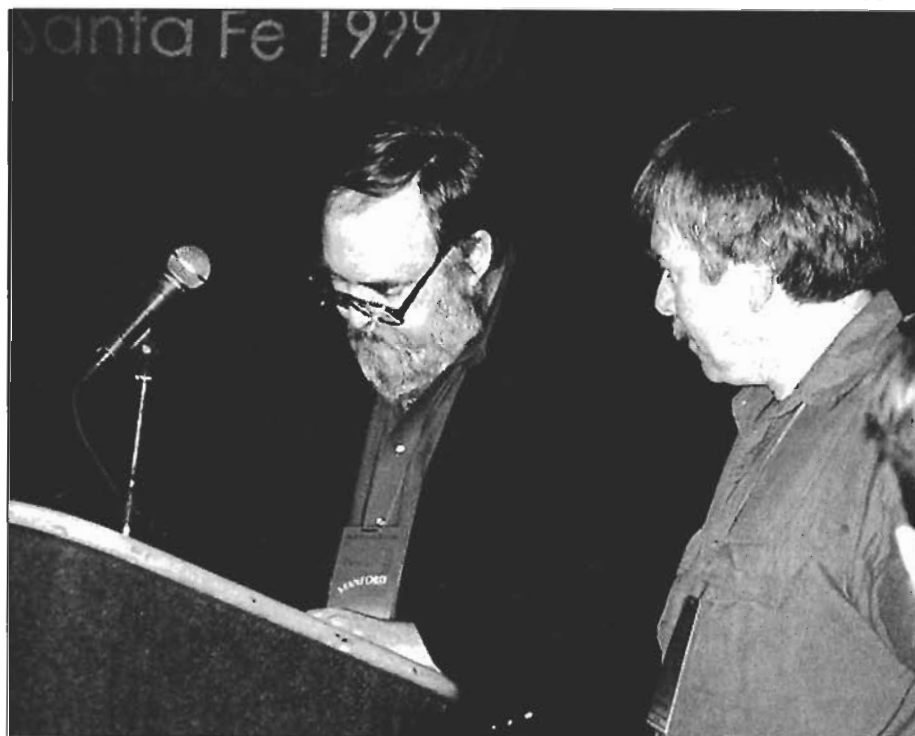
last fall. Although it is not a new idea, American archaeologists had so thoroughly rejected it over the past half century that only researchers of the stature of Dennis Stanford, Smithsonian Institution archaeologist, and Bruce Bradley, the widely respected lithic technologist, could have brought it back into serious consideration.

Dr. Stanford, who recently stepped

down as director of the Smithsonian's Anthropology Department, articulated their belief in a Solutrean-Clovis link at the conference's closing banquet Oct. 30. As a result, researchers now are considering Ice Age links between Europe and the Americas.

"I suspect... there will be a whole spate of work by everyone else trying to prove us wrong," Stanford told the banquet audience. "And that's great. That's what science is all about." He said that he and Bradley would be continuing to work on details of the hypothesis, and although his presentation was playful and sprinkled with laughs, the message was pro-

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Archaeologist Dennis Stanford, left, and geochronologist Thomas Stafford share the speaker's platform at the Clovis and Beyond Conference in Santa Fe. Stanford, conference co-organizer, questions Stafford about his presentation (see page 7).

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Leonard Ranch Expedition To Probe Ice Age Sediments

Would you like to spend two weeks of your summer working at an Ice Age site in a picturesque valley of Western Oregon? The **Center for the Study of the First Americans** Leonard Ranch Expedition 2000 is offering volunteers the chance to support and be part of a multidisciplinary field project in late June or July.

The Leonard Ranch site is in Coast Range foothills about 100 miles southwest of Portland. Paleontological excavations are focused around a freshwater spring. Preliminary testing in the mid 1990s revealed a paleontological site buried beneath a mudflow. A recent pilot study indicates that the site contains a record of ground sloth, an unusual Ice Age mammal, wood, gastropods, hair, and possibly archaeological material.

Principal investigator Robson Bonnicksen, Director of the **CSFA** and Professor of Anthropology at Oregon State University, says this summer's field research will focus on the excavation of well-preserved faunal remains from the lower levels. Team members will assist with mapping, excavating, and screen-washing to recover ancient inorganic and organic remains. Participants will tent-camp three miles from the site, on a 180-acre organic farm near the head of the Luckiamute River. A cook will prepare meals in the camp's field kitchen.

Three teams will be involved in two-week-long sessions: Team 1, June 19–June 30; Team 2, July 3–14; and Team 3, July 17–28. Team members will pay \$1,000 per person, or \$575 for a single week. For information, contact the **Center for the Study of the First Americans**, 355 Weniger Hall, Oregon State University, Corvallis OR 97330; ahall@orst.edu; 541-737-4595. A \$100 registration down payment, refundable a month before the session begins, gets members a detailed briefing book on the project. Full payment is due a month before the session starts; ask about family discounts and tax deductibility.

The overall objective of the Leonard Ranch Expedition 2000 is to develop a

systematic knowledge of the cultural and environmental history of the region and an understanding of the linkage between environmental and cultural change through time. The project draws on the expertise of a multidisciplinary research team of scientists: George Poinar, zoologist and entomologist; Herbert Huddleston, soil scientist; Jesse Ford, paleoecologist; and archaeologists Bonnicksen and Cliff Hedlund.

Dr. Bonnicksen lists these specific objectives:

1. Excavate late Ice Age sediments and soils adjacent to the spring vent using standard excavation procedures

(trowel-scoop-bucket), screen washing, and flotation procedures.

2. Map and photograph excavation walls, in situ specimens and other features of interest.
3. Collect sediment, soil, pollen, plant macrofossils, gastropods, fossil insect remains and artifacts. Expand our understanding of local and regional landforms, depositional and site formation processes by using standard geoarchaeological techniques.
4. Analyze sediments, soils, plant macrofossils, insects, hair, and flaked stone materials to reconstruct, when possible, the environmental history, settlement, subsistence, and lithic procurement patterns.

5. Develop a detailed chronological understanding of local and regional land-

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North Atlantic Hypothesis

continued from page 1

found. "We think that we have enough technological information that is very compelling for drawing a historical relationship between Solutrean and Clovis."

By presenting their hypothesis at Santa Fe, where many of the most prominent researchers involved with the earliest human settlement of the Americas were gathered, Stanford and Bradley certainly received the undivided attention not only of those who will work to prove them wrong,

Dennis Stanford's co-author, lithic technologist Bruce Bradley, left, talks with Forrest Fenn in one of the exhibit rooms at the Clovis and Beyond Conference last fall. Fenn, co-organizer of the conference, is a Santa Fe avocational archaeologist, publisher, and owner of the Fenn Cache of Clovis artifacts.



DOON ALAN HALL

but also those who could add credence to the hypothesis of a European connection with North America's Clovis tradition. As a result of this very public presentation, archaeologists working in Eastern and Southeastern states will necessarily be considering cultural material from any sites of Clovis age and older in a new light. Further, scholars surely will be looking anew at the European upper-Paleolithic sites in general and Solutrean sites in particular. And new emphasis is likely to be focused on the environment along North Atlantic ice margins late in the Wisconsin glaciation. Further, there is likely to be new interest in the antiquity of all very early archaeological sites in the East and possibly interest in underwater archaeology at places on the East Coast.

Stanford, a Wyoming native steeped in Paleoindian archaeology, has taken his time in proposing this alternate hypothesis to explain how some of the first humans entered the Americas. As he told the banquet audience: "I was schooled, as all of us were, in the uni-lineal model with Clovis being the earliest." He said that in the late 1950s and early 1960s, he started working with archaeologists Vance Haynes and George Agogino, and became acquainted with the late Marie

Wormington, then the foremost authority on Paleoindian archaeology. "I spent many happy hours at Marie's house talking about the ice-free corridor, and the northeast Asians coming down through it," Stanford told the banquet audience, "hunting mammoths—all the way to Tierra del Fuego."

Gradually, however, as he analyzed the evidence, "It didn't make that much sense to me," he said, adding: "Many of you know that as early as 1975 I started

proposing that there has to be a pre-Clovis. That's as far as I went. But from Marie's training and Vance's training and everything we knew about Native Americans, they *had* to come from northeast Asia." So Stanford said he began to concentrate his work on Alaska and Siberia.

Discovery in 1966 of some fluted projectile points during a survey in northern Alaska convinced Stanford that he was on the right track. "We thought at the time they were probably pre-Clovis, but now we know they are much later than Clovis and probably even later than Folsom," he told the banquet audience, adding that he eventually spent at least 30 years, off and on, working to find pre-Clovis or Clovis sites in northwestern North America that would be evidence of the first people who came across Beringia.

"But we never did."

With the collapse of the Soviet Union, Stanford and Bradley eagerly went to Siberia looking for clues. They looked at a lot of collections of lithic artifacts, but came home disappointed. "We never found *anything* we thought was *technologically* related to Clovis," he told the banquet audience. "And, in fact, we never saw anything in *Alaska* that I think is technologically related to Clovis, al-

though I know there is disagreement in this room." He spent three months searching in China with other prominent American scientists, but still did not see artifacts that appeared technologically related to Clovis.

"After 30 years, even a hardheaded Wyoming boy like myself gives up and thinks, 'Well, there must be some other answer to it.'" He considered the clues. In eastern Asia as far south as China, and from Japan northward to the Kamchatka Peninsula, archaeologists have found microblade technology—small blades struck from wedge-shaped cores to be fitted into shafts to create deadly arrows or spears. Bifacially flaked points there, he said, tend to be pointed on both ends. Makers of these bi-pointed bifaces, Stanford said, had "a technological mindset for a thick point. In other words, the width-thickness ratio is much higher than Clovis, which is, basically, a flat or a thin point."

