# MAMMOTH TRUMPET

**Volume 28, Number 4 ■ October, 2013**



Center for the Study of the First Americans
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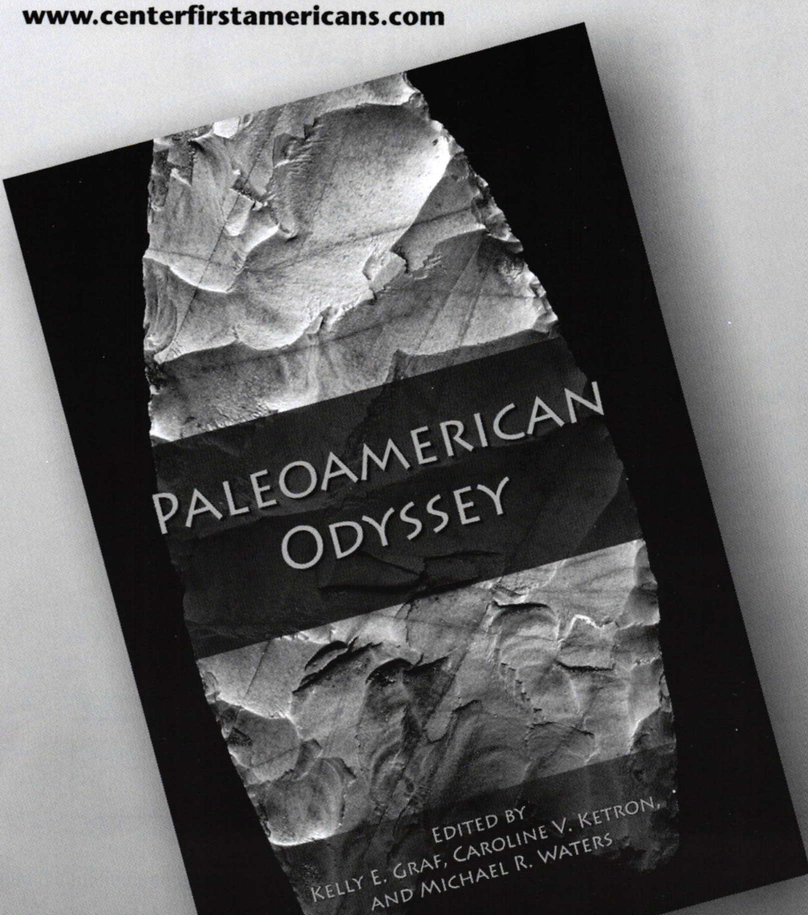
PALEOAMERICAN ODYSSEY
SANTA FE 2013

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Volume 28, Number 4 | Center for the Study of the First Americans | Department of Anthropology
October, 2013 | Texas A&M University, 4352 TAMU, College Station, TX 77843-4352 | ISSN 8755-6898

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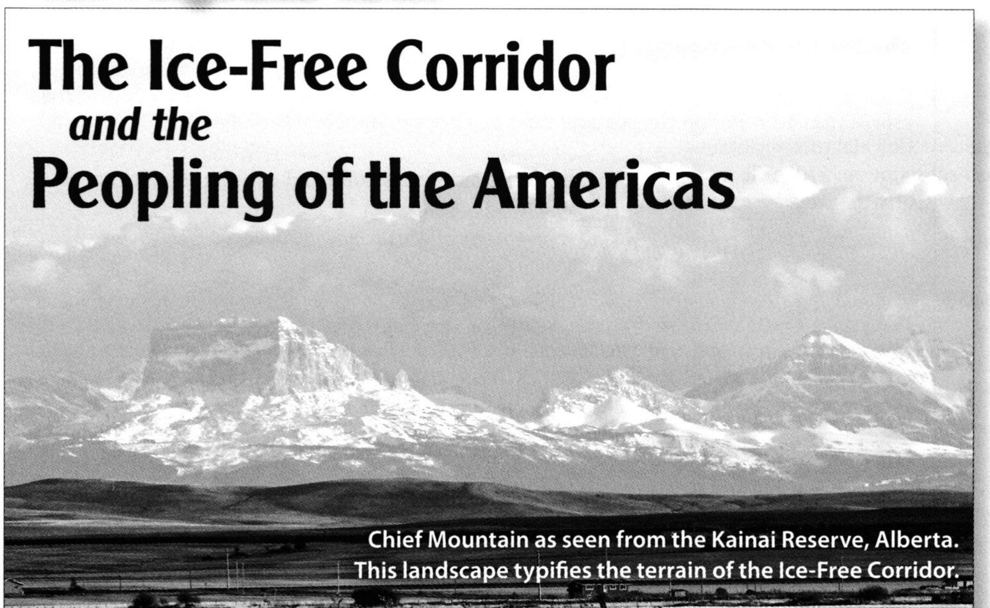
The Forgotten Road

# The Ice-Free Corridor *and the* Peopling of the Americas



JOHN IVES

Chief Mountain as seen from the Kainai Reserve, Alberta. This landscape typifies the terrain of the Ice-Free Corridor.

## INSIDE



**IT'S AN ANCIENT STORY:** The water parts, and people cross over into a land foretold by the migration of snow geese, swans, cranes, eagles, and waterfowl, and discover a marvelous Eden. But through their wickedness—their insatiable lust for meat—the naïve fauna are slaughtered to the last, a destruction so complete that their descendants are forced to eke out a living on twigs and berries. No longer living a life of nomadic ease, they are forced to—ick!—invent agriculture.

This narrative, tied to both the Clovis entry via the Ice-Free Corridor (IFC) and the late-Pleistocene megafauna extinction via the "Blitzkrieg" or Overkill Hypothesis advanced by Paul Martin (University of Arizona) and others, was overtaken by the late 1990s by a resuscitated coastal-migration story: Pre-Clovis sites in South and North America showed that Clovis had entered into or originated in a continent already colonized by other humans. It's possible—even likely—that the earliest migrants traveled down the Western coast, a marine environment with broadly similar resources from Alaska to Oregon. Inland, megafauna had probably coexisted with humans for centuries to millennia. Megafauna extinction occurred during a period of wrenching climate change that dislocated plant and animal communities alike at the end of the Pleistocene, impoverishing the flora and fauna from coast to coast. In this second narrative, the IFC may have been impassable until very late in time, its opening a coda to the story of the peopling of the Americas in which the Paleoindian big-game-hunting lifestyle lingers along the margins of the retreating continental ice sheets.

But recent research suggests that this second narrative is also flawed: The IFC may have opened sooner, the landscape may have been less inhospitable than advocates of a coastal migration suggest, and human foragers may have been more prepared to cope with its challenges than 21st-century archaeologists believe. As always in archaeology, the story begins with time.

### Timing is everything

The timing of the opening of the IFC is central to the question of whether the earliest colonists in North American could have traveled it. The route of the IFC today is a major transportation route, for the most part following the valley of the Mackenzie River and its headwater tributaries into central Alberta along the eastern edge of the Canadian Rockies. Except for the area around the Mackenzie Mountains in the southwestern corner of the Northwest Territories, the location of the Mackenzie River Valley marks the suture line between the Cordilleran (mountain) Ice Sheet (CIS) covering the Canadian Rockies and the Laurentide Ice Sheet (LIS) centered on Hudson's Bay and extending from Maine to Alberta. In the Mackenzie Mountains, the LIS actually flowed up the eastern side of the mountains, meeting the CIS somewhere in the interior of the range.

A coalesced ice sheet almost 1.5 km thick would have been a formidable barrier to human migration from coast to coast, and even a newly opened IFC would likely have been an intolerably harsh environment for humans. On the basis of evidence available in the 1990s, the period of coalescence was thought to have been long. The northern end was thought to have closed as early as 30,000 RCYBP, the southern end later. According to a 2001 paper by Dr. Carole Mandryk (then at Harvard University) and colleagues, the area between the Athabasca and Red rivers in central Alberta may not have coalesced until as late as 21,000–18,000 RCYBP (~21.4k CALYBP).

The problem, as John Ives (University of Alberta) is quick to tell me over the phone, is that there was a "catastrophically destructive geological environment accompanying glaciation and deglaciation." As a result, the evidence of the timing of glacial coalescence is sparse and deeply stratified archaeological sites are rare. Dr. Ives and his colleague, Dr. Duane Froese, argue that few of the available dates support an argument for early coalescence of the ice sheets: "More recent data indicate that the ice sheet coalescence was brief, and that it was the only time in Quaternary prehistory when this happened." If human entry predated the Last Glacial Maximum (LGM), the IFC


**The Mammoth Trumpet** (ISSN 8755-6898) is published quarterly by the **Center for the Study of the First Americans,** Department of Anthropology, Texas A&M University, College Station, TX 77843-4352. Phone (979) 845-4046; fax (979) 845-4070; e-mail csfa@tamu.edu. Periodical postage paid at College Station, TX 77843-4352 and at additional mailing offices.

POSTMASTER: Send address changes to:

**Mammoth Trumpet**
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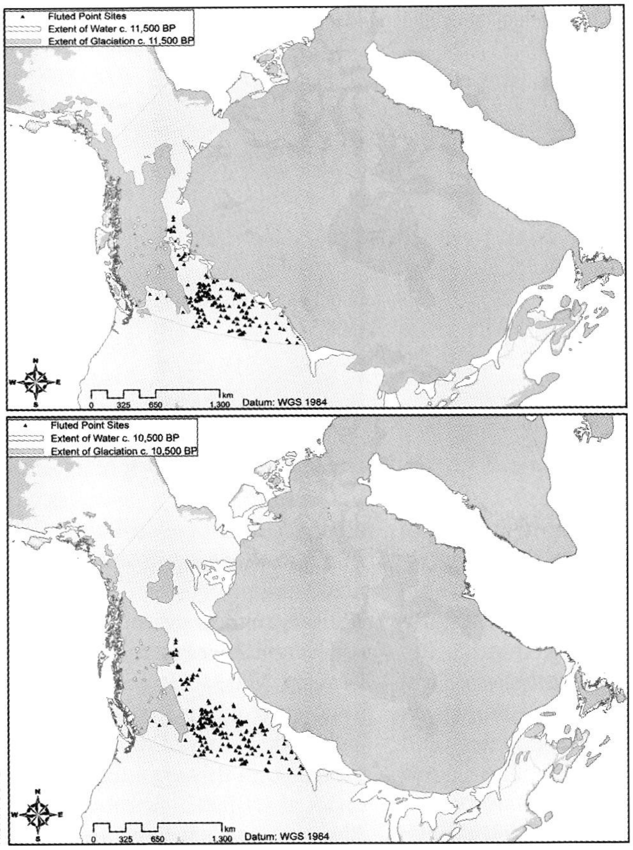
*–Michael R. Waters, Director*

would not yet have closed; conversely, well-adapted foragers could have made use of the area very soon after it opened.

The opening of the IFC is typically portrayed like a jacket zipper unzipping from top and bottom simultaneously, with the middle remaining sutured until the last, blocking entry by humans until Clovis time. But the chronology of deglaciation and the environment of deglaciation are much debated. Work by Arthur S. Dkye (Geological Survey of Canada) and colleagues, using radiocarbon dates on organic material, shows that the ice sheets had begun to unzip by 14,000 RCYBP.

Recent data collected from dune fields in central Alberta by Dr. Kennedy Munyikwa (Athabasca University) and colleagues suggest that deglaciation may have begun earlier in this area. The dunes formed as the LIS retreated. Glacial outwash and moraines provided ready sources of sediment, which was picked up by the wind and transported primarily southeastward. Where the wind slowed, it deposited huge loads of sediment in parabolic and transverse dunes reaching heights of 5 m and lengths of 500–2500 m. Some of the sampled dunes are located east of the LIS boundary proposed by Dr. Dyke and colleagues at about 12,000 to 11,500 RCYBP (14,100 to 13,000 CALYBP). Munyikwa's team used optically stimulated luminescence (OSL) to obtain calendar dates on individual dunes; in some cases, unstable sediments limited sampling of sediment to only the upper half of the dunes. These dates establish dune formation—and by implication LIS retreat from most of central Alberta—at 14,000–15,000 CALYBP (about 12,000–12,500 RCYBP), approximately 500 years earlier than the OSL date obtained by Dyke's team, but within the OSL uncertainty band. Because Munyikwa's team was only able to sample the larger dunes halfway down to their base, however, it's possible that dunes started forming at an earlier date. By implication, the IFC may have opened earlier in this area than has been generally accepted.

An important implication of Munyikwa's work is that the IFC wasn't only ice free, it must also have been water free. To form such large dunes requires a large sediment source area; barren dry ground with little vegetation is ideal. A disturbance regime limiting colonization by plants is often important. This means that at the time dunes were forming, glacial meltwater lakes must not have inundated much of the corridor in central Alberta. Humans, if able to manage the severe climate and sparse game of recently deglaciated terrain, could have been present in central Alberta prior to Clovis.



