BLOOD FROM A STONE

The public has always been amused at the scientist's willingness to devote himself to details that seem trivial to common sense. At their first meeting, Sherlock Holmes asked Watson whether he had read his monograph on the different varieties of cigar ash. Aristophanes, tongue in cheek, portrays the Greek scientific philosophers measuring how far a flea can broadjump and arguing which end of a goat emits its noise. In Gulliver's Travels, Swift satirizes the Royal Society for examining under the microscope substances that a gentleman should not be willing even to mention in polite society. Yet the public has come to recognize that the scientific researcher, like the detective, can sometimes—if he or she is patient enough—make startling inferences from the most insignificant-seeming of clues.

Since 1980, Tom Loy of British Columbia has been looking at the blood residue that has often been left, he has discovered, upon prehistoric stone tools. The analysis "was intended to be part of a dissertation that never quite made it," in his phrase, because what he began to discover was "eminently more interesting." For Loy, working entirely alone, without students or assistants, has developed a technique for crystallizing the hemoglobin in blood scraped off of knives and projectile points by dissolving the residue in a solution of various salts and other chemicals. As the solution dries, the hemoglobin forms crystals that vary according to the species of animal it derived from.

In other words, Loy can not only ascertain that a certain implement was employed to kill or carve, but he can tell what species of animal it was used upon. Furthermore, by measuring differences in the blood's oxygen isotope, he can sometimes pinpoint which drainage basin the animal lived in; with a mass spectrometer he can say something about the mean annual temperature during the month the animal died. Holmes himself could do no better, and indeed his successors, the forensic specialists, are becoming interested in Loy's methods as archaeologists and anthropologists are.

But how is it possible for blood protein to resist water and bacteria for 1000 years, not to mention surviving the process of cleaning? Loy explains: "As the blood comes out and gets onto the tool" when an animal is killed or butchered, "chemical reactions in the blood initiate clotting: at the same time, the blood begins to dry immediately. Anybody who's actually butchered with stone tools knows that the blood starts out being very slippery, but pretty soon your fingers begin to stick together and you can't peel your hands off the tool. That's both from the drying and a certain amount of the clotting process. But the blood doesn't clot all the way, because it runs out of the mediating chemicals. "What's happening is that the serum albumin molecule, the major constituent of the colorless part of the blood, is very sensitive to changes in its environ-

TRUTH - NO STRANGER TO FICTION

"I think it was always the imaginative aspect of paleoanthropology that drew me in, and the almost unimaginable aspects of human evolution that I found so compelling: the idea that we once really were different kinds of creatures was something that captured my imagination even as a child," speculates Misia Landau.

Landau is a physical anthropologist and Assistant Professor at Boston University. Recently, in a series of articles and lectures (see suggested readings), she has put forth an idea that has captured the interest of fellow anthropologists as well as of those who study the history and philosophy of science. The idea... that scientists are storytellers to a much greater degree than they have imagined. In particular, when formulating theories of human evolution, paleoanthropologists have not only had recourse to such storytelling devices as analogy and metaphor, but also to various narrative patterns—above all the story of the hero as it appears in myth, folk tale, and literature.

An example can be drawn from a paper concerning Australopithecus afarensis, which is therein described as "very close to what can be called a 'missing link.' It possesses a combination of traits entirely appropriate for an animal that had traveled well down the road toward full-time bipedality, but which had retained structural features that enabled it to use the trees efficiently for feeding, resting, sleeping or escape" (Stern and Sussman 1983). Here we not only have a metaphor with powerful historical associations, the "missing link," but something else as well. In her article "Human Evolution: The View from Saturn," (Landau 1985) Landau observes: "When these authors say that 'A. afarensis had travelled well down the road toward full-time bipedality,' not only do they speak in metaphor, they also tell a story." A story. And very a traditional story at that—indeed, one of the oldest in the world, that of an adventurous journey, an odyssey, perhaps even a quest. Behind the foreground discussion of locomotor apparatus, a reader sensitive to such things can discern the dim outlines of a literary shape. Not only has A. afarensis been fitted into the theory of evolution, but the latter has been assimilated to a traditional story type in which a hero strikes out upon a new path, has many adventures, and in the end succeeds in transcending his humble origins.

In her early exploration of paleoanthropological literature, Landau was sensitive to such connections. But the scratch on the glass, so to speak, was Vladimir Propp's classic study, Morphology of the Folk Tale (1928).