He conceded that there are big-blade traditions of the Eurasian middle Paleolithic that resemble Clovis. "That material is way over here," he said, pointing out the region around Lake Baikal on a slide projected on a screen in the banquet room. "Bruce is very fond of saying, 'You know, it's farther from the farthest-east big-blade site over here in central Asia to Fairbanks, Alaska, and the Nenana culture than it is from Fairbanks to Miami.' And," Stanford said, "there's nothing in between that really looks like Clovis. In fact," he added, "much of this big-blade middle-Paleolithic material really looks to us like it is more oriented toward Europe, and I suspect it is."

Turning to North America and the Clovis complex, Stanford pointed out that there tend to be large blades and blade cores in the Southeastern states. Using a map to illustrate the proposition that Clovis may have spread westward and northward, he noted that there are fewer and fewer blades or blade cores in Clovis sites as one moves westward from the Southeast, where they were a strong technological component.

Stanford said he and Bradley asked themselves: "Where else does this kind of technology occur?" He continued: "Of course it's in Iberia. And more specifically, within the Solutrean constellation of technology." The term "Solutrean" is



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Team 2 July 3–14

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Team members will assist with mapping, excavating, and screen-washing to recover ancient inorganic and organic remains. Team members will learn how scientists develop a picture of past cultures and environments. In addition to working with archaeologists, including **Robson Bonnicksen**, director of the CSFA, teams will work with a zoologist and entomologist, a paleoecologist, and a soil scientist. The scientists will give evening slide presentations, and there will be field trips to make the expedition a memorable experience for participants.

Specific objectives of the expedition:

- Excavate late Ice Age sediments and soils and recover environmental and cultural evidence using standard excavation procedures, screen washing, and flotation procedures.
- Map and photograph excavation walls, in situ specimens and other features of interest.
- Collect sediment, soil, pollen, plant macrofossils, gastropods, fossil insect remains and possibly artifacts.

- Learn about sediments, soils, plant macrofossils, insects, hair, and flaked-stone tool analysis.
- Develop a detailed chronological understanding of local and regional landforms, depositional and site formation processes.

The Leonard Ranch site is in the beautiful Coast Range foothills about 100 miles southwest of Portland. Leonard Ranch Expedition 2000 will be developing systematic knowledge of the region's cultural and environmental history. Participants will tent camp on a 180-acre organic farm just 3 miles from the site. A camp cook will prepare and serve meals in the camp's field kitchen.

Enrollment fee for Leonard Ranch Expedition 2000 is \$1,000 per team member (\$575 for a single week.) Your \$100 registration, refundable a month before the session begins, reserves your place on the team and gets you a detailed briefing book in the project. Full payment is due a month before the session starts. Ask about family discounts and tax deductibility. *Enroll now!*

Schedule today!

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not well defined. It means different things in different geographical areas. However, from about Bordeaux, France, southward around the Bay of Biscay across northern Spain, he said, are materials that look very Clovis-like. Showing a slide of an apparent Clovis point, Stanford pointed out fluting by pressure flaking and evidence of some basal grinding. "How do you like this Clovis point, gang?" he quipped. "This is from northern Spain." He emphasized that he and Bradley were not simply seeing the morphological similarities between Clovis and Solutrean materials, but were analyzing details of the methods the Clovis and Solutrean knappers had employed to create them.

What ultimately encouraged the two researchers to go to Europe in their search for a Clovis predecessor wasn't their lack of success in finding a precursor for Clovis in Asia or even the amazing parallels between Clovis and the older Solutrean. The final nudge was a report on mitochondrial DNA research that suggested some Native Americans and a few Europeans might share a genetic marker.

Now, however, the best evidence seems to be the suite of correlations they have found between artifacts from Iberia and those from American sites such as Cactus Hill in Virginia. He showed the audience a number of slides illustrating affinities between Solutrean artifacts and tools discovered at sites in Eastern states, most notably Cactus Hill. "Pressure flaking?" he asked. "Pressure flaking was invented by Solutrean people. And in fact we see stage heat treating, just like in Clovis."

Stanford continued: "There's a lot about the way Solutrean people handled lithic technology that I think is really remarkable." First, he said, they liked exotic raw materials and would go great distances to get them. "Very much like our Clovis guys." Perhaps Solutrean people weren't as mobile as Clovis people, but they were still importing raw materials. He said that when Spanish and Portuguese archaeologists start seeing exotic raw material, they know they're in a Solutrean site even before they find a diagnostic artifact.

Stanford told the audience, as he

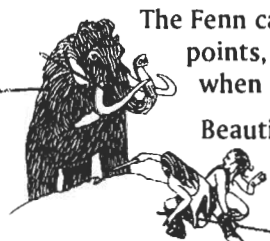
showed slides to help him illustrate the techniques, that what Bradley was excited about was the consistent and deliberate use by Solutrean knappers of *oultre passé*, or overshot flaking and their reduction of points from bifaces. An *oultre passé* flake, he explained, "comes all the way across a large biface, and it takes off the opposite edge. And what we see in Solutrean is a series of these flakes—sometimes three or four can actually reduce a very large biface." He said that many of the large bifaces that had been exhibited at the Clovis and Beyond Conference indicated a deliberate use of the *oultre passé* technique.

Stanford quipped that he didn't want to bore his audience about the intricacies of *oultre passé* flaking "because there's only about three of us in the room that really get off on it," but he made it clear that it was a very deliberate and carefully controlled technique that leaves unmistakable evidence in the archaeological record. Such flakes found in sites other than Clovis and Solutrean, he said, were mistakes. "When that flintknapper took

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off that *outré passé* flake, he probably said a whole bunch of bad words." Not so in Clovis and Solutrean. "So this is one of the hallmarks. We see them in Solutrean material and Clovis material," he said, showing slides of the characteristic ends of *outré passé* flakes. "When you find these in your next Cody site," he joked, referring to the widely known late-Paleoindian tradition found at a number of places on the High Plains and Rockies, "let me know." After the laughter subsided, he drew more laughter by adding: "When you find a whole bunch of them at your next Cody site, like we find at Clovis sites, then maybe we'll re-evaluate our position on this technology." His clear message: after Clovis time, ancient knappers did *not* deliberately use the *outré passé* or overshot flaking technique.

Using slides, Stanford pointed out how toolmakers prepared their "platform," the specific point where flaking pressure is applied. "It's just absolutely done the same way in Solutrean and Clovis. And as far as we know, by no one else." He noted that archaeologists who survey for Paleoindian sites, especially in the Southwest, know about the distinctive flakes left by this particular flaking technology. Surveying blowouts, he noted, "where

and Bradley believe that caches may indicate a strategy for optimizing raw materials. "This is an intentional technology where you take one of these very large bifaces and you can use it as a core," said Stanford. "It is a handy way of moving raw material around the country. I think we're seeing a lot of that in Clovis and I know we're seeing a lot of it in Solutrean." Large bifaces, he said, could be made into tools, scrapers or projectile points.

Stanford said the spectacularly large points found in France, Spain, and Portugal as well as in North America also suggest an affinity between Clovis and Solutrean traditions. "I think we're beginning to move into things beyond technology. We've got art—we've got mobile art."

early American cultures, what are the problems with the Stanford-Bradley hypothesis?

Most archaeologists would cite both time and space—Solutrean sites tend to be a few thousand years older than Clovis—and they're on the opposite side of the Atlantic Ocean.

The Solutrean sites are dated to 16,000–20,000 radiocarbon years ago while Clovis sites date to no more than 11,500 radiocarbon years. Stanford readily concedes that the 6,000-year time gap is a problem. But Bradley and Stanford observe that the Clovis precursors proposed by some experts in Central Asia have about a 30,000-year time gap. "So I like our 6,000 years just fine," said Stanford, adding that when pre-Clovis

Archaeologists Tom D. Dillehay, left, of the University of Kentucky, and Dennis Stanford of the Smithsonian Institution chat after Stanford's banquet presentation.



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you don't stand a chance of finding an arrowhead because every arrowhead collector in the world's been there, you can actually *identify* a Clovis site on the basis of these platforms—very wide, very well set up, and very heavily ground." They are very different, he said, from flakes found at a Folsom site. He used the example of surveying out in Colorado's San Luis Valley where there are many sites: "We can nail a site as being Clovis long before we ever turn a diagnostic artifact."

"Our friends in Portugal told us, 'We can nail a Solutrean site . . . on the basis of those platforms long before we ever find a diagnostic artifact.' Think about that."

Stanford then turned to the topic of Clovis caches, the puzzling collections of often large, bifacially flaked artifacts. He

Solutrean people, he continued, were very advanced in "soft technology," the weaving, basketry, ropes, nets and the like, which seldom are preserved in archaeological sites. Solutrean needles, he said, were extremely tiny and had delicate eyes that would accept modern thread very nicely. "We also get them in Folsom." Such needles, he said, certainly would not have been used for sewing animal hides. They suggest cloth, although experts believe such needles were employed in weaving and basket making, too. Solutrean people, said Stanford, evidently had a very advanced soft technology and were "real innovators." Further, there "probably was a lot of soft technology we don't know about."

With all the similarities in lithic and soft technologies linking Solutrean and

sites such as Meadowcroft and Cactus Hill are considered, the timing may prove not to be a problem because early radiocarbon dates for pre-Clovis levels at those sites are similar to late dates for Solutrean. "I suggest that the earlier dates probably will hang in there and those overlap the Solutrean," he said.

"So what's left?" he rhetorically asked the banquet audience. "You've got to get them across the Atlantic! That's a major problem for all of us folks that are from Wyoming," he conceded. But showing a slide depicting an astronaut's-eye view of the North Atlantic as it would have appeared late in the Pleistocene, Stanford argued that from the point of view of the people commonly referred to as Eskimos, the crossing wouldn't have been an insurmountable problem. The slide




showed France mostly under glacial ice and a rim of ice circling the Atlantic to North America.