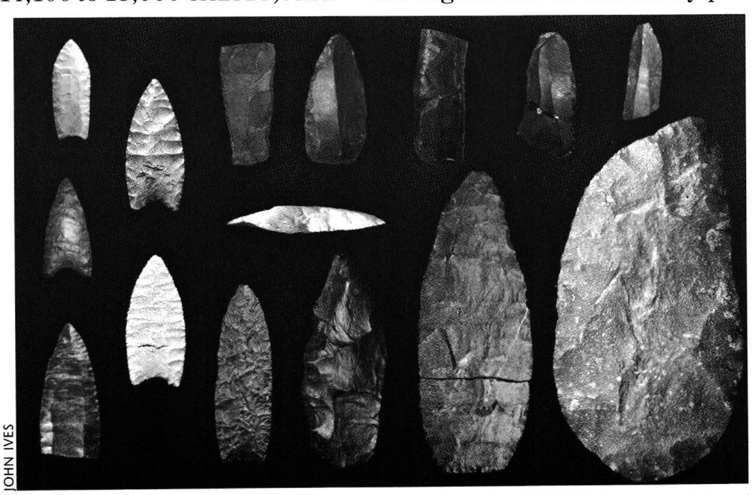

KISHA SUPERNANT

Once the coalesced ice sheets were breached, the width of the deglaciated Ice-Free Corridor expanded rapidly. These maps show the change over 1,000 years. The abundance of fluted points tells us the IFC supported game and was hospitable enough to attract hunters from the south.

## Alberta isn't the whole story

Conditions in central Alberta tell us little about conditions farther north in the IFC. "We know excruciatingly little about this area, in spite of all the assumptions made by researchers arguing for or against entry through the IFC," Ives observes, "The threshold of potential entry could be earlier" than is generally accepted. However, he continues, "There is painfully little directed research with respect to the earliest occupation of the region. It's an extremely poorly investigated area that is still not well understood, and we are not in a position to be as definitive as the debate has been in the last decades." In short, few data exist that establish definitively when the IFC opened in this area.

The evidence may be scant, but what's available is intriguing. Evidence from Charlie Lake Cave along the Peace River in central Alberta indicates that the corridor was pass-



JOHN IVES

These bifaces and points are the imprint of different cultures attracted to the IFC from north and south.

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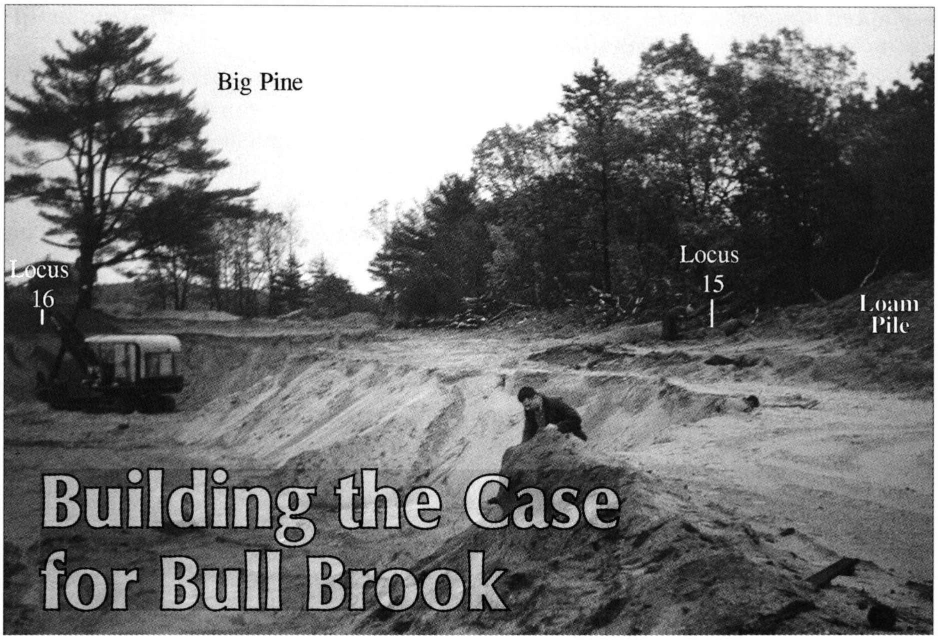
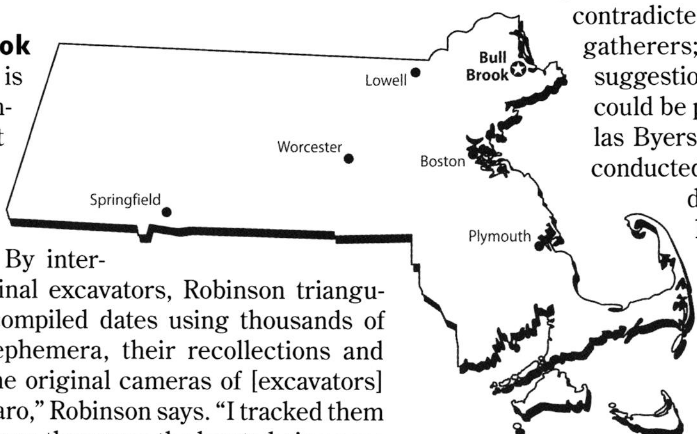



**Robinson says of this photo shot by Bill Eldridge 31 October 1954, "View facing east showing the center of the Bull Brook circle after one half of the site was excavated. This and similar slides show the flatness of terrain across the central open area of the ring-shaped settlement, between Locus 16 (left of the big pine) and Locus 15 (along the fence and the wooded area)."**

# Building the Case for Bull Brook

ARCHAEOLOGY reconstructs a complete history from fragments. Nothing better exemplifies the integrity and success of this science than Brian Robinson's recent work at the Bull Brook site in Ipswich, Massachusetts, the largest Paleoindian settlement discovered in North America. Research into spatial organization and patterning at this site, first begun in the 1950s by a group of avocational archaeologists, is enlarging our understanding of Paleoindian social practices and at the same time underscoring what we don't know. The discovery of clusters of Clovis artifacts arranged in a pattern of concentric circles that suggest a single organized event challenges our knowledge of settlement patterns of Pleistocene North America.

## The history of Bull Brook




Dr. Robinson's excavation is immense in scope—to completely examine the work at Bull Brook, he dug through maps, pictures, film, and notes, and the memories of those who made them. By interviewing the surviving original excavators, Robinson triangulated exact locations and compiled dates using thousands of pages of field notes and ephemera, their recollections and pictures. "I actually have the original cameras of [excavators] Bill Eldridge and Tony Vaccaro," Robinson says. "I tracked them down from the families because they were the key to being sure the focal length was correct." And so he began to unveil a greater significance of researching Bull Brook at great depths: One was its history that began in the Pleistocene, another that began in the 20th century.

That group of avocational archaeologists—Antonio, Frank, Joseph, and Nicolas Vaccaro, William Eldridge, Antonio Orsini, and William DiPaolo—discovered what would become not only the first large Paleoindian settlement in the Northeast, but arguably the largest North American settlement from the Pleistocene. This discovery is mind-boggling in itself, and the act of discovering it is at least equally impressive. "It was amazing what they did," Robinson says. "In the first year, they discovered half of a circle and excavated it. At the start of that year, no one even knew what a hotspot was. They figured that out, managed to salvage it, and made a series of maps at the end of the first year when all of the loci were still open there."

From these humble and informal means came a more organized and professional institution called the Paleo Club in 1956. The original excavators realized this discovery demanded more order, and Nicolas Vaccaro offered up part of his workshop in Beverly, Massachusetts, where they held meetings open to any interested party including many well-known archaeologists, with slide shows, film, and discussion about their findings.

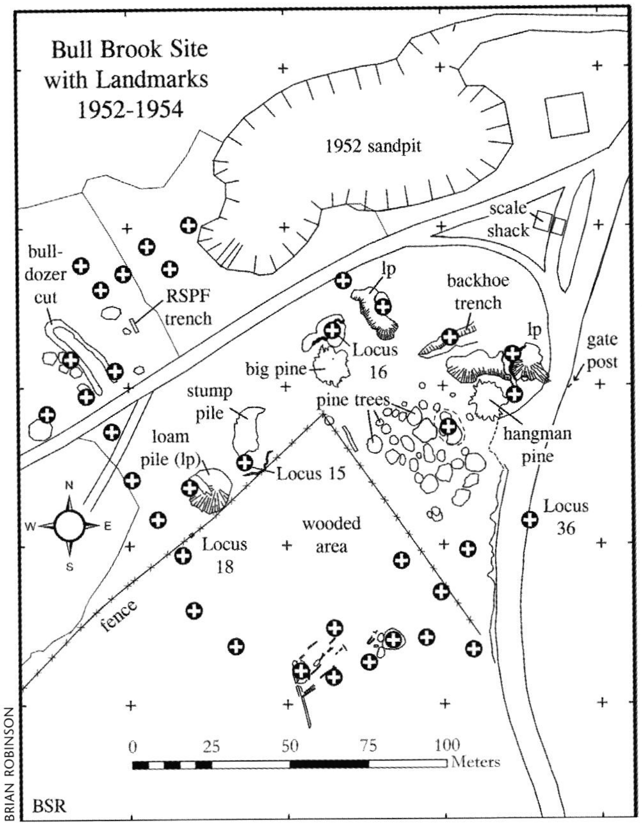
Through this organization, the group recognized that the individual artifact concentrations at the site formed a larger circle. The excavators formed an early hypothesis that Bull Brook was, in fact, a large settlement. At that time, however, this model contradicted expectations about mobile hunter-gatherers; critics denied that there was any suggestion of a system in which these artifacts could be part of a single event. Although Douglas Byers, of the Robert S. Peabody Museum, conducted important small-scale excavations to describe the stratigraphy (Byers 1955), he believed that different artifact proportions in different loci represented change through time, rather than different activities at a single event. Moreover, by 1955 the original excavators had only discovered a half circle, though they thought there was more to be unearthed.

## Scientists and avocationalists, uneasy bedmates

Though this was merely the halfway point in discovering the complete Bull Brook site, the wide gap in archaeologists between avocational and professional became apparent. In fact, the initial aspiration of Paleo Club members toward archaeology caused some scientists to doubt their predictions. Robinson explains that before they discovered Bull Brook, "these guys got interested in archaeology in the '30s, and most of them were Italian immigrants. Back in those days, they had Native American clubs where they would wear really elaborate Plains Indian clothing and things like that." Of course, times have changed and such clubs have lost popularity, "but that was what got them interested in archaeology."

Harvard graduate student Douglas Jordan was skeptical about the influence of the Indian club activities. Even though Jordan had tremendous admiration for the excavators and their work—in 1960 he wrote his dissertation on Bull Brook at Harvard University—he told Robinson that he feared their predictions about the site were too heavily influenced by this culture club. "When these guys first started thinking this was a big camp circle," Robinson remembers, "Doug Jordan was afraid that it was because they were so into this Indian reenactment and Plains Indian stuff that they had in their minds the camp circles from the Plains." But Robinson realized that what could have been simple escapism had the capability to evoke a new reality for the Bull Brook site. "My reaction to that was, 'Well, they did!' They saw the possibility of this when nobody else was looking for it. The fact that they had seen an example from the Plains didn't necessarily falsify their conclusions about things. It made them interested."

Despite criticism, the group plodded on. Bill Eldridge, who acted as the Paleo Club record keeper by documenting and collecting extensive notes and sketches, wrote about their projection in 1953 after the group mapped their area. Eldridge and the others wanted "real archaeologists" to continue the work the Paleo Club had begun, but it was as if the work done was always assumed to be the end of it, without seeing the potential for further excavation. In 1954, half the site was preserved in a wooded area on an adjacent piece of property. Based on their map, Bill and the Vaccaros predicted where more Paleoindian camps would be found. "But they couldn't convince anybody to be interested," They got permission from the land owner to dig in the woods and immediately found Locus 18. This second discovery, though, was likely not as glamorous as they'd hoped. "They dug hundreds of test pits and found only the one locus, so they thought they were wrong. At that time, they thought that they were done."



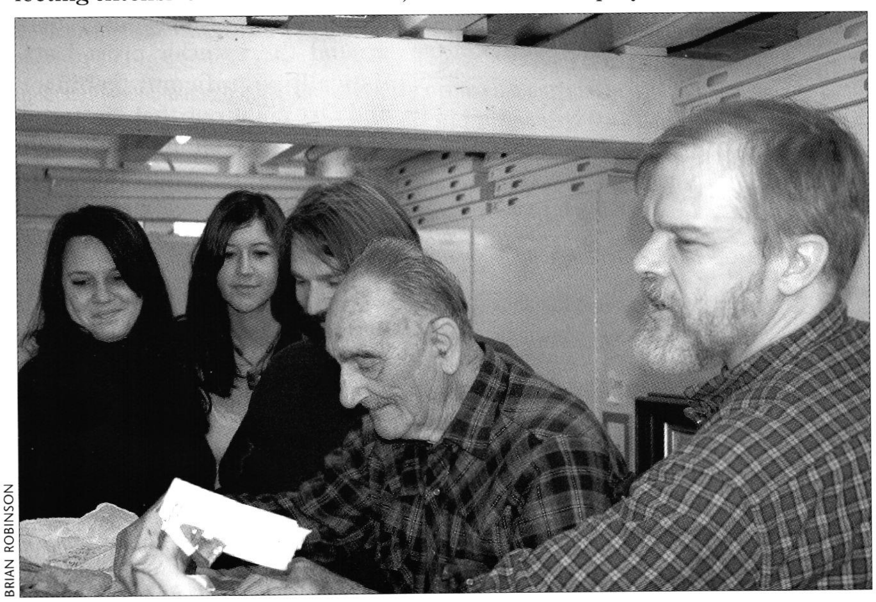

Site plan with landmark data that show the entire extent of the Paleoindian circle at the Bull Brook site. "These are landmarks visible in aerial photographs of 1952–54," says Robinson, "that were also visible in color slides and movies." Symbol ⊕ indicates Paleoindian locus or house location.