Propp worked in the context of a Russian literary movement known as formalism, akin to what later became structuralism. His central insight was that folktales that seemed quite different on the surface
CURRENT RESEARCH IS IN. ARE YOU?

Current Research in the Pleistocene has really taken off! The phenomenal growth of this groundbreaking publication in its brief four-year history is certainly satisfying to us here at the Center. It is an impressive demonstration of the growing interest in the earliest peopling of the Americas and related topics in the evolutionary sciences. This year's issue will include "4 papers from around the globe; almost 50% more than a year ago. We are glad so many people find it worthwhile to participate in this journal, both as writers and as readers.

This increase has not been without growing pains, however. Every additional paper we print has multiplied the time and expense of getting the volume from us to you. We have realized that this issue is as large a publication as we can manage and still stick to our stated goals of quick turn-around of "current research" and an affordable price. As it is, the unforeseen delays attendant to the larger volume this year have pushed our delivery date into October. We apologize to you for this, and are adopting new guidelines to keep CRP on track for future issues.

The new guidelines for contributors to CRP are directed at the two specific goals: limiting the journal to its current size, and speeding up the turn-around time. Starting with volume 5 (1988) absolutely no late papers will be accepted; the editor must receive all papers for a specific issue (not Orono, ME) no later than January 31, 1988. No more than 65 unsolicited papers for the regular sections and 5 solicited papers for the Special Focus section will be accepted for each issue. Each contributor will have no more than two papers published in any issue, and only one paper as senior author. Time being of the essence, the earlier a paper is received, the better its chance of being published in the next issue. If you plan to submit to CRP, please request a printed copy of the Call for Papers from the Center for the Study of Early Man if you do not regularly receive one each year.

And, yes, now the bad news. We have increased the price of CRP this year from $12.00 to $17.00 for individual subscribers and from $15.00 to $20.00 for institutions. This is necessary to pay for the increased costs associated with producing and distributing a larger issue of CRP. We will, of course, honor any prepaid orders at the previous price received before September 15, 1987.

We hope you think the increased size of the journal is worth paying for. If you would like to insure receiving future issues of CRP at this price, please consider subscribing for up to three years at the current price when you order this year's issue. You can order CRP by using the order form inserted in this paper or simply sending us the subscription cost and your name and correct address. As another timely publication frequently says: "Subscribing to our principles is not enough."

FIRST ALBERTANS PROJECT

The Archaeological Survey of Alberta is undertaking an important effort. The Director, Dr. John W. Ives, has recently informed the Center that: "1987 marks the first year of a proposed five-year project dealing with the initial people of Alberta. As you know, Alberta as one time was the location for most of what has come to be known as the "Ice-Free Corridor," and North American archaeology stands to gain a tremendous amount by a concerted effort to investigate late Pleistocene-Early Holocene occupations in this area. Thus this year crews will be surveying in the Upper North Saskatchewan River and Grande Prairie regions, in a search for archaeological materials in the 12,000 BP to 10,000 BP range. At the same time, a crew will be undertaking an initial assessment of the Fletcher site, a Cody Complex bison kill site in the southern part of the province. The research at Fletcher this year will attempt to delineate the site boundaries and address some logistic difficulties such as groundwater seepage, and mineral contamination of bone deposits.

"In a most promising opportunity, the Archaeological Survey of Alberta has initiated a scientific exchange with Heilongjiang Province of northern China. The aim of this exchange is to provide assistance with archaeological research regarding sites in this province of China with remains which appear to date between 25,000 BP and 12,000 BP. During the month of May 1987 myself and Alwynne Beaudoin, Paleoenvironmental Researcher with Archaeological Survey of Alberta, spent three weeks touring various sites in Heilongjiang, meeting researchers and viewing collections. We are currently planning a return visit by members of the Provincial Relics Committee which will involve the Chinese researchers in our First Albertans Project."

Dr. Ives will strive to keep the Center posted on the results of these investigations, which will be published along to Mammoth Trumpet readers.

GLOSSARY

Amino Acid An organic compound consisting of an acidic carboxyl group and a basic amino group. Amino acids are the building blocks of proteins.

Breeding Population A group of organisms sharing a common gene pool.

Cellulose A complex polysaccharide. The principal structural material of plants.

Chert A type of siliceous or arenaceous sedimentary rock, used as an abrasive material.