"A quick measurement from land to land is about 1,400 miles—maybe a three-week trip for an Eskimo, he said. "It's not that far," he continued, and chided the banquet audience: "And here you want pre-Clovis and Clovis people to trek the 7,000 miles from Lake Baikal to Nome, Alaska? On foot? Come on! Carrying all their stuff?" Audience laughter indicated that most people were following his argument whether or not they were fully accepting it. He went on to describe his experience traveling with Native Americans on the Arctic Ocean, and pointed out that cold, icy oceans are relatively calm. And if weather does get bad, people can hole up on the ice in a snow cave or igloo until it improves.

He suggested that Solutrean people may have had a strong incentive to venture out along the ice margins of the Atlantic. As the last Ice Age deepened and life grew more difficult, he said, "I suspect that they were moving out along the now-submerged coast line, continuing to adapt more and more to this type of environment. It's just a hypothesis," he conceded. "Probably can't be tested."

However, he said that Solutrean sites contain mollusk shells, bones of deep-sea fish, and occasional seal remains, all indicating that the people were "really thinking about the ocean or else they were out *on* that ocean." They were, he said, "adapting to a marine, littoral type of environment, collecting shells, mussels, and fishing." Through time, some Solutrean people may have come to rely on sea resources, he suggested, and exploiting a coastal environment could have taken them on the northwesterly arc alongside ice floes all the way to North America.

What will be the result of this hypothesis and its presentation to the Clovis and Beyond Conference? "I think the whole idea here is to get people thinking broadly and I've been considering multiple migrations from multiple geographic areas," Stanford said. "The bottom line is that we're going to know a whole lot more about both Clovis and Solutrean when we're done, and archaeology will be a long way farther down the road." 

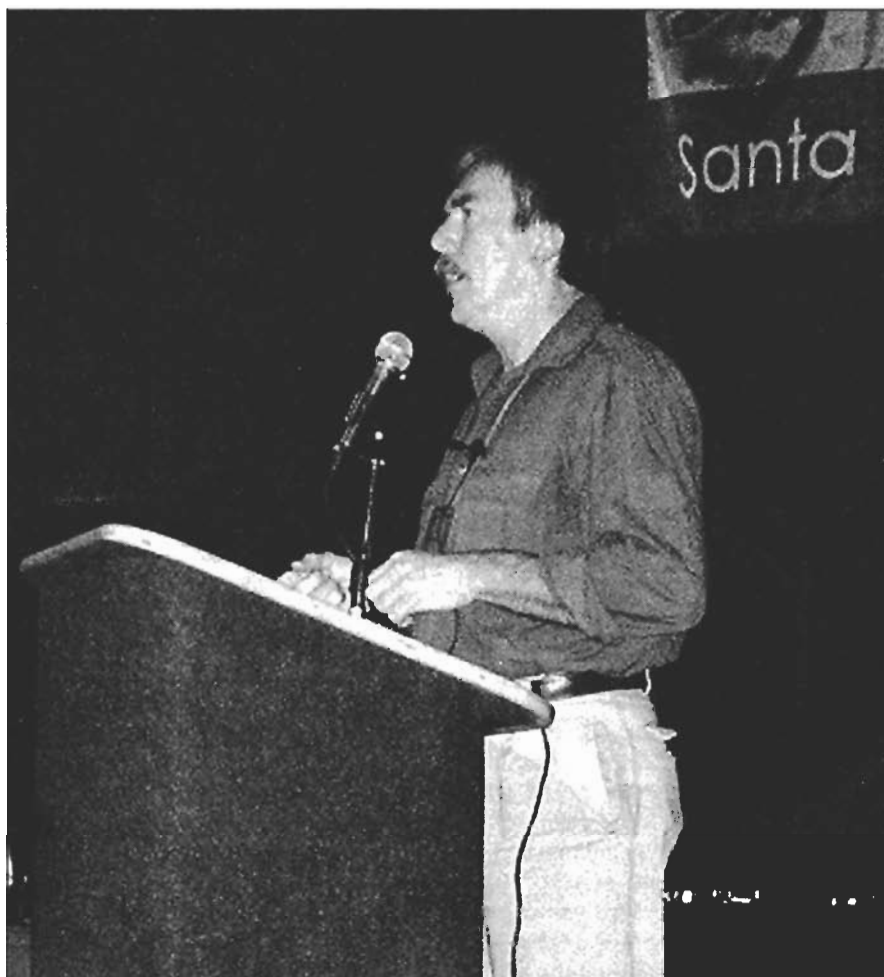
—Don Alan Hall

Perfecting Our Chronologies Could Solve Big Controversies

Stafford Foresees Higher Accuracy, Many More Dates

Some of the most contentious scientific arguments that divide American archaeologists would cease to exist if scientists could perfect and correctly interpret

question "How Can We Develop Better Chronologies of the Past?" Dr. Stafford expressed both optimistic and pessimistic opinions for the archaeologists gathered for last fall's Clovis and Beyond Conference in Santa Fe, N.M. He challenged archaeologists to demand more information from their geochronological laboratories, and also to continuously question the dates labs provide for



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chronologies, says one of America's most trusted geochronologists. Thomas W. Stafford, Jr., also predicts that the next decade will produce critically needed advances in radiocarbon and other dating methods. The result will be a much better understanding of the antiquity of the earliest evidence of humans in the Americas.

In a summary presentation on the

Thomas W. Stafford, Jr., geochronologist, isotope geochemist, stratigrapher, and founder of Stafford Research Laboratories, addresses the Clovis & Beyond Conference in Santa Fe.

their archaeological samples. He emphasized that a thorough understanding of stratigraphy, radiometric dating and archaeology are crucial for establishing



ages for the earliest occupation of the Americas.

Beginning on his most optimistic note, he told the conference, "within the next 10 or 20 years the chronologies that will be available to us as archaeologists, geologists and paleontologists will be unrecognizable to what we have today. They will provide foundations for genetics, human evolution, human biology, cultural change, and physical movements of peoples." He predicted better absolute dates from much smaller samples at lower cost. But he emphasized that such improvements would not occur unless archaeologists take an active role.

Dr. Stafford, geochronologist, isotope geochemist, and stratigrapher, who in 1998 founded Stafford Research Laboratories, a private research institution dedicated to geochronology, organic geochemistry and Quaternary geology, emphasized the basic importance of time to archaeology. What if, he said, we did not know the antiquity of important sites such as Monte Verde in Chile? Or what if we thought it was 10,000 radiocarbon years old rather than 12,500 years old? What if Kennewick Man was thought to be only 2,000 years old or the Anzick skeleton was only 3,000? "Look at the importance of time." The age of an archaeological site or artifact, he emphasized, determines how that discovery ranks in importance within the archaeological record.

He urged archaeologists to become better informed about what goes on in the labs they call on to date their sites. Stanford noted that the labs, whether they do radiocarbon, thermal luminescence, uranium series, or some other form of dating, are esoteric institutions. "I think a lot of people are intimidated by what goes on in the labs," he said. "I want to encourage you, anytime you call my lab or any other lab that provides you with information, to seriously doubt and to question. Question why is that number what it is? Is that result really correct?"

"I feel that you have much more information to give me," he told the archaeologists, "than I have to give you." He urged them to question the physics, the chemistry, and the geology that go into assaying the age of an archaeological sample. "What happens," he said, "is that we have to have an intermingling of questions and

stratigraphy, geology, archaeology." He called it an iterative process.

He noted that accelerator mass spectrometry (AMS) has for many archaeologists the cachet of incredible accuracy in contrast to conventional radiocarbon dating. "I've heard many times," he recalled, "We will establish the chronology by AMS." He urged skepticism. "I want you to doubt the blind acceptance of accuracy; there is no such thing as an absolute chronology. AMS dating does not pro-

*You have to demand
more information from
the laboratories.'*

vide a better absolute truth than any other method used to measure radiocarbon content in a sample—it's just a different technique. AMS dating is no more accurate than the chemistry, the physics that is involved. I want to emphasize strongly that it is the *chemistry* that determines the accuracy of any of these dates, not whether the measurement was done by accelerator or conventional (decay-counting) methods."

There are now no absolutes, he said. "When you receive a geological age, you receive an age estimate, not an absolute geological time." That absolute, he continued, must be the goal for archaeology's future. The first way to obtain better chronologies, he said, is for the archaeologist to ask, "What am I paying money for?" and for the lab operator to ask "What am I providing?" Absolute dates, he explained, require an understanding of the sediments of the site and each sample's geochemical history.

Stafford told the conference that what is needed to obtain closure on long-festering, controversial sites is assurance that dates are *absolutely* and *inherently* correct, regardless of whether the dated sample is bone, charcoal or sediments. "That situation, having inherent accuracy, I feel, is not present today." The goal must be to have an understanding of the geochemistry of the site, so when a date is obtained on a bone or other material, the age will stand independent

of later stratigraphic or archaeological interpretations at the site." That is not now the case, he said.

Another of Stafford's goals for improving chronology is radiocarbon dating of materials more than 50,000 years old. Radiocarbon dates, he said, plateau around 38,000 or 40,000 years before present. "This is not caused by radiocarbon calendar plateaus," he said. "This is caused by a universal—a uniform amount of modern carbon contamination." He believes the problem can be overcome, and with several colleagues he is working to solve the problem.

"We need to be able to take small amounts of samples and obtain finite ages at 50,000, 60,000 and 70,000 years. There *are* ways to do this," he said emphatically. "This is what is needed."

The future Stafford foresees for dating techniques makes further research demands on the biologists, the chemists, physicists, and the archaeologists involved. "What is next needed is to *decrease* our sample requirements tenfold," he said. "If I can date a gram of bone today, it should be 0.1 gram or less, a few years from now." The technology to do so needs to be developed in biochemistry and radiocarbon dating, he said. "We should demand a tenfold decrease in sample size to preserve exceptionally rare samples, such as human skeletal remains."