But their disappointment turned, and the mistake they'd made actually helped to prove their original hypothesis. "It turned out that what they had done was go out into the woods, but they were in the center of the circle," explains Robinson. "They just didn't realize how big it was. It wasn't until a couple of years later when the loci started showing up at the edge of the utility road that they went in backwards and followed it around to complete the circle. This piece of land was later mined for sand as well."

The Paleo Club had correctly predicted where more loci would be found, and by 1958 the loci at Bull Brook did indeed form a circle. Even better, their work was tirelessly documented and photographed, and they had an argument that, even if wrong, couldn't be ignored.

## Context of concentricity: Can the center hold?

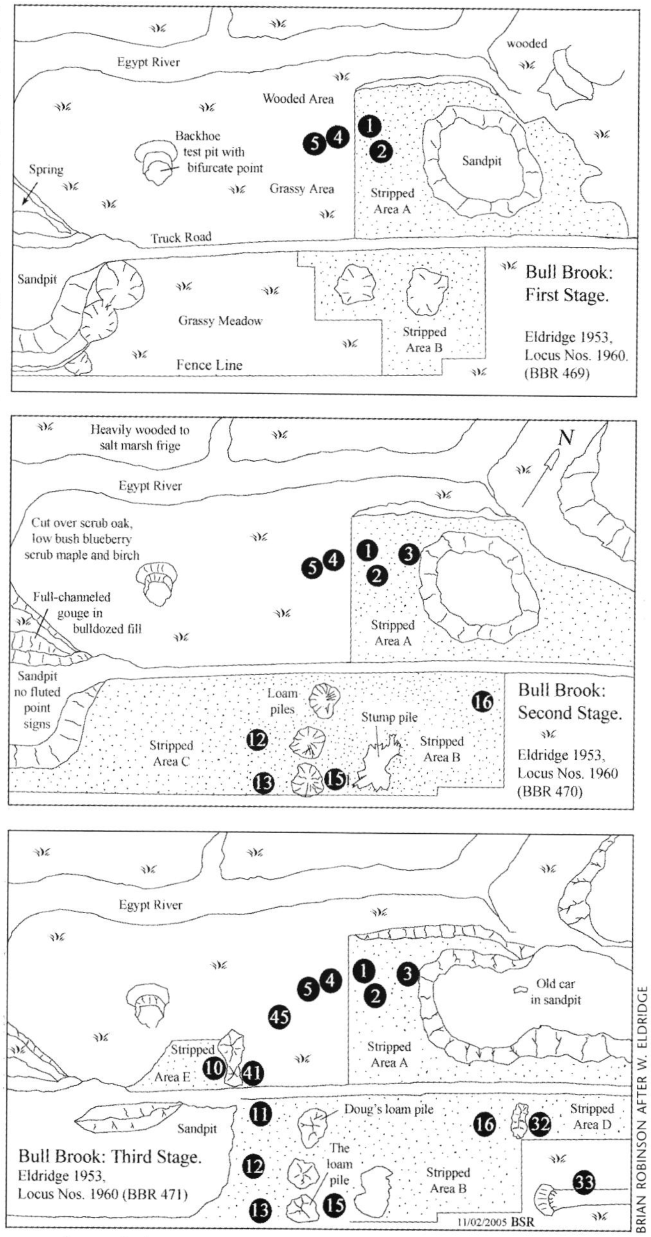
The map of the circular pattern of hotspots remained unpublished for nearly two decades until




The authors of the *American Antiquity* article *(left–right)* Jennifer Ort, photographer Erica Cooper, Bertrand Pelletier, William Eldridge, and Brian Robinson at the Peabody Essex Museum in Salem, Massachusetts, January 2006. (Not present is Adrian Burke.) Robinson is holding a fluted point from Locus 11.

the next major episode of Bull Brook research, when John and Beth Grimes and Director Peter Fetchko of the Peabody Essex Museum (PEM) convinced the excavators that their collections should be brought together for study at the museum. Bill Eldridge was also employed by the museum, so he was always near the precious collections and research. In 1979, the circular plan was published by Grimes and another generation of researchers began building the case that Bull Brook and more recently excavated Paleoindian sites could represent single occupations. Robinson came to work at PEM in 1985 with Frederick West and Marylou Curran when the Bull Brook research was ongoing, and over many lunches with Bill Eldridge began to appreciate the scale and diversity of original field records.

Today, great energy at Bull Brook is focused on understanding the spatial organization of the different activities at the site. Although the circular pattern is manifestly apparent, archaeologists, including Robinson, wondered if this pattern holds any cultural significance. In his 2003 grant proposal to the NSF, Robinson explained that his research aimed to "test whether the ring-shaped pattern was culturally real to the Paleoindians." To do this it was necessary to increase the accuracy of the site plan and cross check all the original sources of information, which would not have been possible without the memories of the excavators, who were then in their 80s. The NSF grant funded graduate student Jennifer Ort, who spent three months at the Peabody Essex Museum, often accompanied by Bill Eldridge. Adrian Burke conducted lithic analysis. Since then, a great amount of spatial artifact analysis suggests that the ring-shaped pattern was very real to the Paleoindians and more organized than anticipated. "We data-checked the hand-written PEM catalog which was made long before I got there," Robinson recalls, "and you can evaluate what the catalogue had before we realized this pattern existed at all."




**Stages of excavation. These three maps produced by Bill Eldridge in 1953 show stages of discovery in the first year of excavation. The locus locations (11), with revised locus numbers that were not used until 1959) were accurately measured in the field, but the surrounding landscape was not drawn to scale. Landmarks on these maps are drawn to scale on the revised plan. Compiled by Robinson from colored originals at the Peabody Essex Museum.**

The artifacts distribution was telling; the scores of bifaces clearly revealed Clovis lithic activity at Bull Brook, and the locus-specific ratio of channel flakes to bifaces and scrapers revealed that systematized fluted-point production occurred only in certain locations. Eldridge and the excavators had already recognized that at least three loci were different from the others, judging by the number of drills and other artifacts (see *In the Eastern Fluted Point Tradition* in "Suggested Readings"). "The interior-exterior locus distinction was never made by the excavators," Robinson explains, "and beyond the observation about drills we had little basis for comparison for any other artifact forms."

By applying spatial analysis, a method only emerging in the 1950s when the original excavators were working, Robinson and his team sought to infer from the contents found at each locus a greater structure. As Robinson and his coauthors note in "Paleoindian Aggregation and Social Context at Bull Brook," the site was discovered before there was much archaeological interest in spatial patterns. As they continued mapping the loci, however, a greater pattern emerged. The concentration of drills, flakeshavers, and bifaces on the interior, and endscrapers around the exterior proved statistically significant: Robinson and Ort point out that "in terms of the average number of tools in each locus, this means that there are, on average, 6.3 and 8 times more flakeshavers and drills on interior loci."

The researchers wondered if the quantity of tool types corresponded to the radial displacement of the locus from the center of the ring of loci. By comparing groups where bifaces, flakeshavers, and drills predominated with those identified by a similar abundance of endscrapers, they found that the relative contrast correlates to the position of the locus within an interior or exterior ring. As a result, Robinson and Ort propose that "the interior and exterior loci are characterized by different kinds of production (such as hunting weapons and skin working) but not necessarily the distribution of end products."

### Putting Bull Brook into context

The chronology of Bull Brook continues to be refined. The Bull Brook phase has been defined as approximately 11,000–10,500 RCYBP. A new method of dating calcined bone, however, reveals a somewhat younger site. Recent dating of calcined bone yielded dates of 10,410±60 RCYBP and 10,380±60 RCYBP. Although the results from this new technology may be revised in the future, they nevertheless suggest that Bull Brook should be placed late in the original temporal range. Consequently, Bull Brook assumes further importance as a defining mark of Paleoindian-period subdivisions and the cultural organization of the Pleistocene.

Robinson's work with Bull Brook is also leading him away from the site itself to nearby areas that might explain more about its social organization. He argues that a study of nearby Jeffreys Ledge, about 2½ km east of Bull Brook, might reveal more about subsistence strategies around Bull Brook and the size of population it could support. (See *Late Pleistocene Archaeology and Ecology in the Far Northeast* in "Suggested Readings.") "Jeffreys Ledge was interesting," he says. "I, like other people, asked, If Bull Brook was there, why was it there?" His work at the Climate Change Institute led him to a fishing bank east of Bull Brook that was an exposed island around the time in which the Bull Brook findings are placed. "I just naturally looked at the bathymetry of the bay, and what I was looking for was something like an underwater valley that caribou might have been herded up or something like that. [**MT 25-1,** "Finding Traces of Early Hunters beneath the Great Lakes.] There was no valley at all; instead there was this ridge, directly opposite Bull Brook, that may have may have been a grassy island one third the size of Cape Cod." This ridge called to mind another question in the case of Bull Brook. "The thing that's so neat about it is that when Bull Brook was occupied, that area was forested. Why would you have a big gathering, potentially for caribou? The island provided a possible scenario."

Jeffreys Ledge, although a recent speculation, stands as a fine example of the depth of inquiry Bull Brook continuously demands. When Robinson speaks of it, it's disguised with the enthusiasm and curiosity of a new beginning. "All I've done is built a case, a plausible scenario, of how this could have affected Bull Brook."

### Establishing an emerging pattern

At Bull Brook, as in Robinson's extensive work, the discoveries that have emerged are vastly different in kind and scope from his original objectives. "My goal was to make what we did replicable enough so that anybody who wanted to could actually go through the exercises." Nevertheless he knows the work at Bull Brook is nowhere near complete. "There's a lot left to be done," he admits. "It's rather imposing." Even now, he secures documents in order to evaluate and rebuild them as he catalogued the others.

Though research at Bull Brook is moving toward proving the hypotheses of the original excavators, Robinson acknowledges the necessity for a modern critique. "If those patterns are like those that we've seen at other sites, they'll show up again. One needs to be a skeptic, but I must admit I have had trouble thinking of a way to disprove that Bull Brook represents an organized event once the patterns became clear."

Robinson believes that with further scrutiny, the organized character of the site will


WILLIAM ELDRIDGE, COURTESY OF THE PEABODY ESSEX MUSEUM

**Nick Vaccaro (*right*) with a fluted point in situ (*arrow* and inset) that was found 11 November 1954, the very day that a group of Harvard students visited the site. The point was not in a locus, but was one of several isolated points found within the center area of the Bull Brook ring. The point (PEM 5063) is today in the collection of the Peabody Essex Museum.**

become more apparent, which will set the stage for questions not yet anticipated. In turn, building the case for Bull Brook continues. MT

*–Ryan Huff*

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## Suggested Readings

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# The Vela Supernova

A supernova remnant (SNR) in the Vela constellation, captured by the European Southern Observatory (ESO) 1 m Schmidt Telescope at La Silla in Chile. The glowing gas ribbons seen here are the product of a shock wave launched into the interstellar medium by a large star that exploded about 11,000 years ago. A "ghost" of the once-large star remains: Located in the central region of this SNR is an ultra-dense neutron star, called a pulsar, that spins more than 10 times a second. Possible long-duration SN-related bursts of gamma rays over the past 30,000 years are recorded in remnant nebulae, like these gas ribbons. Brakenridge tells us that most such nebulae are quite distant, measured in kpc (a pc, or parsec, is a unit of astronomical distance equal to 3.258 light years). This nebula, however, is a remnant of the Vela SN, which occurred quite close to Earth, 250 ± 30 pc. Gauging from remnant nebular shock velocity, it dates to 13,000–16,000 CALYBP. Its magnitude, proximity to Earth, and timing make it a prime candidate for the agent that triggered the Younger Dryas.

**RESEARCHERS REACHING FOR THE STARS** to solve earthly mysteries are shedding tantalizing new light on perplexing questions swirling around late-Pleistocene climate change and mammalian extinctions—possibly including the disappearance of the Paleoindian hunter-gatherer culture known as Clovis.

Predictions that exploding stars release enormous amounts of high-energy photons have been corroborated by optically observing core-collapse supernovas beginning in 1997, according to G. Robert Brakenridge, director of the Dartmouth Flood Observatory and senior research scientist at the University of Colorado Institute of Arctic and Alpine Research. Researchers also suspect that such high-energy bursts at times have altered the climate and ecology on Earth, with sometimes devastating results to animals and humans alike.