Chiroptera The order of mammals comprising the bats.

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CORRECTIONS AND BRIEF COMMENTS

OOPS... Due to an inadvertent editing error, the paragraph describing Tom Lynch's talk at "The Human Story" conference in Orono last February did not properly reflect what he said. The paragraph should have read:

Dr. Thomas Lynch from Cornell University then took the podium and firmly restated his belief that human beings will not prove to have been present in the Americas before about 15,000 years ago. In Brazil, for instance, he thinks that the dates of more than 30,000 years are not in true association with the elaborate rock art and indubitable tools made on flinty rocks. The quartz and quartzite artifacts attributed to an earlier stage may not be human artifacts. Likewise, he questioned the reality and associations of artifacts with very early, pre-Paleoindian dates at Monte Verde, Chile. Challenging even pre-Clovis human occupation in North America, he reviewed problems with the claim of 19,000 to 13,000 years for the lowest levels of Meadowcroft Rockshelter in Pennsylvania. "The fauna and flora are modern, lack extinct species, and are similar to the late Paleoindian or early Archaic appearance of the stone tools," he said. Layers of coal in the cave walls probably contaminated the ground water and samples from the lower strata with fine particles of ancient coal. Lynch called for testing the ground water near Meadowcroft, to see if it contains colloidal suspended coal that might have been slowly and progressively caught up by the charcoal samples acting as filters.

SUGGESTED READINGS

On Truth - No Stranger to Fiction


On the Blood from a Stone: Interloper with Tom Log


MAMMOTH TRUMPET

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BLOOD FROM A STONE

(Continued from page 1)

ment. As the blood loses water vapor and the concentration of salt in the blood increases, the serum albumin forms a gel which gels the ghost. Normally a molecule made up of a long chain of amino acids bound inside a roughly spherical shape, it falls apart into a long strand of amino acids. As it unarranges, it comes into contact with other serum albumin molecules which are also in the process of coming apart. Often there is a kind of unorganized recombining taking place. As the dried product continues to change, this whole interconnected network of serum albumin molecules begins to look like an unwashed pan of glued-together spaghetti.

When the tour is torn apart, binding sites become available that once had bound the molecule to itself and these attach the "molecular spaghetti" to the surface of the stone tool. "So the thing is firmly anchored on the bottom," Loy continues, "and is intended growing up to the top of the layer. Then, when the tool is abandoned, the soil rehydrates the surface layer to a degree, dust, clay, and soil particles impinge on the surface of the polymer, because they too save reactive surfaces, they also bind with the exposed binding sites. So you have a kind of sandwich," Loy says, "and it starts to disintegrate, with the blood protein preserved in between. "The bonding between the albumin and the soil particles is strong enough so that no more water doesn't have the energy to break these bonds in order to attack the protein." Decay is thereby prevented; for normal decay is merely a continuation of what goes on regularly while the body is alive: the removal of broken bits away with old blood cells and the like simply keep going when all the body dies. But on the stone tool, the protective layer of soil keeps that from happening.

Initially Loy was able to use magnification to do only rough identification: "It was possible to go through and screen a whole collection of tools and pick out the unique one used cutting meat and those used cutting roots and other things. I felt that I had some way of distinguishing at least the gross functions of the tool. I spent a long time investigating various stains that would identify different classes of materials: for example, ones that could tell cellulose from other proteins or blood from cellulose. Normal biological stains are not that discriminating.

From there, Loy was led to seek methods for making subtler distinctions, not only between blood and other materials but between various kinds of blood. He says, "On a few tools, I found fragments of hair; you could still see the scale pattern of it. I phoned a researcher in the Fish and Wildlife Department and he tells me they had a collection of hair that I could photograph" to use for comparison. By chance, the woman who brought the collection included with it a pamphlet put out by the San Diego Zoo describing the Ammodorhysus, a type of elephant mamba in order to identify the species of animal from which it came: each species produces its own distinctive-shaped crystal.