"The next thing that should happen," he told the conference audience, "is a fivefold *increase* in the number of radiocarbon dates that are available at a site." He stressed also that this fivefold increase in dates should be accompanied by a fivefold *decrease* in the costs of these analyses. Stafford emphasized that he was not trying to create more business for radiocarbon labs. He expressed dismay at the high price archaeologists must pay for each radiocarbon assay and the difficulties this creates when trying to unravel the chronology of complex sites that require more than a few dates to unravel their histories.

"There are ways to decrease the cost fivefold," he said, adding that increased accuracy provided by better chemical purifications should be coupled with increased efficiency in the labs. It is unreasonable to entice archaeologists with exceedingly accurate dating methods,


yet make these analyses so costly that scientists resort to affording fewer dates of lower quality. "It would be very easy to decrease these costs by using laboratory automation," he said.

"So what I'm asking you, again, is to insist on more analyses. To understand archaeological records, especially at geologically complex sites, we need at least five times more numbers."

Stafford emphasized the need for more education for those who utilize radiocarbon and other chronology laboratories. He said chronology should not simply be a "black box" for the archaeologist. "I want to ask you to provide better chronologies for your sites," he said. Then, "to get better chronologies of these sites, you have to demand more information from the laboratories. You have to demand explanations. You need *much* more information than is available to you on the physics, the chemistry, the geology, and how these processes work."

Stafford's abstract, published in the conference program and web site (www.clovisandbeyond.org), cited a critical need for instantaneous three-dimensional modeling of artifact and feature distributions and geological stratigraphy of sites. He also called for "exhaustive teaching of and computer availability of modern sedimentological and stratigraphic processes and examples" and "biochemical or structural methods to distinguish between human

*We need at least
five times more
numbers. . . . There
are ways to decrease
the cost five-fold.'*

and natural modification of lithic and bone materials." He stressed developing these graphical tools because they will enable chronological samples to be taken more precisely and with far better chance that the dates will answer chronostratigraphic questions relevant to the archaeological problems. 

—DAH

Geoarchaeological Methods Crucial for Finding Pre-Clovis

Convince Skeptics With Hard Data, Waters Advises

Finding unequivocal evidence of human presence in the American West that is older than 11,500 radiocarbon years will require meticulous geoarchaeological investigations, says one of the leading scientists working on questions of the peopling of the Americas. Speaking to the Clovis and Beyond Conference last fall, Michael R. Waters, a professor in the departments of Anthropology and Geography at Texas A&M University, offered a detailed guide for hunting pre-Clovis sites.

In a presentation titled "A Geoarchaeological Approach to the Study of the Early Archaeological Sites in the Western United States," he defined geoar-

chaeology as "the application of the concepts and methods of the geosciences to archaeological research problems." Though he detailed the extraordinary difficulties that face any archaeologist who would seek evidence of Clovis-era people or their predecessors, he concluded that geoarchaeology offers a realistic approach for finding sites that science will accept as convincing evidence of human habitation prior to the well-documented appearance of the Clovis complex.

Dr. Waters began by reviewing the parameters science requires of an acceptable site. "You have to have definite human-made artifacts or human remains at the site, these artifacts or remains must occur within a solid geologic context, and the site must be well dated by a reliable dating technique." In the Americas, he said, that technique is radiocarbon dating.

"All important archaeological sites



Pendejo Cave in southern New Mexico has apparent evidence of pre-Clovis human occupation, but because the stratigraphy is complex and problematic, the site probably won't meet Waters' geoarchaeological criteria. Pre-Clovis habitation could be unequivocally established by direct dating of hair proven to be human by DNA analysis.



MICHAEL R. WATERS

An ancient dune sequence exposed along the coast of Baja California, above, is indicated by an exploring archaeologist. Below, inspecting an old midden eroding from another Baja California dune.



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that have produced a shift in archaeological thinking about the peopling of the Americas have fulfilled these requirements." The first was Folsom, New Mexico, in 1927, and then Clovis, New Mexico, in 1952. "Both of these sites have acceptable artifacts, excellent stratigraphic context, and are reliably dated."

Other early archaeological sites in the West, he said, have problems meeting one or more of these three criteria. He detailed specific problems encountered at sites that had been thought to date well beyond the age of the oldest Clovis site, and in doing so he explained how geoarchaeological studies complement more traditional archaeological work.

"Geoarchaeological studies are responsible for documenting site microstratigraphy, and in placing this stratigraphy within a regional stratigraphic context," he told the conference audience. "Stratigraphy is so important because it is the framework on which all archaeological, geochronological, and paleoenvironmental data are referenced." He went on to note that geoarchaeological studies are responsible for collecting the appropriate samples to date the archaeological site. "As we all know," he said, "proper dating is *crucial* to the acceptance of any pre-Clovis site."

He also stressed that geoarchaeological studies can also assess the context

in which artifacts are found, and thus address the question of whether artifacts were deposited in a high-energy or a low-energy depositional environment, and help resolve whether they are genuine artifacts or "geofacts," a term used to describe rocks that have been fractured by nature but appear to have been produced by humans.

Waters said he wished to convince everyone attending the conference that geoarchaeological studies are an indispensable part of establishing the antiquity of early sites in the Americas. And although the focus of his presentation was the western United States, because that had been his assignment by conference organizers, he stressed that his advice applies anywhere in the Americas.

Much of his presentation was devoted to what might be called archaeological disappointments—sites that for one reason or another have not fully satisfied all three of science's requirements for acceptability. He did not discount the possibility that archaeologists will find cultural evidence that predates the age of the Clovis culture, and more significantly, he gave specific advice on likely places to look for it.

"One promising place to search for pre-Clovis sites would be along the Pacific Coast," he said, "especially if people took a coastal route into the Americas." Although most evidence of Pleistocene occupation along the coast is submerged because of rising sea levels as glaciers melted at the end of the last Ice Age, Waters said potential sites do exist along the modern coast line and that a geoarchaeological approach can help narrow the search for these sites.

"One might think that a good place to prospect for sites would be in alluvial sediments at the mouths of streams entering the ocean," he said. People moving along the coast would find fresh water and many food resources at such places. As an example, he showed slides of a river mouth in Southern California. "There are many promising stratigraphic exposures for study in this area," he said, but he added that when one studies the alluvial stratigraphy, the oldest exposed alluvium only dates to about 4,200 years ago. "Unfortunately older sediments that could potentially contain early sites lie deeply buried below the water table.

Thus there's no hope of ever finding early sites in alluvium at the mouths of streams unless this alluvium has been uplifted."

Though mouths of streams undoubtedly would have attracted the earliest human travelers, Waters counsels against seeking pre-Clovis sites in alluvial environments and suggests searching in other places where sediments were being deposited during the late Quaternary. "One of these would be coastal dune fields," he said, showing a slide of dunes in Baja California and pointing out a partially exposed midden. "Somebody's lunch is eroding out of this dune," he quipped. His slides depicted old dunes containing layers of ancient soils that might indicate surfaces where people once lived. One slide depicted such a layer containing artifacts. "So I think this is an excellent place to work," he said, but he noted that a geoarchaeologist would need to establish the sequence of sand dune formation.

"Also, I think another great place to look would be coastal rockshelters or rockshelters that are close to the coast. In places where the continental shelf is the narrowest, such as along the coast of northern Baja California, these shelters would have been visible during lower sea stands and may have attracted people."

Waters said that the history of geoarchaeology is closely linked with Paleoindian sites. One of the early pioneers in geoarchaeology, Kirk Bryan, established

the antiquity of the renowned Folsom site establishing the area's geology. Later, Ernst Antevs helped establish the antiquity of the Clovis locality at Blackwater Draw. In the 1960s, C. Vance Haynes found that cultural material at Nevada's Tule Springs site was not 27,000 years old, as had been originally reported.

Waters used Tule Springs as an example of the importance of geoarchaeological analysis of sites. The original investigation of this site west of Las Vegas had found bones of extinct camel in association with hearths and artifacts. Charcoal from the hearths was found to be older than 27,000 years, an apparent major breakthrough in the study of the peopling of the Americas. Subsequent geoarchaeological studies led by Haynes examined the microstratigraphy of each of the archaeological localities. Haynes also put in long trenches to establish the site's stratigraphy within the regional stratigraphic framework. Though Haynes and archaeologist Richard Shutler found no question of the authenticity of the artifacts, they discovered that the artifacts occurred within a stratigraphic unit dating to no more than about 10,000 years old. Further, what had appeared to be remnants of hearths proved instead to be old springs around which decayed wood—some samples dating to greater than 27,000 years—and other organic matter had accumulated. Waters said that the bones probably were those of animals

that came to the spring and died, leaving their bones to be incorporated into the spring deposits. Tule Springs had definite artifacts, but they turned out to be younger than reported and apparent hearths were actually geological features.

"I think this site clearly shows the need to rigorously examine the geological as well as geochronological context of any proposed pre-Clovis site," he said.

Waters reviewed a few other examples of western archaeological materials that have been reported to be older than Clovis and described how geoarchaeology has played a role in their interpretation. The Malpais and San Dieguito complexes of the Sonoran and Mojave deserts have been archaeological problems. Believed to date from approximately 9,000 years back to perhaps 35,000 years, the cultural material occurs in and on desert pavement surfaces that have formed on old landforms.

"Desert pavement is essentially a single layer of stone that creates a mosaic or an armor over a landscape feature," Waters said, showing slides to illustrate. "Many of the desert pavements in the Southwest were formed by a process known as deflation." He explained the deflationary process. Wind blows away the fine materials—sand, silt and clay—leaving stones that are too heavy to be picked up by the wind to sink gradually to a common level. The stones form the armor-like surface known as a desert pavement. Stone artifacts on the original surface would be incorporated into the desert pavement. In time, he noted, the pavement will develop a brown to black coating known as a desert varnish, which he said usually consists of iron and manganese.