One supernova in particular has piqued Brakenridge's interest, the explosion approximately 13,000 years ago of a star some 800 light years from Earth in the southern constellation Vela. Significantly, this so-called "Vela Supernova event" coincides with the onset of a period of severe cold and drought conditions across the Northern Hemisphere known as the Younger Dryas Stadial (12,900–11,550 CALYBP). Faunal remains from this period testify to a sudden jump in mammalian extinctions beginning roughly 12,830 CALYBP, extinctions that have sparked various hotly debated explanations that include climate change, overhunting, disease, and the impact of a large comet.

Brakenridge suspects more than a casual connection between the exploding star, the Younger Dryas, and the sudden demise of megafauna. The Vela event "may have initiated the Younger Dryas climate change, and caused the extinction of the terminal Rancholabrean fauna," and drastically altered the lives of Clovis-age people, Brakenridge writes in an article in the 2011 issue of the journal *Icarus*. "Vela may also have caused extinctions of large, mostly diurnal, open dwelling mammals at this time, across much of the temperate and high latitudes," he writes, "and it may have exerted a significant impact on the lifeways of the Paleoindian/Clovis hunters, whose well-dated lithic and other material remains dominate New World archaeological records just prior to Younger Dryas time . . . and disappear shortly thereafter."

He's quick to point out that this hypothesis isn't a "silver bullet" that can totally explain late-Pleistocene system collapses, particularly megamammal extinctions. He concedes that the cause, or causes, of this complex issue lack widespread consensus, but he believes Vela merits consideration as a probable trigger for the Younger Dryas climate change. For Brakenridge, a supernova, with its attendant massive bursts of gamma rays, absolutely warrants a place among the possible causes of the Younger Dryas and consequent events. Why? Because we know the Vela event happened, and the predictable fallout from it may have dramatically reshaped our planet.

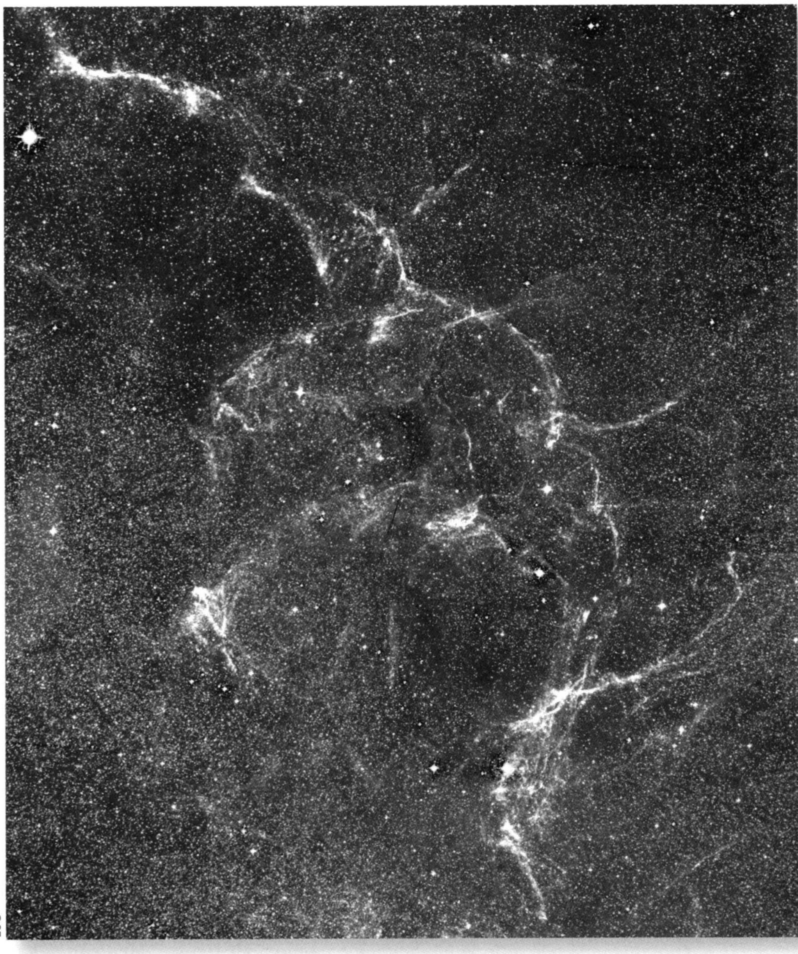
## A spectacular show of deadly force

A supernova is the sledgehammer of the cosmos, capable of unparalleled devastation, and small wonder, for it's nothing less than an exploding star. When a star explodes—either an exhausted star, a "white dwarf," that suddenly reignites, or a massive star whose core collapses—more energy is released in a matter of weeks or months than our Sun emits in its lifetime of billions of years. The matter that constituted the star is violently expelled, creating a shock wave that sweeps dust and gas before it throughout the vast interstellar reaches. The shattered material becomes star stuff, which in the distant future may coalesce and become offspring of the deceased star. Detectable remnants of past supernovae tell us our galaxy experiences on average one such event every century.

On Earth the Vela event would have been a dazzling spectacle. Picture this: When the star exploded, Brakenridge explains, an intense invisible photon flash of gamma rays and X-rays lasting "several minutes at most" would have collided with Earth's upper atmosphere and immediately disrupted the ozone layer. What then followed was intensely bright glaring light. An observer looking skyward would have seen a luminous star brighter than a full moon. “There is no question Paleoindians would have looked up at the sky and seen this,” Brakenridge assures us. The glare would have persisted for three to five months before it started to fade.

Meanwhile, destruction of the precious ozone layer would have unleashed a succession of events that wreaked havoc

## *A shock to Pleistocene life and climate*



ESO

with the landscape and spread a pall of misery and death over the organisms living on it. With the ozone layer partially or completely obliterated, Clovis people would have immediately suffered severe sunburn, and over time a high incidence of skin cancers, especially deadly melanoma. They surely would have witnessed immediate wilting of plants sensitive to UV light, followed by heavy mortality of some floral species, particularly in the Northern Hemisphere, where the impact is thought to have been greatest.

### The heavy hand of climate change

The long-term effects were even more calamitous. Scientists predict that long-term massive doses of gamma rays catalyze chemical reactions between oxygen and nitrogen molecules, creating first nitrogen oxide, then nitrogen dioxide gas, a photochemical smog that darkens the sky and dramatically cools the land below.

We have an inkling of the consequences of such wholesale cooling. Historians remind us of the devastation that resulted in 1815, when Mt. Tambora in Java blew a third of its 13,000-ft-high bulk skyward in a volcanic eruption. The explosion killed 10,000 Javanese outright. Far more destructive, however, was the effect of the sunlight-obscuring gas and dust effluvia. Famine and disease caused by starkly colder temperatures killed 82,000 people in the Far East, and halfway around the world destitute farmers suffered through “the year without summer.”

The Mt. Tambora event, shattering and widespread though its effects certainly were, shrinks to a mere footnote in history compared with the profound climate changes Brakenridge attributes to the Vela Supernova, which he believes ushered in the Younger Dryas. The effects of the YD are measured on the epochal scale, over hundreds of years, not tens of months. Severe drought completely altered vegetation patterns across the landscape, thereby depriving many herbivores of their traditional food supply. Adapt or perish is the unalterable rule that decides success or failure in the struggle for survival, and the fossil record is the score card of winners and losers among megafauna species (**MT 27-4,** “Mass Extinction of Megamammals: A Prehistoric Who-Done-It”). Humans likewise, forced to adapt to dramatically changing environments, would have found it necessary to replace vanished food sources with alternatives. Clovis hunter-gatherers, for example, may have abandoned their subsistence strategies and distinctive stone toolkits and adopted new tool types compatible with changing ecosystems and a new host of prey animals.

### All cataclysms aren’t alike

Brakenridge is quick to cite differences between his hypothesized Vela Supernova event and the so-called “Clovis Comet,” a theorized extra-terrestrial event that has been proposed as the cause of massive late-Pleistocene climate changes, the extinction of large mammals, and the demise of the Clovis culture (**MT 23-1** through **-3,** “The Clovis Comet”). Adherents of the Clovis Comet theory propose that 12,900 years ago a comet struck Earth and created a huge explosion that ignited continent-wide forest fires, destroyed food supplies for large megafauna, and ultimately drove them and their human predators into extinction. Critics of the theorized Clovis Comet contend that there is no evidence for Clovis-age continent-wide fires (**MT 24-4,** “Fire Record Undercuts Clovis Comet Theory”), that data are misrepresented (**MT 26-4,** “The Clovis Comet Revisited”), that other scientists can’t duplicate the data, and that confirming evidence is lacking.

“I draw a large distinction between my work and that,” Brakenridge says of the supposed Clovis Comet. He’s confident of his theory because it deals with a known and extensively examined event. In the case of the Clovis Comet, “exogenetic causation for terrestrial environmental changes requires a high standard of proof," Brakenridge charges in his newer *Icarus* article, written 30 years after the first. He disputes the Clovis Comet theory because no one has produced evidence that a cataclysmic event actually occurred at the critical time in question, the end of the Clovis period. None of the terrestrial changes he attributes to the Vela Supernova, on the other hand, relies on off-planet explanations. Brakenridge submits that the theorized effects of the Vela Supernova on the Earth and its organisms are scientifically confirmed, their validity "verified by theory, modeling and identification of an actual candidate event" by researchers in the rapidly growing field of gamma-ray science.

## The birth of a new branch of science

Tracking the activity of stars isn't new for Brakenridge, who has pursued astronomy since his youth. Gamma-ray science, though, is a relative newcomer. As early as 1948 researchers predicted that supernovas should emit bursts of photon energy, but it wasn't until the 1960s that scientists had the ability to detect such emissions. That's because most gamma rays are absorbed by the atmosphere, making a space-based platform necessary to study them. Explorer II launched in 1961 gave the new field a giant leap forward. Science got a big boost during the Cold War era of the 1960s and 1970s, Brakenridge explains, when the Defense Department launched satellites to detect nuclear explosions by measuring emitted bursts of gamma rays. Scientists assigned to surveillance noticed a curious anomaly: The satellites were picking up gamma-ray activity, not related to nuclear testing, but instead originating from a distant point in the galaxy. The discovery sparked intense scientific inquiry, and the National Aeronautics and Space Administration (NASA) launched its gamma-ray programs, thereby creating a new discipline known as gamma-ray astronomy. Innovative technology in this field has made it possible to create highly detailed computer models of supernovas and other gamma ray–producing events and to study their behavior. Of the hundreds of supernovas so far identified, the Vela Supernova is the closest known event during the past 30,000 years, after which the remnant nebular record fades. Theory and repeated observations of these events in other galaxies now indicates that Vela was capable of inflicting catastrophic damage on the scale of the Younger Dryas Stadial.


ROBERT KRIMMEL, USGS

**The Vela Supernova was more devastating to life on Earth *by many orders of magnitude* than a volcano as violent as Mt. Tambora, or the eruption in 1980 of Mount St. Helens in Washington State seen here.**

## A theory a long time in the making

Following a career path in geology, Brakenridge closely eyed scientific progress surrounding supernova research. It was the seminal book *The Historic Supernovae* by Clark and Stephenson published in 1977 that excited him about the possible effects on Earth of a supernova event. After writing the paper for *Icarus* in 1981 on the hypothetical impact on the Earth of the Vela Supernova, he dropped his research for a time. Armed with a new doctorate in geology and trying to get a job as a geologist, he thought it wise not even to mention the paper on his curriculum vitae. Geologists, he frankly says of his colleagues, are a conservative bunch. "I didn't want the paper to be a distraction," he confesses, "you know, get into an interview and have people ask, 'Well, what is this thing about a supernova you wrote on?' "

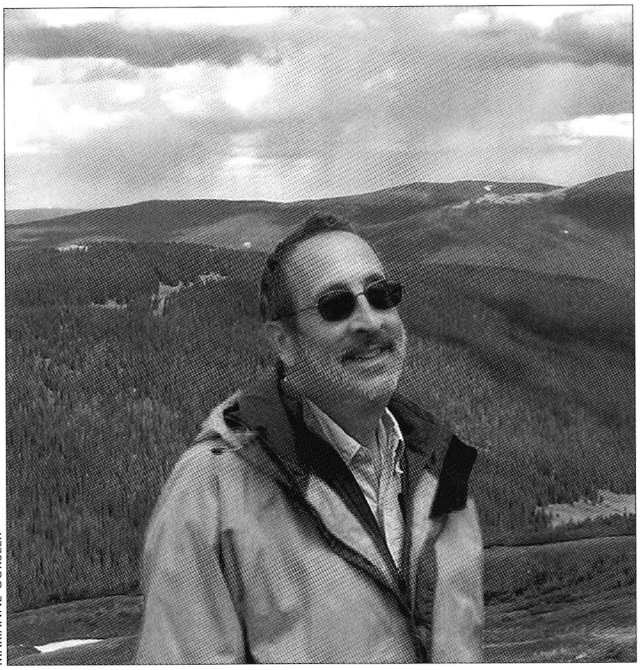
The obstacle that hindered his further research was the lack of available data on supernova-related hard photons. At the time the very existence of radiation capable of producing measurable effects on Earth was purely speculative. That was then. Today Brakenridge is confident that the astronomical community, with a firm grasp of supernova science, is poised to contribute to the hotly contested debate over the causes of rapid Pleistocene climate change and mammalian extinctions. He explains that "satellite-based gamma ray observations conjoined to ground-based optical telescopy have established the location of beamed gamma ray bursts and beamed or un-beamed X-ray bursts and their high energies," linked them to supernova events, and calculated the high intrinsic energies of bursts or flashes for specific events. Such quantified data make it impossible to ignore the influence on Earth of cosmic radiation. Once considered speculative, radiation flashes now "are a normal component of Solar System radiation history," says Brakenridge.