Later people utilizing the area may have dropped artifacts onto the desert pavement, creating the archaeological problem of rela-

Rockshelters, such as this one near Baja California's northern coast, might have attracted some of the first people.



MICHAEL R. WATERS



DON ALAN HALL

The Calico Hills site in the Mojave Desert has proven difficult to establish as proof of human occupation before Clovis time. The site has remained open to the public.

tively recent stone tools occurring on the surface alongside much earlier ones deflated from earlier landforms. Waters said that archaeologists working in the area have suggested that a chronology of artifacts could be established because the old Malpais and San Dieguito artifacts would be found *in* the desert pavements because they were present at the time of pavement formation, while later artifacts from Archaic and Ceramic cultures would be found *on* the desert pavement surface. These archaeologists further proposed that the ancient artifacts could be distinguished because they would be coated with a desert varnish while later artifacts, such as potsherds, would not.

Waters said the archaeologists had based the 35,000-to-9,000-year age for the old artifacts on three lines of evidence: dating of the desert varnish, the association of these artifacts with Pleistocene landforms, and finding typologically similar artifacts in the basal layers of the Ventana Cave site in Arizona. Dating desert varnish, Waters explained, has proven complicated and contentious. One method proved too chemically complex to work. Dates from direct radiocarbon dating of the varnish have been disputed, and evidently the technique is not yet acceptable to all scientists. That leaves the presumed antiquity of the artifacts dependent upon association with Pleistocene-age landforms.

"The strongest evidence for the age of the material actually comes from its apparent association with Lake Cahuilla," Wa-

Waters's analysis of the shoreline of an Ice Age lake in the Wilcox Basin of southern Arizona involved this trench. Artifacts there seemed to be in deposits greater than Clovis age, but careful analysis determined that they were in a colluvial sheet-wash deposit that covered the old shoreline.

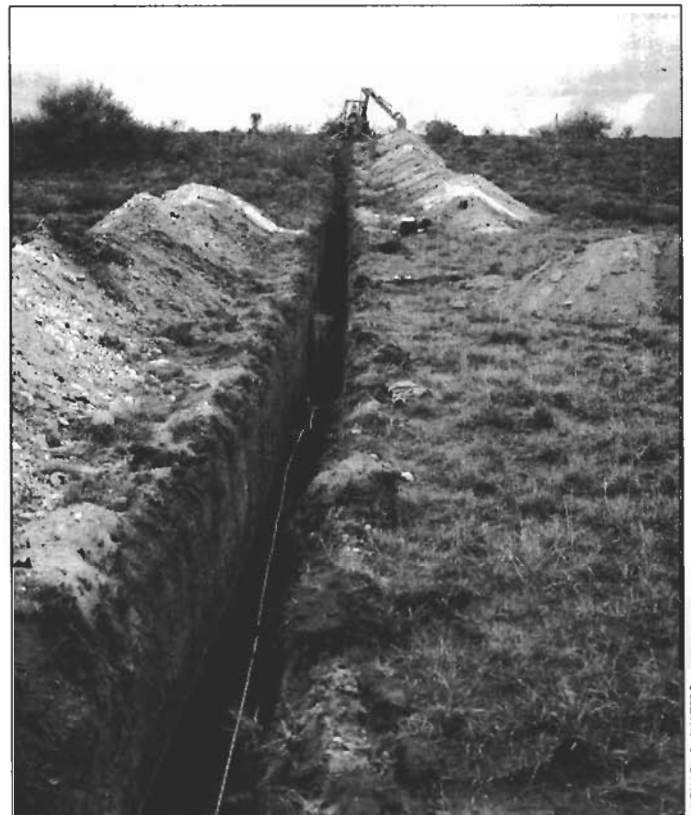
ters said, pointing to Southern California's Imperial Valley where a large pluvial lake, much larger than today's Salton Sea, existed in Pleistocene times. This Lake Cahuilla, he said, had a surface area of well over 6,000 square kilometers, in contrast with the 200-square-kilometer surface of the Salton Sea. Both Malpais and San Dieguito artifacts were reported to have come from the older Pleistocene shorelines that were dated to about 35,000–25,000 years ago. An archaeologist reported that the

artifacts occurred in desert pavement that formed directly on the old shorelines. "While this association appears to infer great antiquity for these artifacts," Waters said, "a closer examination of the geology of this area illuminates a problem."

Showing slides of the site, Waters said that examination of the stratigraphy showed that there is a significant unconformity between the artifacts in the desert pavement and the beach deposits. He explained that when the lake receded, the upper portion of the shoreline became eroded and then covered with colluvial deposits washed down from the adjacent slopes. Then deflation occurred with the resultant formation of desert pavement containing the artifacts. "Thus the artifacts clearly post-date the Pleistocene shoreline."

He added that the only place where San Dieguito I artifacts are found in stratigraphic context is at Ventana Cave in southern Arizona. Initially dated to about early Clovis time, material from the stratum was subsequently dated to about 8,500–9,500 radiocarbon years ago. "The San Dieguito I complex appears to be early Archaic in age and not pre-Clovis," Waters said. "However, further research is needed on this topic because we really don't know the age of the older Malpais artifacts."

Another example cited by Waters in which artifacts possibly older than Clovis age were reported to be in association with



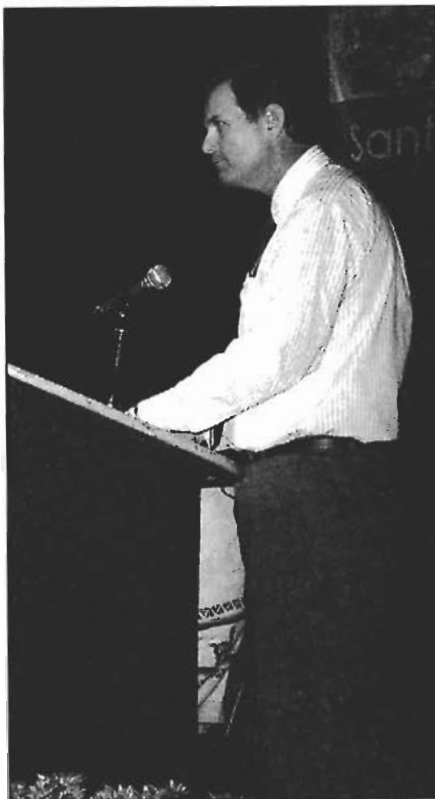
MICHAEL R. WATERS

late Pleistocene shorelines was in the Wilcox Basin of southern Arizona. There, on an ancient lake's shoreline, stone tools were found in what was believed to be beach deposits. Waters's geoarchaeological approach to the question of the antiquity of the artifacts involved backhoe trenches in the ancient shorelines so he could examine the lacustrine stratigraphy and obtain material for radiocarbon dating.

"When the original site locality was re-examined within the

geological context it was soon discovered that the old artifacts were not *from* the old beach deposits but actually came from a colluvial sheet-wash deposit that covered the old shoreline," Waters said, as he showed slides of work at the site. He found that the beach deposits date approximately to 14,000 years ago, but they were covered by about a meter-thick deposit of material of more-recent deposits. Based on the regional geology and the dates that he obtained for the site's stratigraphy, it became obvious that it wasn't a pre-Clovis site. "These artifacts could be no more than two to four thousand years old."

Another important role of geoarchaeology is to separate artifacts from geofacts. "The best example I can give you," Waters said, "is the question over the origin of specimens at the Calico Hills site in Southern California." He noted that this site, where some believe there are artifacts more than 200,000 years old, is situated on an alluvial fan that extends from the mountains. "The fan sediments at this site are extremely coarse, consisting of many gravels that were deposited in a high-energy debris-flow environment. And also most of these gravels are cherts and chalcedonies." He showed slides of the site and its gravels and stones that are, he said, typical of debris flows. Some geoarchaeologists believe that the reported artifacts from Calico are geofacts and not artifacts. "What appears to have happened at the Calico site is that boulders and cobbles and pebbles of



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chert and chalcedony, which easily fracture conchoidally, were caught up and transported in a high-energy debris flow environment down the side of the fan. As the rocks smashed into one another they were fractured and produced the Calico specimens."

Other sites have the same problem, Waters said, citing the Pinto Wash locality in the Imperial Valley and the Texas Street site in San Diego.

A site that is a candidate for accep-

Geoarchaeologist Michael R. Waters speaks to the Clovis and Beyond Conference in Santa Fe.

tance as being older than Clovis is Pendejo Rockshelter in southern New Mexico. Veteran archaeologist Richard S. "Scotty" MacNeish has reported evidence of occupation extending back to 37,000 years, said Waters, explaining that the stratigraphy of the shelter is complex and problematic. Radiocarbon dating has indicated that sediments at the site are apparently mixed. "Furthermore," he added, "artifacts appear to be unconvincing in my opinion. Most of them are broken limestone fragments." He suggested that they could be spalls from the roof or the side of the shelter. However, there is a third line of evidence at Pendejo.

"The most intriguing evidence that Dr. MacNeish has is human hairs," said Waters. "He reported in *American Antiquity* that two of these hairs dated to about 12,400 years B.P." Though the hairs were microscopically identified as human, Waters thinks science will require further evidence before Pendejo is accepted as a pre-Clovis site. "I think what needs to be done is DNA testing on the individual hairs and then a specific DNA-tested hair needs to be radiocarbon dated," he explained. He went on to say that MacNeish had informed him that such tests have been done and will be reported in a book being published by the University of New Mexico Press.

Though archaeologists can learn from problems at early sites that have not gained general acceptance as pre-Clovis, Waters is confident that the geoarchaeological approach is the best way to find early sites. "What we need to do first is identify late-Quaternary landforms, then define the late-Quaternary stratigraphic sequences within these landforms, and then prospect in the deposits of the correct age." Look for sites, he added, in places where deposition was occurring during the late Pleistocene and at places where people would have been conducting their activities.

"Pre-Clovis sites, like Clovis sites, are

Southern Arizona's Whitewater Draw, pictured here, reveals a braided-stream environment not likely to contain a site of Clovis age or older.



MICHAEL R. WATERS

A millingstone in situ within the high-level depositional gravels at the Double Adobe of Whitewater Draw, an environment not conducive to good site preservation.



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going to be extremely rare and are going to be extremely difficult to locate because of geological processes." Waters, who received his doctorate from the University of Arizona's Department of Geosciences, went on to compare the distribution of Clovis sites with the geologic record of numerous valleys in southern Arizona as an example. "When you look at the location of buried Clovis sites in southern Arizona you find that most are clustered down in the lower San Pedro River Valley."

"You have to ask yourself, 'Why is this?' To address this question, we have to look deeper into the regional geology of all the alluvial stratigraphic sequences that have been developed for the various stream valleys." He showed a map of Arizona depicting the age and type of geologic deposition that has taken place over the last 15,000 years. Several valleys have no deposits of Clovis age, "so you're not going to find any Clovis sites there." Three localities did have deposition tak-

ing place at the right time. However, in two valleys deposition occurred in a high-energy braided stream environment. In such a situation, artifacts from a site would have been reworked into a secondary context during flooding. Those artifacts, Waters said, "would be basically invisible in the sand and gravel deposits." Only in the San Pedro Valley are Clovis sites preserved.

So what was so different about the San Pedro Valley? "Right after Clovis activity in the San Pedro Valley, the Clovis living surface was immediately covered by the Black Mat," he said. It was a marsh-type depositional environment. "This low-energy depositional environment did not disturb the archaeological materials and buried the sites... with minimal disturbance. Then by *sheer luck* the older deposits were never eroded away."

Waters emphasized that immediate burial in a low-energy depositional environment was needed for initial preservation of Arizona's celebrated Clovis sites such as Lehner, Murray Springs, and Naco. And just as important, they never chanced to be eroded away.

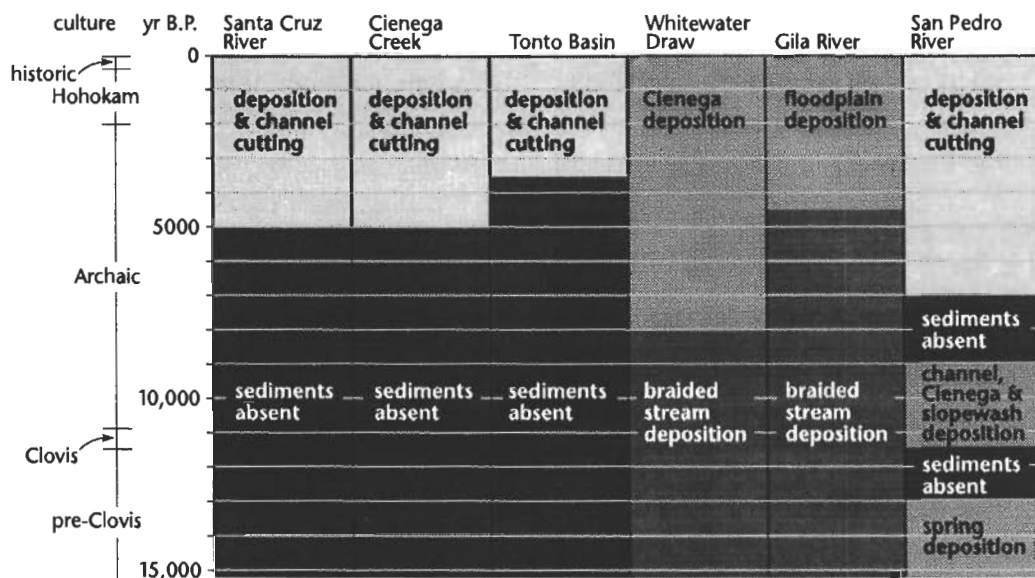
He went on to raise the difficult question of Clovis population densities and sampling errors. "We have to be careful about interpreting the intensity of Clovis activity and the density of Clovis occupation in Arizona—and I believe in the West in general—based on the fact that we have a highly fragmented geologic record." The San Pedro Valley, he noted, has a Clovis campsite and at least four kill sites, possibly more. "We have to ask ourselves, is this level of Clovis activity unique to the San Pedro Valley or, alternatively, was Clovis activity just as intense in the other valleys but we just don't have any preserved evidence of it?"

Though Waters emphasized that at present he does not believe that there are any unequivocal pre-Clovis sites in the western United States, he indicated that sites earlier than Clovis may someday be

Mammoth bones from the San Pedro Valley's well-preserved Naco Clovis site on display in Santa Fe.




GEORGE WILSON



MICHAEL R. WATERS

Correlation chart shows the general alluvial history of several streams in southern Arizona. Only the San Pedro Valley, far right, has Clovis-age deposits.

found there. "We need to keep looking for early sites, and we need to keep an open mind on this." 

-DAH

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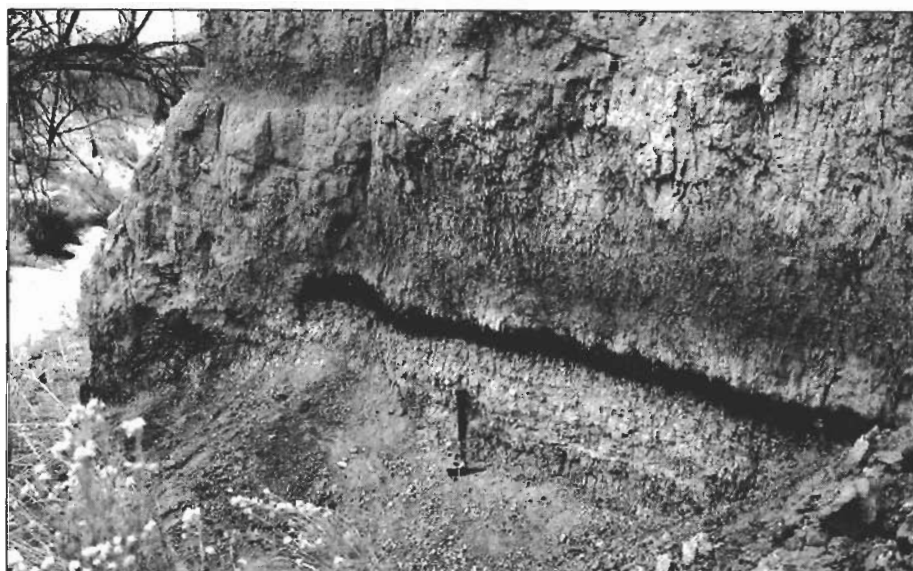
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At the San Pedro Valley's Murray Springs site, the black mat, which covered the Clovis living surface, is readily visible.



MICHAEL R. WATERS

First Americans Probably Were Not Marine Specialists, Scientist Argues

RECENT DISCOVERIES have left more and more archaeologists looking toward the sea and boats as an alternate hypothesis for explaining how, and possibly when, humans entered the New World. But Utah archaeologist Everett Bassett remains skeptical of the possibility that groups of marine specialists sailed long distances over open oceans during the Pleistocene. He presented one aspect of his work, "Cold Water Avoidance Model: Implications for the Peopling of the Americas," in a poster session at the Clovis and Beyond Conference in Santa Fe, N.M. last fall. His model is an outgrowth of his own experiences working on ships and on fishing boats at high latitudes.

Although adventurers have conclusively shown that humans *could* do it, Bassett suggests that researchers should also be asking whether they *would* do it. That consideration is particularly important in a cold water

setting such as the north Pacific Ocean, one possible route of early entry to the New World where, Bassett believes, the costs of long-distance ocean travel during the Pleistocene would have far outweighed any benefits. Bassett's work evaluates the benefits and costs of coastal foraging and, based on the decisions made by more than 100 ethnographic

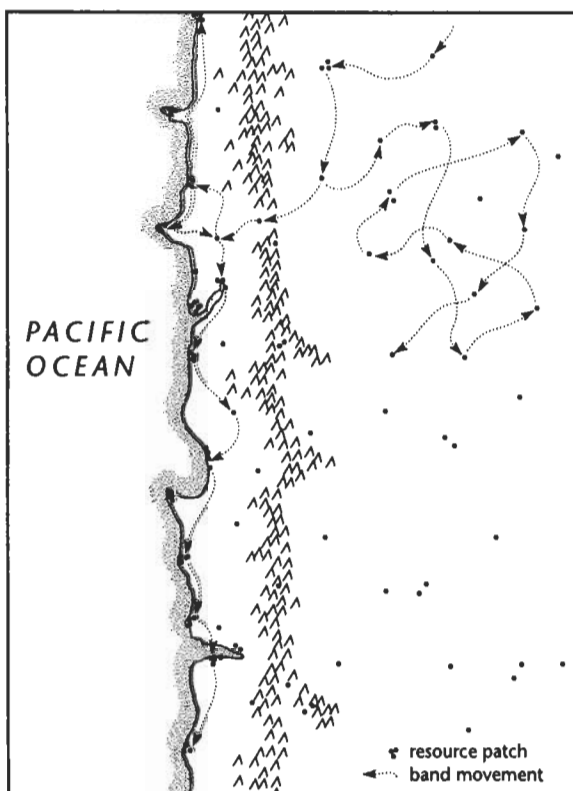
coastal groups, he predicts what decisions made by ancient humans would have optimized their survival. He concludes that highly mobile and wide-ranging Pleistocene foragers would have had little need for complex technology—including boats capable of long-distance ocean voyages. In fact, such technology would create huge opportunistic costs, hobble terrestrial mobility, and limit foraging options.