"There has been a big change in our understanding of Supernovas over that period of time," Brakenridge says. "Everything I outlined in 1981 is still there, but what was more speculative then is less speculative now." That explains why he picked up his story again and wrote the newer 2011 article for *Icarus.*

## Defending and disputing the effects of the Vela Supernova

Brakenridge points to evidence that documents the precipitous onset of the Younger Dryas and supports his choice of the Vela Supernova as prime mover in the upheaval. Spikes of carbon-14 and the alkaline earth metal beryllium in ice and marine cores and tree rings coincide with abrupt drops in ammonia and methane in ice cores—precisely the markers that signify such an event. Moreover, geologic data from various locations register spikes in soil and inland water fertilization, indicating increased atmospheric nitrogen fixation and an infusion of compounds of various mixed oxides (NOx)—results entirely compatible with upper-atmosphere disturbance associated with a supernova impact.

The fossil record confirms his theory. Dated stratigraphic and faunal sequences in central North America, for example, verify a sudden pulse of extinctions beginning around 12,700 CALYBP, coinciding with the Vela Supernova event, of large mammals including the Columbia mammoth, dire wolf, camel, and horse; deposits a century younger, however, "are devoid" of extinct fauna remains. Brakenridge concedes he can't explain why the Northern Hemisphere appears to have borne the major impact of the Vela Supernovae event or why some species were affected more than others. It's also worth noting that species not generally on a hunter's menu also died out during the same period in Europe, Asia, and Africa. Could these disappearances be related to the Vela Supernova? Brakenridge would say it's certainly worth exploring.


MARIANNE OURSLER

Brakenridge at Rocky Mountain National Park, Colorado, 2012.

Although studying the impact of ultra-violet energy on animals was beyond the scope of his paper, Brakenridge suspects that massive doses of ultra-violet radiation played a part in faunal extinctions. He notes that the effects of UV radiation are showing up in "shallow water marine organisms, such as coral reefs, which appear to be at their limits now." Indeed, some researchers believe the major Ordovician-Silurian extinctions of 450 million years ago may have resulted from radiation bursts powerful enough to affect life. A burst of such magnitude strikes Earth every five million years or so, or roughly 1,000 times since our planet was formed.

Predictably, skeptics abound. Some critics of his 2011 publication faulted his apparent disregard of the law of parsimony, Occam's Razor: When competing theories come into play, the simplest one is preferred. Don't, for example, look to outer space for solutions to earthly problems that may be found by examining natural Earth processes. Brakenridge disagrees. In his mind the Vela Supernova hypothesis is the thriftiest explanation for all phenomena associated with the Younger Dryas, and one firmly grounded in a known event with predictable consequences. "I think Occam's Razor would favor an explanation like this," he declares. "It certainly isn't legitimate science to discard it out of hand because you are unfamiliar with it."

I'm hoping the Quaternary community does not approach this from the standpoint of questioning whether our Paleoenvironmental record requires a supernova," Brakenridge says. "Rather, the Vela Supernova was a late Quaternary event that certainly did occur, and was large enough to affect our atmosphere." Was it in fact large enough to disrupt the climate and doom significant numbers of the animal kingdom to extinction? "I'm inclined to think that it was," Brakenridge contends.

### The road ahead

There remain questions yet to be answered to validate his hypothesis. A significant task that demands attention is to refine the radioisotope signal at the time of the Vela Supernova event to obtain a baseline for evaluating future data. Specifically, he sees the need to plot an annual or near-annual record of carbon-14 and beryllium across a range of sites for the period preceding and following the event. Work done thus far indicates a sharp increase in those isotopes, but he frankly confesses there's "a great deal of complexity about what those readings mean." He hopes to complete a paper in the near future with refined numbers that plot the intensity of gamma radiation with the corresponding level of carbon-14.

"I don't think I can support this hypothesis by just describing the effects," Brakenridge explains. His goal is to make the strongest possible case that the Vela Supernova event occurred, that it occurred at the right time, and that its magnitude was great enough to have caused the effects he claims. Then, he says, "let the ecological and biological implications fall where they may." MT

*–George Wisner*

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## Suggested Readings

Brakenridge, G. R. 1981 Terrestrial paleoenvironmental effects of a late quaternary-age supernova. *Icarus* 46:81–93.

——— 2011 Core collapse supernovae and the Younger Dryas/terminal Rancholabrean extinctions. *Icarus* 215:101–06.

Clark, D. H., and F. R. Stephenson 1977 *The Historical Supernovae.* Pergamon Press, New York.

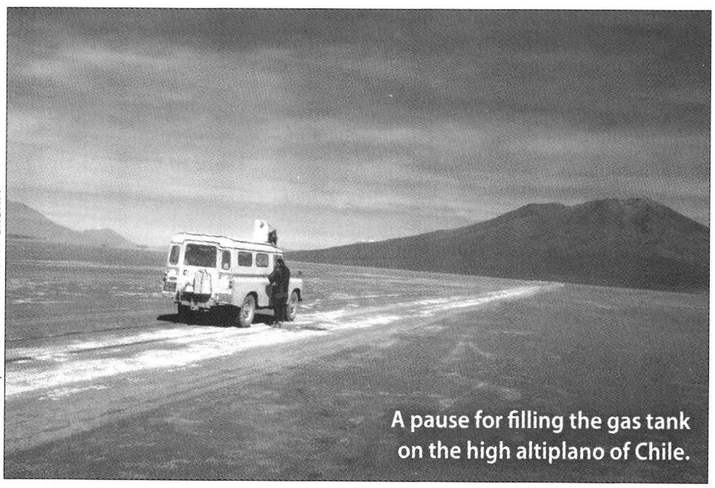
# Looking Back at Over 40 Years of Research on the Peopling of Latin America

*by Ruth Gruhn*

***Editor's note:** In 1969 Ruth Gruhn and her husband, Alan Bryan, and their five-year-old child set off in their now-famous Land Rover on a great adventure: a 12-month journey that carried them the length and breadth of Latin America, from Mexico to the Straits of Magellan, from Chile to Uruguay and Brazil. We asked Dr. Gruhn to share her memories and images of this memorable accomplishment with* Mammoth Trumpet *readers. Below is the first of her 2-part recollection.*

FOR ME the research focus upon early Latin America began in 1969, when my husband, Alan Bryan, and I undertook a 12-month trip by land from New York to Argentina and Brazil. Our intention was to visit and evaluate Pleistocene-age archaeological sites then known in Latin America. In this article, I'll describe our discoveries, and reflect upon the great progress made by international researchers into the record of the first South Americans since that memorable journey.

For decades before our trip, the dominant archaeological model among theories concerning the early peopling of the Americas was the concept of Clovis-first, the idea that the earliest people were specialized hunters of megafauna, principally mammoth, who, at the end of the Pleistocene ca. 13,000 years ago (ca. 11,000 RCYBP), had entered the interior of Alaska from Siberia and passed south through an ice-free corridor east of the Rockies, speedily to populate both continents of the Americas. This primordial American culture, known as Clovis, was characterized by large fluted projectile points.



UNLESS NOTED, ALL PHOTOS: RUTH GRUHN

A pause for filling the gas tank on the high altiplano of Chile.

This model continued very strong during the 1970s, with the publications of Paul Martin and his idea of "blitzkrieg," the rapid continental expansion of the Clovis big-game hunters, resulting in the extinction of the Pleistocene megafauna throughout the Americas. The map of the wave of advance of Clovis hunters throughout North and South America appears a fantasy now; but it is important to remember that at that time, the great majority of North American archaeologists knew virtually nothing about early sites in South America. Most knew only of Fell's Cave, near the Straits of Magellan, excavated by Junius Bird in the 1930s, which had yielded stemmed "Fishtail" points in association with bones of extinct horse and giant sloth. It was observed that some of these points were fluted, a morphological feature considered similar to the Clovis type. With later dates of ca. 12,700–13,000 years ago (10,700–11,000 RCYBP) for the earliest occupation level at Fell's Cave, it was easy to imagine an extremely rapid movement of Clovis hunters from North America through Panama and down throughout all of the southern continent to its very tip.

Among North American archaeologists at that time, there were very few scholars who had doubts about the Clovis-first model. One of these was Alan Bryan. In the 1960s, Alan and I were young professors of anthropology at the University of Alberta in the city of Edmonton in western Canada. We were living right in the middle of the famous Ice-Free Corridor; but we soon realized that the area had been severely eroded by the late-Pleistocene continental ice sheet, and it would not be possible to find any evidence of an entrance by humans before the end of the Last Glacial Maximum. It was necessary, then, to look for old archaeological sites south of the perimeters of the continental ice sheet; and we turned our view to Latin America.

## A trip anticipated for years

From the beginning of his academic career, Alan's principal interest was in the problem of the timing and circumstances of the first entry of humans into the Americas. In his research for his doctoral thesis (*Paleo-american Prehistory*, published in 1965 by the Idaho State College Museum), conducted in the excellent library of the Peabody Museum of Harvard University, Alan found reports of Latin American archaeological sites that appeared to be older, and of a very different character, than the famous Clovis sites in North America. So, when our first sabbatical leave came in 1969, we decided to travel by land to South America in order to visit known early sites. In those days, our university had enough funds to support the project. No less important was the agreement of the grandparents to our intention to take our preschool child with us on the adventure.

So we bought an excellent field vehicle, a classic Land Rover, in England; took delivery at the port of New York; and set forth, passing through the southeast U.S. into Mexico in August 1969.

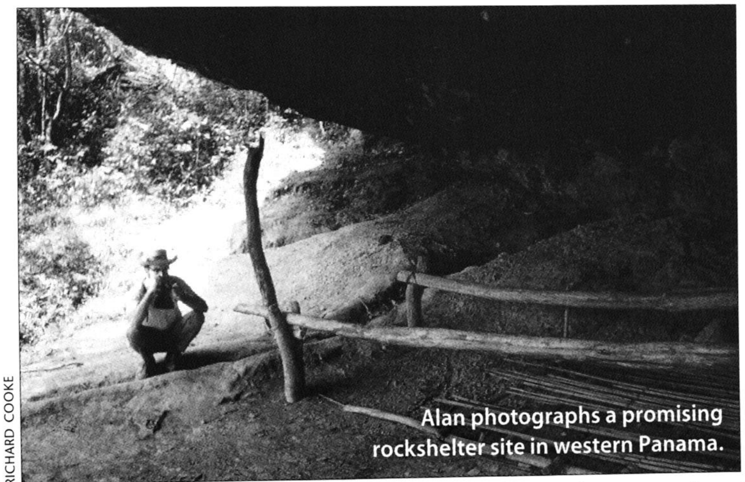
Their circum–Latin America route.

We stopped for a few days in Mexico City, to visit with geoarchaeologist José Luis Lorenzo at the Instituto de Préhistoria. In 1967, José Luis had taken us to visit the late-Pleistocene localities of Tlapacoya and Valsequillo. We had an opportunity at that time to examine the complex late-Pleistocene volcanic deposits exposed in deep sections in the Basin of Mexico and the Valley of Puebla. Intensive archaeological and geochronological research has taken place in the region since our visit, and the time of first human entry into central Mexico should soon be established.

## A Paleoamerican discovery that has endured

We arrived in highland Guatemala in September. Here we spent two months residing in the traditional Mayan town of Chichicastenango. While I undertook ethnographic observation of the customs of the indigenous people, Alan carried out an archaeological reconnaissance in the mountains around the town center. Observing basalt flakes weathering out of a bank along a pathway, Alan discovered the Paleoamerican site of Los Tapiales, situated in an open meadow on the continental divide at an elevation of ca. 10,000 feet.

In the case of Paleoamerican research, it is necessary to know what to look for in the field. I recall the observation of the famous Mayanist Edwin Shook, when Alan showed him the basalt flakes from Los Tapiales: "Alan," he said, "in all honesty, I would not have recognized those flakes as artifacts." It is not surprising to me that there are still few Paleoamerican sites known in the Maya area. Well, in the summer of 1972, we returned to Los Tapiales for complete excavations, which produced, among flakes, bladelets, burins, flake scrapers, and bifaces, a base of a fluted point and a date of ca. 12,700 years ago (ca. 10,700 RCYBP). Los Tapiales is still the oldest dated archaeological site in Guatemala.


RICHARD COOKE

Alan photographs a promising rockshelter site in western Panama.