Given the need to minimize resource return as suggested by Bassett's model, ancient people could have pursued one of two separate coastal strategies, mobile foraging or marine specialization. Which strategy they followed would be dictated by the cost of "wet" foraging at that latitude and the relative abundance of "dry" versus "wet" resources relative to the human population. An important aspect of the model is that "dry" resources also include coastal species such as beached seals, seabirds and littoral shellfish which, in terms of potential exposure, are more similar to inland species.

Bassett believes that the efficiency of foragers using an expedient technology and trying to obtain "wet" resources in colder waters would be limited by:

- "shorter foraging episodes due to incipient hypothermia"
- "longer recuperative periods to allow their bodies to regain normal temperatures"
- diminished hunting effectiveness "due to delayed reflexes and shivering"
- a total caloric deficit due to loss of body heat and increased metabolism.

Given those costs, Bassett suggests that there would be little incentive to indulge in high-risk, offshore activities in colder water, especially since the relative costs of alternative dry resources tend to stay fairly constant with an increase in latitude. He observes that while spearing fish on the coast of Mexico, for example, indigenous groups normally stay in the water for several hours and are successful, on average, about every 35 minutes. But in the cold water off the coast of Washington State, "foraging episodes would actually be shorter than the average encounter rate for fish of a usable size." Meanwhile the cost of hunting deer remains fairly constant at both latitudes.



Hypothetical foraging
band movements—
coastal and interior.

EVERETT BASSETT



For these reasons, at higher latitudes, "wet" resources would be increasingly ignored as long as sufficient "dry" resources could be accessed. In situations where the ratio of dry resources to human population remained high, such as in Tasmania, this strategy was retained into historic times.

Eventually, with increased populations and a depletion of dry resources, marine specialization becomes the best available option for many coastal groups. Marine specialists, he added, are "more sedentary," allowing them time and space to repair and maintain their craft and to perfect the complex technology necessary for successful offshore foraging. Since their main resources are underwater and therefore more "invisible," efficient use of any locale increases with time and experience, encouraging a sedentary life. Such societies can store large amounts of food and are therefore willing to take risks if these risks can ensure a large return. Northwest Coast Indians provide the classic example of this "marine specialist" strategy.

These two strategies, coastal mobile foragers and marine specialists, are identifiable in the archaeological record. This is especially true at high latitudes. While mobile foragers will maintain a tool kit of a fairly constant size (what they can carry), marine specialists will require buffering technology that corresponds to the degree of exposure to cold water; at higher latitudes more complex technology is required.

Bassett emphasized that he is not saying Pleistocene mobile foragers did *not* make use of some type of boats or water craft. Rather, he is suggesting that ancient people would have used them in very specific ways, such as is seen in the ethnographic record. These logistics allowed them to safely cross rivers or access "dry" resources such as seals, seabirds or lithic sources on offshore islands during calm weather without sacrificing their ability to pursue other inland resources such as elk or mammoth over distance. "Expedient water craft (such as rafts or reed boats) are indeed used by these societies," Bassett said,

'Marine Adapted': A Meaningful Term?

ISOTOPE ANALYSIS of bones recovered from archaeological sites in various points along the Pacific Coast of North and South America has been used to characterize ancient humans and animals as "marine adapted." However, archaeologist Everett Bassett questions whether such evidence, which traces food sources to land or sea, is meaningful.

"I am somewhat uncomfortable with the term 'marine adaptation,'" Bassett said in reply to a question from the *Mammoth Trumpet*. "It conjures up established ideas of how people 'should' act along coasts if only they possessed the technology. Since the mid-Holocene in most of North America this has meant nice boats, harpoons, sedentary villages, smoked fish stocks, and so on. My work suggests that this lifestyle is one that we eventually see in most places worldwide—but only after a depletion in terrestrial fauna, an increase in regional human populations, and/or a decrease in mobility." He says that earlier people appear to have been unspecialized, risk-averse, mobile foragers utilizing any resource they could find that had a good return rate. While isotope analysis is useful for identifying landscapes used in prehistory, it presently cannot specify marine fauna trophic levels and therefore tells us nothing about species consumed or technology used. His continuing doctoral dissertation research at the University of Utah quantifies ethnographic and archaeological data to identify patterns of coastal use.

Bassett observes that many coastal subsistence activities are not mutually exclusive with terrestrial ones and do not contradict a general mobile foraging way of life. "Generalized foragers in Tasmania and Tierra del Fuego and elsewhere often used temporary rafts and other floating devices to cross streams and access offshore islands during calm weather to gain access to seals, sea turtles, lithic sources, etc. Yet they remained mobile

foragers, eschewed storage or complex technology, lived in small bands and made consistent use of a broad range of inland resources," he says. "Therefore, evidence of early humans on California's Channel Islands, the Indonesian archipelago, Malta, or Australia does not necessarily indicate 'marine specialization' as we usually think of it."

General foragers, Bassett says, faced quite different decisions from those made by marine specialists such as those along the Northwest Coast. "For nonspecialists the coast is just another terrestrial ecotone, much like a lake margin or the edge of a snowfield, requiring neither specialized skills, technology, or demographic logistics. In this sense all humans are 'marine adapted,' and the term has little meaning without further clarification."

Bassett suspects some people may find his model "a little schizoid" because it both supports and rejects a simple coastal migration hypothesis. "On the one hand I am saying people were definitely using coasts and coastal resources from the earliest times and could move quickly along them. But I am also saying that this use would not have extended to specialization that requires a reduction in mobility, an increase in technology, and an abandonment of alternative resources." He says that the greater the exposure to cold water and high waves (especially at high latitudes), the greater the differential would have been between the efficiencies of exploitation of wet (ocean) and dry (coastal and inland) resources.

"It is exactly because there did exist rich patches of coastal (and inland) resources that people did not settle down and specialize. As long as one could expect to move on to a new, not-yet-exhausted patch, one would. And the richer the patches the more quickly they would skim off the 'cream' and move on to a new one. This same sort of logic has been used to explain the deferral of terrestrial specializations, including agriculture."

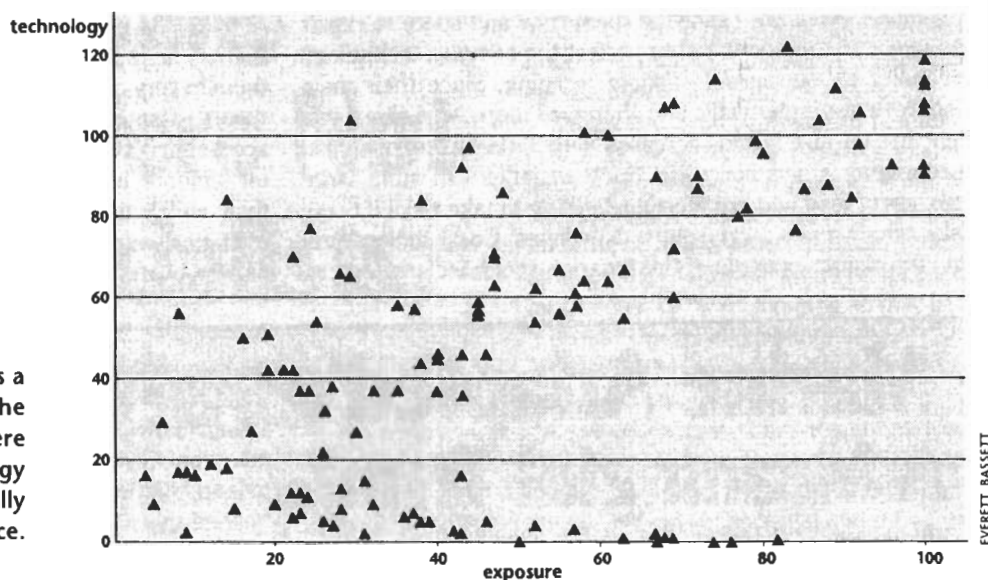
Bassett currently is working on a model of patch use and mobility to show how bands of foragers might have reached Chile in a very short time, even before the northern interior was settled.

but these are "classic hunter-gatherers who just happen to include coasts within their logistical rounds."

Marine specialists with boats capable of long-distance seafaring, he added, are more tethered to their craft. They must maintain a technology that allows them to buffer themselves from cold, wet and stormy seas. They must have a place to store their food. And they must carry life-sustaining cargo such as drinking water. The costs associated with maintaining such a complex suite of technology can far outstrip the payoff, he suggests, particularly for mobile societies with access to sufficient alternative resources.

So far, little archaeological evidence has surfaced to suggest that ancient Americans were "marine specialists" or specialists of any

Technology required as a function of exposure. The greater the exposure to severe weather, the more technology foraging peoples generally require for subsistence.



sort, Bassett said, "and we shouldn't expect that they were, given the small populations and abundant resources available at that time." If marine-adapted people with a "complex marine economy and specialized technology" were in place along the now-flooded coast in either northeast Asia or North America, archaeologists should expect to find evidence further inland, not only of specialization but also of the resource depletions that drove it. "But we don't."

DEE SIMPSON DIES

Ruth DeEtte "Dee" Simpson, longtime principal investigator of the Calico Hills site and a singular voice in American archaeology, died Jan. 19 in Redlands, Calif. She was 81. She had a long career as an anthropologist in Southern California where she was curator of museums including the San Bernardino County Museum. While associated with the Southwest Museum in Los Angeles in 1954, she began an archaeological survey of the Manix Basin in the Mojave Desert east of Barstow, Calif. In 1958 she showed surface-collected materials from the area to European scientists. When Louis Leakey, of Olduvai Gorge fame, saw the artifacts, he urged excavations to find examples in situ and suggested the Calico Hills site. Simpson directed more than two decades of excavations there. After retirement from the San Bernardino Museum in 1983, she continued to curate the museum's Calico Hills collection. Simpson took great pride in the fact that the Calico site was a community project funded by, and in full view of, the public.