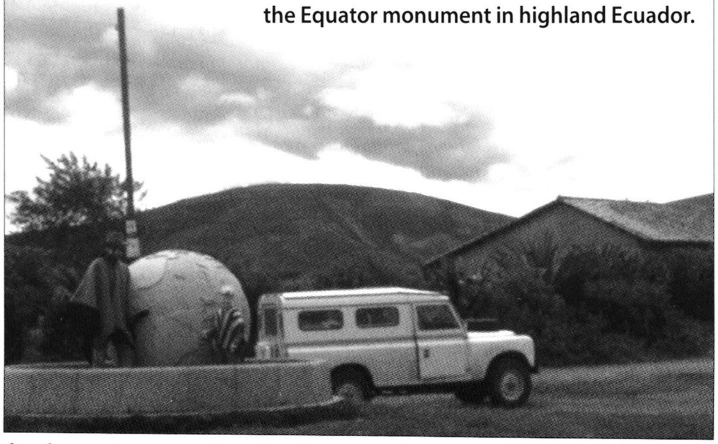
In December 1969 we continued south, passing through Honduras, Nicaragua, and Costa Rica. At the end of December we arrived in Panama, the gateway to South America. As there is no road connection through the dense rain forest and rugged country extending from Panama into Colombia, we had to wait a month for a ship to Venezuela. We had the opportunity to meet with Smithsonian archaeologist Richard Cooke, and together we visited interesting archaeological sites in western Panama.

## As far as the eye can see, Clovis-age dates—and earlier

In January 1970, when we arrived in South America, we encountered for the first time a very different archaeological world. In Venezuela, at the museum at IVIC, a scientific research institute in Caracas, we were introduced to El Jobo points, long, narrow, and thick projectile points of late-Pleistocene age. We traveled west with the Venezuelan archaeologist José María Cruxent to view the type locality of El Jobo points on the Rio Pedregal terraces, and to visit late-Pleistocene sites in the region of the city of Coro—Muaco, Cucuruchú, and Taima-taima—in which bones of extinct fauna had been discovered in association with El Jobo points, with dates of ca. 14,000–16,000 years ago (ca. 12,000–14,000 RCYBP). We resolved to return to Taima-taima for further excavations; and in 1976, working with Cruxent and the paleoenvironmental specialist Claudio Ochsenius, we uncovered in waterlogged sands at the base of the section a medial fragment of an El Jobo point in the pelvic area of a juvenile mastodon; and vegetal digesta around the skeleton was dated at ca. 15,000 years ago (ca. 13,000 RCYBP).

We arrived in the Colombian highland city of Bogotá in mid-February 1970. Here we met with Colombian archaeologist Gonzalo Correal, and discussed with him the recently excavated rockshelter site of Tequendama, which had yielded dates of ca. 13,000 years ago (ca. 11,000 RCYBP), associated with a simple unifacial lithic industry. While in the Bogotá area we also visited the rockshelter site of El Abra, which had also produced early radiocarbon dates from its lower occupation levels. Correal's associate researcher was Thomas van der Hammen, a Dutch palynologist who had produced a detailed record of late-Pleistocene paleoenviromental changes in the area of Bogotá. In all, we gained a fine impression of the research in late-Pleistocene environments and the correlations with the archaeological record in the Bogotá uplands. We were confident that in the future other late-Pleistocene archaeological sites would be found in the area. We were not surprised when, a few years later, Correal discovered and skillfully excavated the open site of Tibitó, with simple uniface lithic artifacts in association with remains of horse and mastodon; and a date of ca. 13,800 years ago (ca. 11,800 RCYBP), corresponding to the site's pollen zonation.

In Ecuador, when we arrived in Quito, we contacted archaeologists at the Museo de Arqueología, who took us to the nearby site of El Inga, situated on an open ridge between two arroyos. This site, which had been excavated by the North American archaeologists Robert Bell and William J. Mayer-Oakes in the late 1960s, was very disappointing, as the sediments on the ridge were eroded and very shallow, without clear stratigraphy. In the adjacent arroyos were nodules and pebbles of obsidian. We concluded that the site was a toolstone quarry and workshop, used by hunters over thousands of years, resulting in the diversity of projectile point types observed in the lithic collections.



Alan and our youngster with the Land Rover at the Equator monument in highland Ecuador.

Traveling south along the Ecuadorian coast, we encountered for the first time the great Pacific coast desert of South America. Exploring the region of the Santa Elena peninsula, we saw a number of small open sites with lithic artifacts among deposits of shell. Some years after our visit, Karen Stothert discovered the stratified site of OGSE-80, where the lowest occupation level, termed pre-Las Vegas, produced evidence of a foraging economy based on plants, small animals, and sea food, associated with simple lithic artifacts and an age of ca. 12,800 years (ca. 10,800 RCYBP).

We spent a month in Peru, traveling between the desert coast and the Andean highlands, visiting famous late-prehistoric ruins like Chan Chan, Huaca del Sol, and Chavín de Huántar, always keeping a lookout for early preceramic sites. While traveling on the coast, a daily pattern was to eat dinner at a restaurant in the nearest town, and then drive out into the empty desert and camp overnight. One morning we awoke to find ourselves parked in the middle of a looted prehistoric cemetery, with skull fragments, bones, shreds of textiles, and potsherds scattered about. A fine welcome to ancient Peru.

We stayed in Lima for a few days, as Alan knew a friend with young children there; and we made contact with archaeologists who took us to visit the open hill slope site of Chivateros, with quartzite bifaces reported by Edward Lanning to be late Pleistocene in age. To us, however, it appeared to be a toolstone quarry that could be any age, not only late Pleistocene.

We left the arid coast at Pisco and ascended the Andes to the Ayacucho basin, where Scotty MacNeish was then working on his major project on the origins of Andean agriculture. For us, his most important site was the cave of Pikimachay. At the time of our visit, the excavations in the cave were descending to the level of the Ayacucho complex, with remains of extinct fauna beginning to appear. A giant sloth bone was to produce a date of ca. 16,000 years ago (ca. 14,000 RCYBP). For years afterward, archaeologists have expressed doubt about the lithic industry associated; but recently the Pikimachay lithic collections at the national museum in Lima has been restudied by Peruvian archaeologists, and definite artifacts have been identified in the Ayacucho complex collection.

## Definitely a no-frills tour

After a stop in Cusco and a visit to Machu Picchu, we traveled to Lake Titicaca, past the late-prehistoric ruins of Tiwanaku, and south on the altiplano of Bolivia, above 11,000 ft in elevation. Here we had an adventure. Crossing the remote salt flat of Uyuni on our way to the Chilean border, we lost the track (there were no GPS devices in 1970). As evening came, we had to stop and camp out in the middle of nowhere. We carried freeze-dried food for such an eventuality, but it was pretty awful. The next morning, local people in a passing vehicle spotted us and showed us the right track. As we approached the Chilean border town of Ollangüe, we saw a truck stopped in the road. As we pulled out to pass it, we were waved down by a crowd of people on the truck's flatbed (such vehicles commonly serve as buses in the remote Andes). They had run out of gas, so we offered the contents of one of our jerry cans. Chatting with the people, we discovered that a Bolivian border official was on board. He told us that we should have checked out in the town of Uyuni, 200 km back! Don't worry, he said graciously, he would examine our documents and telegraph our departure back to Uyuni. Good thing we had donated the gas. It turned out, though, that we needed that gas. There was no service station in the tiny Chilean town of Ollangüe, so we had to drive on. Fortunately it was downhill all the way, dropping thousands of feet off the altiplano, so much of the way we coasted. Luckily we came across a railway yard about half way down and were able to buy some gas there, and so we descended into the Atacama desert of Chile.

In the beautiful little town of San Pedro de Atacama, we spoke with Gustavo LePaige, the parish priest, who had set up a museum displaying the region's archaeological treasures, including late-prehistoric wooden artifacts, preserved in the dry desert. At some localities Padre LePaige had collected crude bifaces and large flakes that he believed were related in time and typology to European Paleolithic industries such as the Acheulian; but upon visiting the open sites of Lomo Negro and Ghatchi, we saw that they were only surficial quarry/workshops that could be of any age.

As we drove south in the Chilean coastal zone, the desert gradually gave way to a more vegetated zone and a pleasant California-like environment, in fall foliage. In Santiago we visited the Museo Nacional and met with Chilean archaeologist Julio Montané, who escorted us to the small basin of Tagua Tagua, about 100 km south of the city. At this site, on the buried shoreline of a paleolake, he had excavated remains of a mastodon associated with lithic artifacts that dated ca. 13,800 years ago (ca. 11,800 RCYBP). Some years after our visit, Lautaro Nuñez, excavating in another area of the lake basin, recovered Fishtail projectile points in association with mastodon remains, dated at ca. 12,700 years ago (ca. 10,700 RCYBP).

### Meeting John Fell, the man and his cave

It was then the month of May, approaching the southern winter season, too late to drive all the way south through Argentine Patagonia to the Straits of Magellan. So we left the Land Rover on the museum lot in Santiago and took a train down into the temperate rain forest zone to Puerto Montt (the nearest city to the now-famous site of Monte Verde, but that was a later discovery). From there we flew down the spectacular Chilean Andes to the port town of Punta Arenas, where we met John Fell himself, who arranged our visit to the famous cave excavated by Junius Bird (**MT 23-4, 24-1, -2,** "In the Footsteps of Junius Bird").

Luckily for us, in 1969 there had been further excavations at Fell's Cave by the French archaeologist Annette Laming-Emperaire; and her trench was still open, exposing the stratigraphy, rich in lithics and animal bone. Observing the setting of the site, we understood why the cave had been so popular with hunters for thousands of years; it overlooked a wide grassy canyon floor, which held a small lake that attracted game.

While in the Straits of Magellan area, we also visited the huge Cueva del Mylodon. It's of interest that Alan observed rockshelters in the same rock formation near the famous cave; and years later, Hugo Nami excavated the site of Cueva del Medio, which produced Fishtail points of the same radiocarbon age as those of Fell's Cave, again associated with bones of extinct horse.

The Straits of Magellan was as far as we were to travel toward the southern tip of South America, the far end of the American world. We flew back to Santiago, retrieved the Land Rover, and headed eastward over the Andes into Argentina. MT

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## Ice-Free Corridor

*continued from page 3*

able to both bison and people by about 10,500 RCYBP (12,500 CALYBP) and maybe before 11,200 RCYBP (13,100 CALYBP) for bison. Northern- and southern-clade bison may well have interacted along the Peace River by Clovis times.

### Environments of passage

Even if the IFC was open by the Clovis period, or even before, it isn't entirely clear that the corridor was passable by humans. In an influential 2001 paper, Mandryk and colleagues argued that there simply weren't enough food resources in the IFC to support a viable human population between 18,000 and 13,000 RCYBP and that it was not a possible route into North America prior to ca. 11,500 RCYBP.

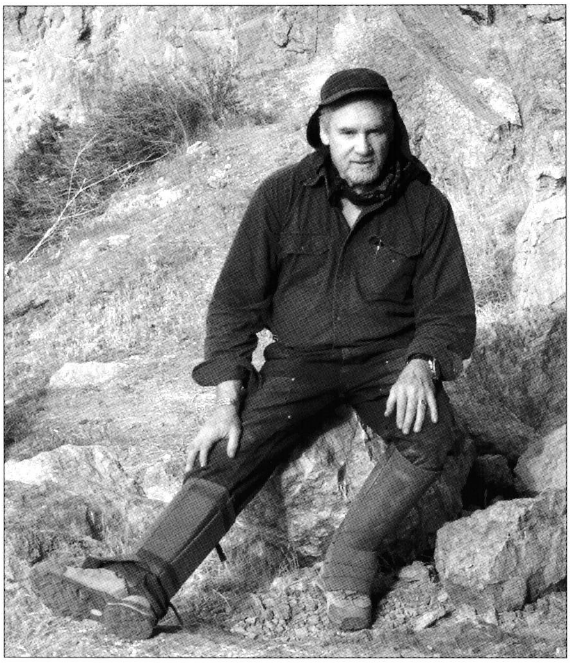
The environment of the corridor would certainly have been harsh: Giant meltwater lakes blocked access for long periods of time, and both ice lobes and large meltwater streams would have blocked passage southward along lake margins. Katabatic winds—strong air currents sweeping down from the ice sheet onto the exposed valley floor—may have cooled temperatures in the corridor. The growing season may have been short. In the recently exposed corridor circa 12,000 RCYBP, the primary plant communities would have been limited to herb and shrub tundra.

But if the growing season was short, so was the melt season. Stream flow and deep lakes may only have posed a significant movement barrier at the height of summer. In late spring or early fall, however, ice may have afforded safe passage to groups well equipped to survive in Arctic conditions. Especially along the western margin of the IFC, along moraines pushed up by ice, exposed drumlins, and the deglaciated mountain front, small and large game may have been available. Even at the height of glaciation, exposed mountain peaks ("nunataks") may have served as refugia for plants and animals. During the warm season, the herb tundra community may have supported grazing megafauna, including bison, horse, camels, deer and elk, and other animals. "If bison could live in different regions inside the IFC, then humans could have too," Ives and Froese conclude.

Ives adds that "deglaciated soils would have been rich in fixed nitrogen from the ice, and in potassium and phosphorous from rocks of the Canadian Shield" that were ground up as the LIS progressed westward. "Nowadays, we call this 'fertilizer.' When the proglacial [large meltwater] lakes drained, the fossil lake beds may have been rich grasslands. This would have provided tremendous incentives for people to enter the corridor following the game animals attracted to these land surfaces."

A passable corridor isn't necessarily a place where a person can live year-round, as Ives makes clear. It's unlikely that people were living full-time at first in the newly deglaciated corridor, but seasonal use early on was likely. Ives points to the abundant potholes of the prairie provinces, relict kettle lakes formed by melting chunks of ice embedded in glacial outwash. During the summer months, "every pothole has a nesting pair; it's the 'duck-making factory' of western North America. Nesting waterfowl would have been abundant, concentrated in front of the remaining ices masses, and could have acted as a seasonal trigger to bring people into the area."

Seasonality and migration are interesting phenomena: If waterfowl appear when it's warm and migrate away when it turns cold, it takes no great leap of imagination to believe they are tracking summer climates. "Migrations suggest other places," Ives says, "Waterfowl travel between worlds, both spiritually and geographically. It is conceivable that First Nation's ancestors valorized the chaotic and retreating deglaciation zone as an arena with meaningful opportunities" rather than a dangerously insurmountable barrier to movement—a last place where conditions resembling the Ice Age lingered. For people already summering in the IFC, the temptation to follow game to the south may have been strong, the act less suicidal for well-equipped and provisioned hunters that it seems in our 21st-century world, where a mile is an improbably great distance to walk.



REID GRAHAM

Ives during summer 2013 field work in Utah.

## The Corridor and the peopling of the Americas

Regardless of whether the IFC was open to foot traffic by Clovis people, there is little evidence to suggest that it would have been passable early enough for people to get to Monte Verde in Chile by 14,300 CALYBP (12,300 RCYBP) or to the Friedkin site, Texas, by ca. 15,000–15,500 CALYBP. Thus, Ives concedes, "it is unlikely that the IFC could have been the first and principal route into the Americas."

But as the corridor opened up, population groups separated for millennia likely encountered each other while hunting along the margins of wetlands and in the vast expanses of herb tundra covering the deglaciated landscape. "The receding periglacial world may best be viewed as an intriguing avenue of communication in which eastern Beringian, Plains, and Great Lakes populations and ideas moved readily," Ives speculates. Clovis and later Paleoindians appear to have moved north into this landscape, bringing their distinctive lithic technology and carrying with them Knife River flint from North Dakota. Evidence from the opposite direction—microblade technology, though as yet poorly dated, occasional points resembling early examples found in Alaska, and the fact that fluted points and other early artifacts are made almost exclusively on local raw materials—all hint at populations entering the region from the north. Ives suggests that the Peace River, with its rich archaeological record, may have been one such meeting ground. There may have been many such places and encounters.

This reimagining of the deglaciated IFC as a meeting ground between vastly different cultures is a powerful new perspective on the earliest archaeological record of the corridor region. No longer shackled by interpretation as a one-way highway to a southern paradise, the archaeological record of human life in the corridor is open to new interpretation. This is a world that Ives and colleagues are beginning to explore using culturally informed models of knowledgeable and thinking actors negotiating a diverse and socially complex landscape. The geographical confines of the IFC provide an important lab where such models can be tested and refined, providing insight into encounters that must have been replicated countless times as human groups encountered the other on the vast unpopulated landscapes of the New World.

Such models would have far-reaching importance for understanding human interactions among early social groups navigating the rapidly changing post–LGM landscapes of the Americas. MT

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## Suggested Readings

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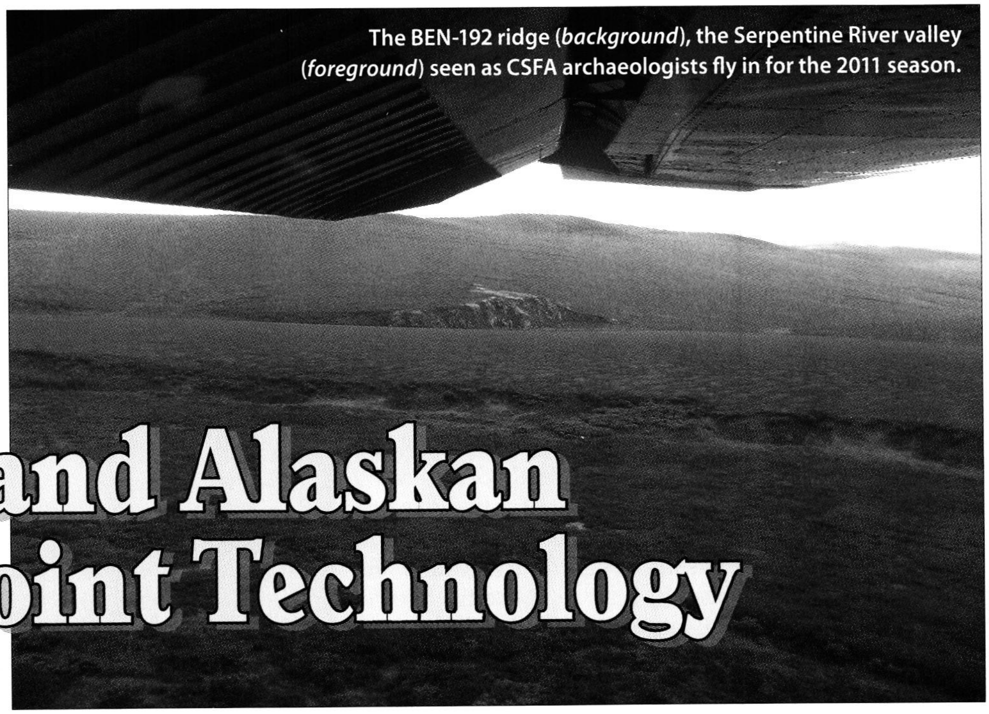
## New Answers, New Questions

# Ben-192 and Alaskan Fluted-point Technology

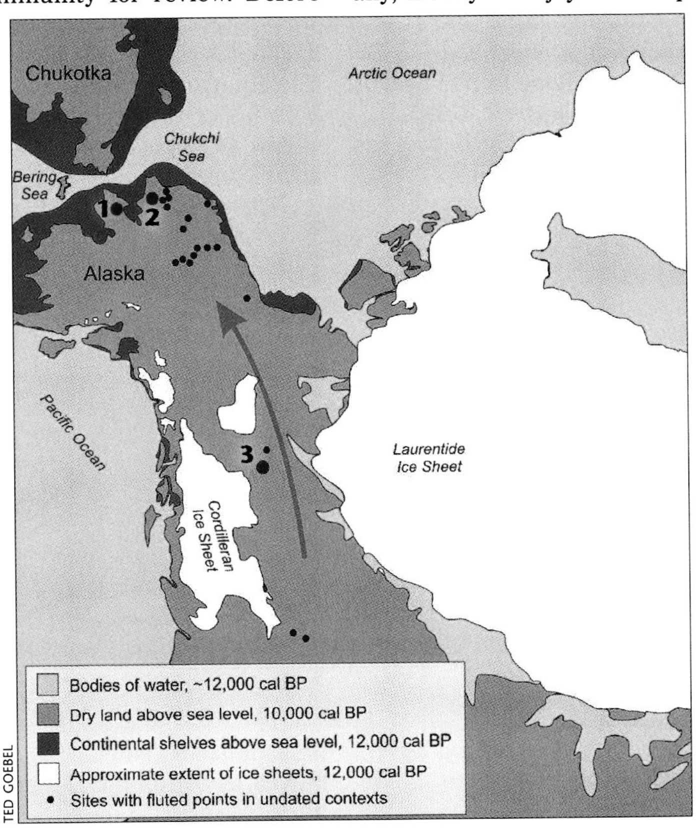


The BEN-192 ridge (*background*), the Serpentine River valley (*foreground*) seen as CSFA archaeologists fly in for the 2011 season.

HEATHER L. SMITH

GIVEN THE DEEP STRETCHES OF TIME separating us from our subjects, First Americans researchers must reconstruct early human lifeways from evidence carefully gathered and rigorously interpreted, then present their conclusions to the scientific community for review. Before accepting anything as true, our peers must reach a consensus on the meaning of the evidence. This is a long road that can take years to travel, and it has its share of potholes. Indeed, one of the great ironies of our field is that when we finally settle the answer to one question, we often find we've generated several more—our version of the Hercules/Hydra conundrum. The intriguing Serpentine Hot Springs site in Alaska's Bering Land Bridge National Preserve serves as an excellent example.

As a result of recent fieldwork by dedicated CSFA researchers and others, this isolated site is now helping us see more clearly into one small piece of the past. Although the image remains hazy, the hand holding the spyglass is steadier now, confirming details that were only blurred suspicions before—while leaving some answers obscured.



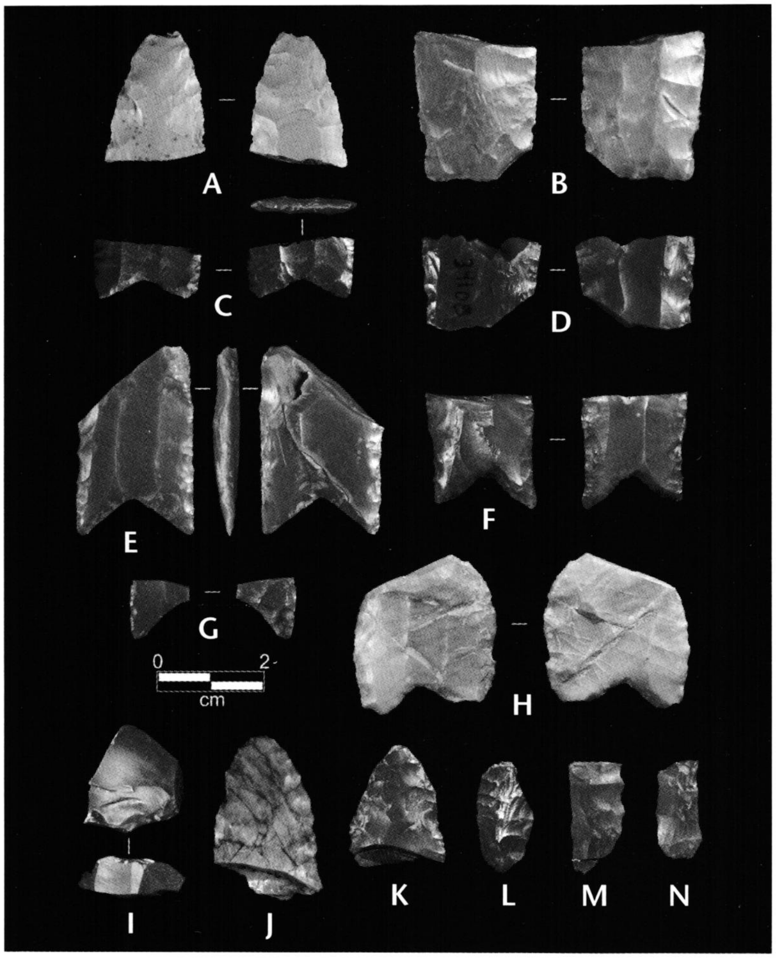

TED GOEBEL

**Beringia, showing conditions now and during the terminal Pleistocene. Fluted-point sites mentioned in this story: 1, Serpentine Hot Springs; 2, Raven Bluff; and 3, Charlie Lake Cave.**

### First contact

Located near the far end of Alaska's Seward Peninsula, Serpentine Hot Springs is one of the loneliest spots in America. Until recently, the region drew just a handful of visitors annually, mostly to enjoy the unique natural tors and hot springs. But in 2005, National Park Service archaeologists Robert Gal, Chris Young, and Sabra Gilbert-Young discovered a triple-fluted projectile point base made of dark red-brown chert atop a ridge 500 m northwest of the springs (**MT 24-3,** "Fluted Point Technology in Alaska"). Although degraded by erosion, much of the site retains intact cultural deposits—and the two 50-by-50-cm units they excavated yielded a small lithic assemblage that included a channel flake from another fluted point. They recorded the site as BEN-192.

BEN-192 wasn't just one of




**Representative lithic materials from BEN-192 and nearby lithic scatter BEN-170. A–H, fluted-point fragments (A is from the surface of BEN-170; B–D are surface finds from BEN-192; the remaining four fluted points are from subsurface contexts in Unit 2); I, core tablet spall; J–K, biface tips possibly from fluted points; L–N, channel flakes.**

the few known Alaskan fluted-point sites with intact deposits, it was the first fluted-point site known for the Bering Strait region—an irresistible draw to First Americans researchers. From 2009 to 2011, CSFA field crews led by Associate Director Ted Goebel and Ph.D. candidate Heather Smith conducted fieldwork at the site. Other participants included CSFA Director Dr. Mike Waters, Bob Gal of the NPS, Sergei Slobodin of the Russian Academy of Sciences, CSFA researcher Dr. Kelly Graf, several CSFA graduate students, and a number of native Alaskan crew members.

Now, after several seasons of careful excavation and subsequent analysis, we finally have a substantial body of data to work with, as well as a suite of radiocarbon ages that firmly date the occupation . . . and the results are a bit surprising.