Bassett suggests his model has implications for the movement of people into and across the Americas. In addition to a maritime passage to the New World, archaeologists must consider at least two pedestrian routes. One remains an ice-free corridor through the interior, the second along the West Coast. The timing of entry along those routes hinges, in part, on the localized extent of glacial ice, an issue that Bassett feels remains

poorly understood. But the nature and distribution of available resources would help govern travel along either route and to some extent would dictate foraging logistics. Inland faunal resources, while rich and providing greater biomass, are also more unpredictable and often distributed randomly over the landscape. This does little to stabilize directionality of movement for a people pursuing these animals, Bassett said.

Resources along a virgin coast, on the other hand, were clumped and in linear groupings on fairly predictable locations such as headlands and estuaries. Although these resources, including seal and seabird colonies, were abundant, they are temporarily short-lived once they have been disturbed. People then have a choice either to backtrack to a location they had just exhausted, or advance to new undisturbed areas where predictable resources are anticipated. For people moving into North America from Asia, this means they would have kept going south, quickly. Such decisions would be further reinforced if the foragers were hemmed in by mountains.

Bassett believes that early generalized foragers utilizing patches of coastal resources would have adhered to the "marginal value theorem," staying at one location only until the food supply dipped below what might be expected elsewhere—moving rapidly down the coast chasing resources. "I see them as going to one area where seals or sea birds would have been, for example," Bassett said, "jumping in and clubbing a few, disturbing the remainder, and then dispersing to the next spot because it would now be more profitable." In effect, they would have behaved, he suggested, much like a cat presented "with a line of milk bowls, quickly lapping up just the cream from each bowl and leaving the milk." That approach, he argues, is distinctly different from marine special-

ists who, to forage efficiently, need to "hunker down" for a considerable time at profitable locations and process lower-ranked resources.

"At this point we can't really know how and where entry into the Americas took place," Bassett added. However, if at some point bands of foragers got south of the ice sheet in North America, say, 17,000 to 14,000 years ago, some might have been close to the coast and others would have been farther inland. Groups following both strategies would have moved fast, capable of traveling "probably hundreds of miles" in a year with the size of the group and the speed with which they traveled limited only by the need to maintain an adequate breeding population. The greater likelihood of dispersal across interior landscapes may have kept populations lower there for a longer time.

The generalized foragers would move more quickly down the coast than would specialists, had they been present, and with more directionality (south) than would interior foragers—allowing Pleistocene foragers to reach South America much more rapidly than previously assumed. "If my model is correct, we might expect to see people in Chile before we see them in, say, Virginia," said Bassett.

As researchers present new theories for early entry, Bassett said, they should seriously question why people would have taken risks to leave a specific area if ample resources were present. For that reason he questions recent research suggesting that pre-Clovis people may have migrated to the New World by boat from the Iberian peninsula, a hypothesis offered at the conference by Smithsonian archaeologist Dennis Stanford.

Leonard Ranch Expedition

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forms, depositional and site formation processes by use of radiocarbon dating, tephra (if present), stratigraphy, and soils for placing the recovered remains from the site in a temporal framework.

"We believe that it is important to edu-


Clovis & Beyond Plaque



MARCEL KORNFIELD

Wyoming archaeologist George C. Frison received this Paleoarchaeologist of the Century plaque, designed by Forrest Fenn from a Fenn Cache point, at the Clovis and Beyond Conference. C. Vance Haynes of the University of Arizona received an almost identical plaque as Geoarchaeologist of the Century.

"He's basically saying that people in Europe got into boats and journeyed across the North Atlantic," Bassett said. "But there was no great diminishment of resources in Western Europe at that time, and I have to wonder why groups of people would do that. The next time we


cate team members about our interdisciplinary research project," says Bonnichen. "Although every working day is a learning event, evening slide presentations and field trips organized by participating scientists are designed to enhance the learning experience about how we develop an objective knowledge about past cultures and environments. Our interdisciplinary team of scientists will provide an integrated lecture series to project participants." 

see this occurring is not until 19,000 years later when groups of medieval Norse and Irish fled overpopulated communities that were trying to scabble an existence on already-exhausted agricultural lands." Bassett calls the similarity of lithic technology between Clovis and the Solutrean "very exciting" and agrees that it suggests continuity. However, he says, "this may be offset by discontinuities of time (4,500 years) and of strategy: mobile bands of risk-averse hunter-gatherers becoming technologically complex marine specialists and then reverting to their former life-style.

"I don't mean to throw cold water on Dennis's theory," said Bassett, apologizing for the pun. "I think it is very exciting. Our two conclusions both depend on pattern recognition but come from such different places that it is difficult to integrate them at present."

Although skeptical about early boat travel to the Americas, Bassett concedes it remains a possibility—if all conditions were right. But researchers must remain diligent in their search for evidence to back it up, while being flexible in seeking alternative explanations for the early peopling of the Americas. This requires what he terms "open-minded skepticism."

"Certainly it is possible that people came here in boats," Bassett said. "But I think we should be very cautious about sticking Pleistocene peoples in boats in cold water." He noted that there is much literature suggesting that mobile hunter-gatherer populations would have been averse to taking large risks. For example, they probably would not run up and stab a living mammoth if they could scavenge a dead one. The same goes for tapping coastal resources. They would for example, probably have tried to club a seal on shore before risking an offshore venture very far to get one.

"It just doesn't make much sense that they came long distances in boats," Bassett said. "They would have needed fresh water, specialized hunting and fishing gear, and warm, waterproof clothing. If they were able to do it in 20- or 30-mile jumps, they might have come that way. But I just don't think early peoples needed to take very great risks in coming to America." 

—George Wisner

Correspondence

On Monte Verde

by Tom D. Dillehay

In October 1999, *Scientific American Discovering Archaeology*, a new popular magazine, published a lengthy report entitled "Artifact Provenience at Monte Verde: Inconsistencies and Confusion," by Stuart Fiedel of John Milner Associates, a private archaeological contract firm in Alexandria, Va. His lengthy review of the second volume (Dillehay 1997) on the Monte Verde site in Chile is full of accusations, errors, and misrepresentations of the scientific evidence. Accompanying Fiedel's review were short commentaries by several Paleoindian specialists and short responses by Dillehay and Collins.

By publishing his review in this non-refereed magazine, Fiedel was able to make many unfounded accusations and to lead the reader to believe that the scientific evidence in the Monte Verde volumes is inadequately documented, inconsistent, and confusing. Fiedel's sole motive in publishing his review was to discredit the "compelling" archaeological evidence from Monte Verde in defense of the Clovis model. His review is hostile and inflammatory, with "a belligerence rarely seen in scientific spats" (See References: *Science*). We strongly encourage fair and constructive criticism, but our objection in this case is that Fiedel's review is neither fair nor constructive—and is often highly misleading. We have created a site on the World Wide Web to respond to Fiedel's allegations and correct his numerous factual and interpretive mistakes.

The Editors of *Discovering Archaeology* rushed Fiedel's review to publication without standard scholarly review, because, they wrote, "One of the most important conferences on New World prehistory in more than 50 years—the Clovis and Beyond symposium in Santa Fe, Oct. 28–31—will assemble most specialists on the topic to discuss the statement of knowledge about when and how the New World was settled. We felt it was extremely important that participants in that conference have this information available in its entirety."

"*Scientific American Discovering Archaeology* has absolutely no position on the issues raised in this special section, and publishing it in no way implies confidence or doubt about any opinions expressed. Our only purpose is to present this information accurately, fairly, and quickly [our emphasis]."

A more detailed response to Fiedel was not written at the time of his review because we were given only a few days by Jeff Leach, editor of *Discovering Archaeology*, to prepare a short reply. The editors of *Discovering Archaeology* could not guarantee the publication of the long response that we prepared. Because Fiedel's review was published in *Discovering Archaeology* and avoided peer review, we have been unable to make our reply available through conventional scientific journals. Fiedel's factual and interpretive errors are so numerous that the response we've had to produce to rebut him is prohibitively long for most journals. Thus, we have produced a web site to make available our response. The address is www.uky.edu/Projects/MonteVerde/

There, we not only correct Fiedel's mistakes, but we also respond to the remarks of some commentators and provide

an errata list to correct our editorial oversights in Volume 2. We do not present a point-by-point rebuttal to all of Fiedel's accusations. In order to do this, we would have had to write an even longer response than the current 45-page, single-spaced report. Additional co-authors, who worked on the Monte Verde project and who currently are in the field on other projects, will add their comments as they have the time to read and respond to Fiedel's review.

Our web page is divided into six parts. Part 1 is an introduction. Part 2 addresses general issues and the broader implications of Fiedel's review. Part 3 is our long reply to Fiedel's accusations and to those of some commentators. Part 4 is an errata list for Volume 2. Part 5 is a brief conclusion. Part 6 shows nine photographs of *in situ* projectile points and excavation procedures.

Over the past 20 years, diehard Clovis advocates have questioned the radiocarbon dates (Lynch 1990; West 1993), the artifact context (Lynch 1990; Morlan 1984), the research methodology (Dincauze 1990), the quality of Latin American scholars working on the Monte Verde project (an anonymous reviewer in 1982), and certain members of the research team. The integrity of the site has been sustained despite these constant attacks. With little else left to attack, Clovis advocates have now turned to the final report and other publications. We suspect that skeptics of Monte Verde (and other early sites) will always exist and that the attempts to invalidate the site will continue. If attempts similar to Fiedel's review appear in the future, we will not respond to them.

Tom D. Dillehay, University of Kentucky.

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