## A rare treasure

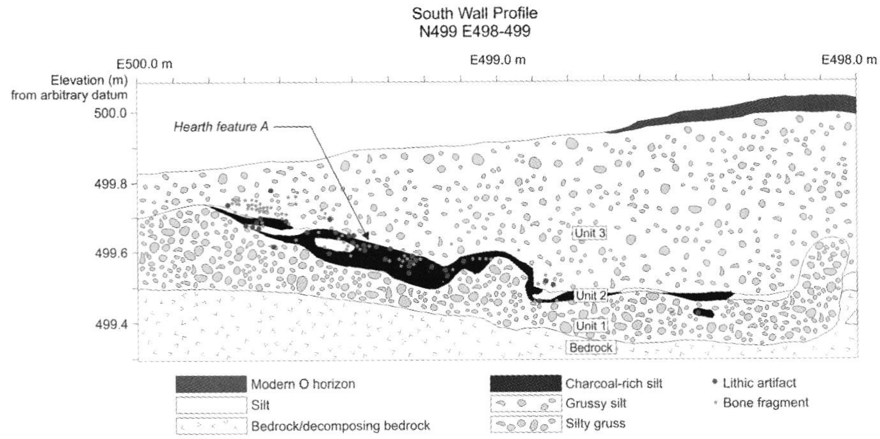
BEN-192's southern locus retains deposits up to 70 cm deep. Although a close examination by Waters and Graf has revealed frost heaving and shattering, as well as minor rodent disturbances, the stratigraphy is surprisingly well preserved. In addition to a patchy modern soil at the surface, the deposits include three distinct units. Unit 1 is a basal layer of silty gruss (decomposed granitic bedrock). It probably formed as material moved downslope from a nearby exfoliated granite knob, mixing with windblown silt. Unit 3 consists of a grussy silt of the same origins. Sandwiched between is a thin layer of fine silt about 10 cm thick, sealed by Unit 3 soon after deposition. This layer, Unit 2, contains nearly all the cultural materials.

The five burned features found so far have proven rich sources of datable material. Given the thousands of calcined bone fragments recovered, it seems likely the occupants were burning both bone and wood. So far, the CSFA team has submitted 25 charcoal samples for AMS radiocarbon analysis. "We had a devil of a time trying to concretely date the cultural layer," Goebel admits. "The dates ranged from about 9,900 to 12,200 years before present. . . . But how can we have features used for 2,000-plus years?" A review of the previous research suggested a solution to the dating challenge: For more than 10,000 years, both historic and prehistoric natives of the region preferred willow as firewood over blueberry and birch shrubs, the only other common woody plants in the vicinity. "Willow charcoal seems to be the human signal," Goebel concludes. The other charcoal may have originated from natural fires.


**Heather Smith (*foreground*) excavating at BEN-192 in 2011.**

## Questions settled

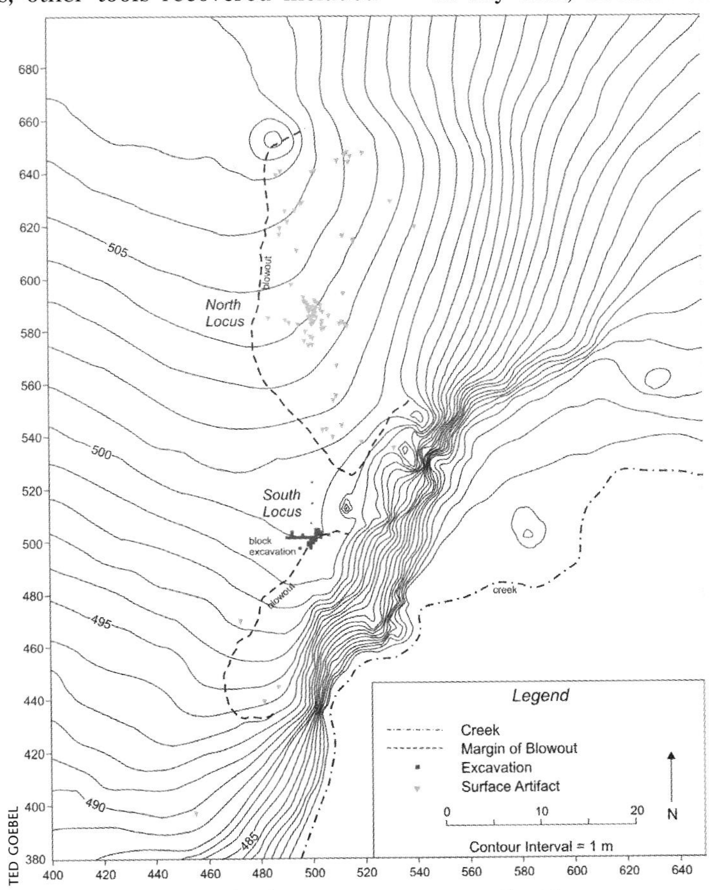
The NPS researchers provisionally dated the fluted-point occupation to about 12,000 CALYBP. The CSFA team's willow-charcoal dates cluster in a fairly tight range of 12,000–12,400 CALYBP. This is notably younger than Clovis (12,800–13,250 CALYBP), and about the same age as the multiple-fluted point from Charlie Lake Cave in British Columbia, as well as a similar point from the Raven Bluff locality on the western end of the Brooks Range, 320 km to the northeast.




**Representative stratigraphic section from BEN-192 as exposed in 2010, showing hearth feature A.**

In addition to the fluted base collected in 2005, the assemblage from BEN-192 now includes two more fluted-point fragments from the surface, as well as four recovered from subsurface contexts. All the buried points came from Unit 2, and all were associated with features rich in charcoal and bone. The excavated lithic assemblage numbers another 1,481 debitage fragments and 27 tools, together with 115 artifacts found on the surface. The debitage consists of at least 31 channel flakes and numerous bifacial thinning and retouch flakes; other tools recovered included 9 bifacial-point fragments and 15 biface fragments.

The tools were made exclusively on cherts and chalcedony, though small amounts of quartzite, obsidian, diabase, and quartz debitage were recovered. X-ray fluorescence traces the obsidian to Batza Tena, 450 km to the east; the cherts and chalcedony probably came from the Brooks Range. Did the toolmakers acquire the material via an existing trade network, or did they collect it themselves? "Frankly, I don't know," says Goebel, "but they were very mobile and traveled great distances. Whether they were personally accessing all those materials, or coming into contact with people who had, it still required long-distance travel either way." Smith agrees that "it's quite possible that both scenarios were at play. The large geographic spread of fluted points across the north, and movement of specific raw materials in northwestern Alaska, suggests that Alaskan fluted-point makers were capable of crossing significant distances."




**Map of BEN-192, showing elevations, surface finds, and 2009–2011 excavations.**

A subassemblage found in close association with the fifth and westernmost hearth includes bladelets, microblades, and a core tablet—all typical of a microblade tradition. These artifacts may be the reason one observer has referred to the BEN-192 assemblage as fluted-point technology "grafted" onto a microblade culture. "I don't think this concept should be ignored," Smith states. "The uniformity and precision of the flute scars are reminiscent of the skills necessary to manufacture well-made, standardized microblades. It's likely more than coincidental that both Alaskan fluted-point technology and microblade technology are restricted to the North. However, evidence for true microblade technology is lacking in the BEN-192 assemblage, so at the moment we don't have solid evidence that the people who were making the fluted points at Serpentine Hot Springs were also well versed in microblade technology."

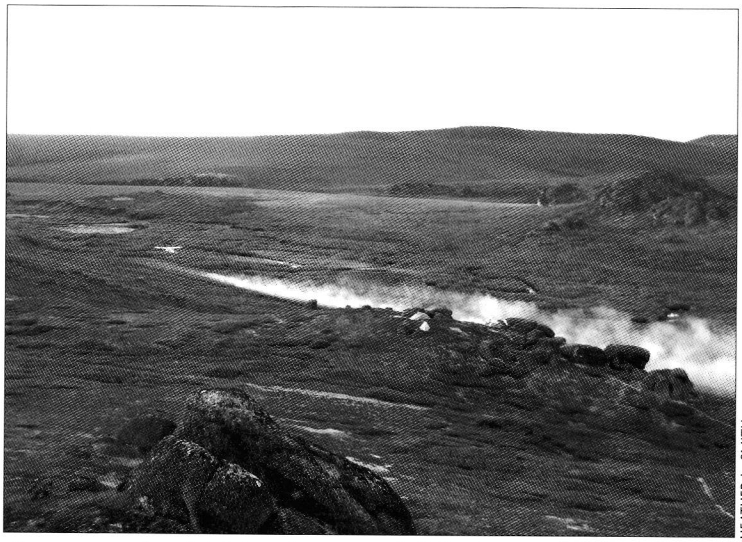
In any case, Goebel notes that the microblades at the site "weren't unequivocally associated with the fluted-point occupation. Some came from a point about 10 to 15 meters away." Furthermore, Goebel continues, "the microblade technology we've found here isn't well understood. They seem to use a different technology than the classic microblade technology known from elsewhere in Alaska, which uses blades struck from the ends of wedge-shaped narrow cores." Though no cores were recovered from the site, a core tablet spall, used to rejuvenate a core to create a new workable surface, was found with the microblades. It was oval shaped.

## The implications

What we now know about BEN-192 has locked the doors on some hypotheses—and kicked others wide open. For one thing, the site proves that humans were in central Beringia during the terminal Pleistocene. We've long assumed they *had* to be there. Now, after a decades-long search, we've finally found the smoking gun.

The greatest significance of BEN-192 lies in the fact that it was the first Alaskan site with a buried fluted-point assemblage found in direct association with datable material. It's also clear that the cultural complex of which it's a part is too young to be ancestral to Clovis. That's no real surprise; for years now, most researchers have concluded that fluting technology was a continental American invention. Now we're another step closer to nailing down this assertion for sure. The dates we have so far from BEN-192, Raven Bluff, and Charlie Lake Cave tell the same story: Fluted-point technology arrived in the Far North no earlier than 12,400 CALYBP. So BEN-192 almost certainly represents a reverse diffusion of the technology back up through the Ice-free Corridor—though it's remotely possible that fluting technology was independently invented in Alaska. Still, as Smith puts it, "It seems pretty far-fetched that it would be independently invented twice, on the same continent, and at locations that were connected by a corridor inhabited by large, migratory prey animals such as bison and caribou."

We can't yet say, however, whether the migration was of people or only technology. Determining that, according to Goebel, "will hinge on discovery of more sites, more points, and more dates, especially in the Northwest Territory and the Yukon." Indeed, this is the focal question of Smith's dissertation research, which has her crisscrossing the continent examining Northern fluted points in various collections.



The airstrip and camp (*foreground*) and BEN-192 atop the leftmost ridge (*background*).

HEATHER L. SMITH

The fluted points recovered from BEN-192 bear a distinctive hallmark, the multiple fluting seen elsewhere in Alaska and Canada. "The consistency in the degree of uniform and precise parallel fluting on Alaskan/Yukon points is distinctive to the region," Smith points out. Given their deep basal notching, they were almost certainly fluted with a punch tool. Interestingly, the toolmakers of BEN-192 seemed quite confident in their ability to flute these points—a difficult process for most flintknappers. So what, you ask? Well, consider this: There are no known sources of toolstone anywhere near Serpentine Hot Springs. All lithic materials had to be brought from elsewhere, often from hundreds of kilometers away. Nonetheless, the flintknappers at BEN-192 actively engaged in final fluted-point preparation, where a slip could destroy hours of work. "They were showing up without much in their toolkits, and using everything they could out of the raw materials they brought," says Goebel. "It seems odd that they would be fluting these points with the potential high failure rate. But then again, maybe the failure rate wasn't as high as we think."

The reason why Arctic Paleoamericans used the multiple-fluting technique, however efficient it may have been, is also a key focus of Heather Smith's research. "As of now," she says, "I can only speculate that this technique was used in this region because it facilitated hafting to materials that were also unique to the Arctic/sub-Arctic. This method of basal thinning might have been necessary to incorporate a fluted bifacial technology into preexisting hafting methods; however, evidence for this is lacking. Ultimately, I'm tempted to hypothesize that a raw-material constraint on the size of the haft had a major influence."

While CSFA probably won't do any further work at BEN-192, there are almost certainly other fluted-point sites tucked away on the Seward Peninsula—and Ted Goebel would like to go looking for them. "All these years, we've been saying people came across on the Bering Land Bridge, but no one had any hard evidence. BEN-192 gives us a better idea of where we need to go and what we need to do to find more Pleistocene sites. I've got a good feel for the landscape and geomorphology now. It's an expensive place to work, but I think if we have the resources, we can get out there and find more of these sites."

Meanwhile, Smith is conducting a technological and morphological comparison of fluted points throughout Alaska, Canada, and the northern U.S., as well as incorporating insight from migration and diffusion studies and the ethnographic record to answer the question of when and how fluted-point technology entered Beringia. "For me this is a dream project," she declares. "I hope this research is able to increase our understanding of the significance of fluting technology in the American North, and allow further insight into Paleoindian adaptation as their world altered during the transition from the Pleistocene to the Holocene. Stay tuned!" MT

*– Floyd Largent*

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