"So I got in contact with the authors and went down to the University of California at Davis," Loy says. "One of the authors, Dr. Robert Washino, was an anatomologist. He had been using this technique to study the detectors for equine encephalitis... so he was crystalizing mosquitoes full of hemoglobin. Loy combined Washino's techniques with those he recovered from an old book published in 1909. Recherh and Brown, the book's authors, had tried for 70 years for their study of hemoglobin crystalization to acquire a record of the color. Loy compared their black-and-white photomicrographs of over 100 species of crystals with a similar-sized catalogue published by Washino in 1976, and began to see a relationship between the area of a nanogram of protein... What I had to do was find all of the most useful series of chemicals, salt concentrations, etc., that would precipitate each different species. For each animal's hemoglobin, there would be an optimum solution for crystallizing the most material.

"How does one pinpoint that optimum? Patiently, my dear Watson. After adding a series of salts and other chemicals to each sample, Loy would slowly warm the slides and begin evaporating the solution to increase concentration, then apply a cover slip under which the sample would eventually crystallize. "Eventually" turned out to be a radically varying period of time for different species. Says Loy, "Some animal's hemoglobin is only slightly affected by the chemicals, so it either doesn't form many crystals or takes a very long time to form them. For example, the hemoglobin from buffaloes head crystallizes almost the second you put the final solution on the microscope; you have to look at it really fast because the crystals are gone within 10 minutes. But with caribou, to get the final crystalline solution takes upwards of 3 days."

"There are approximately 600 amino acids in each of 4 chains that are bent, distorted, and arranged to make the roughly globular or spherical hemoglobin molecule. In the case of hemoglobin—or any other such molecule—there are amino acids that have to be in just the right spot to make a certain kind of bond or to hook onto another molecule at a particular location. If the molecule is wrong the molecule can't assemble itself properly, or it simply doesn't function. But there are also a large number of silent neutral amino acids that are merely there as spacers; you can substitute one for the other and it won't do anything major to the molecule." And in fact such substitutions do occur as a result of random mutation. "There are beneficial mutations which are not always carried in the gene pool very long. But in this case there is a whole series of neutral substitutions, neither particularly good nor particularly bad."

So you have a kind of sandwich, soil above and tool beneath, with the blood protein preserved in between.

"It's this that affects both the actual formation and the development of the crystal, because each amino acid carries with it a slightly different electrical charge, a chemical charge surrounding it and possessing a distinctive shape. As you have different substitutions, they'll cause the protein to be at one place, but they do affect the actual distribution of electrical charge around the molecule. And that affects its shape to a certain extent."

This is one pot that will never boil unless it is watched carefully, and even then, it is a slow business. According to Loy, "It's possible to analyze as many as 25 samples in a very long day. But if you're going to do a series of samples you have to be overlapping. What you have to do is go through and monitor all the slides on a regular basis; once very 20 minutes you have to go back and look at them all again. So it's a matter of keeping track."

And there are other drawbacks and complications of all sorts, conditions must be precisely monitored: open your window on a hot, humid day, and the change in temperature and moisture content may prevent crystals from growing.

Second, artifacts are highly portable: Loy notes that "Just because you may have found one or two artifacts with sheep's blood on them doesn't necessarily mean that sheep was in the immediate area."

Third, there is a need for an extensive catalogue of reference samples. "If one often looks at a crystal," Loy says, "and say, 'Oh, that resembles the crystal preference for the deer, boar or pig.' But if you don't recognize it, you can't identify an unknown crystal unless you've got one like it in a reference collection. On top of that, some of the buffer salts produce crystals on their own, so that the analyst also needs a vast catalogue showing what non-hemoglobin crystals look like; this can take years to accumulate. One obvious weakness of the problem is the centralized collection available to the whole community of researchers. The Australian Museum in Sidney wants to set up a national reference sample collection there, which in time could quite easily become international.

Fourth, even with a reference catalogue there is, Loy points out, "a certain amount of interpretation involved," and the interpretive skills may take years of practice to develop. Loy himself has only managed to train a couple of people. Andre Wood at the Oren- tal Institute and Winston Tennant, who works with a consulting group in Silver City, Nevada, will be the only ones whom Loy knows of to be doing such analysis in North America after he departs; he understands that there are others, but he has not heard of them directly. Indeed, one of his future aspirations is to "get anybody who's ever tried this or is interested in it together for a symposium somewhere and try to give them some encouragement."

For the study of early humans, Loy hopes that hemoglobin crystalization will offer advantages to outweigh its disadvantages of tedium and time. It may help to clinch the identification of dubious early sites by proving that a certain piece of stone is not just an edict but a stone tool with blood on it. It may help to identify fauna, as Loy recently did at a site in the Olympic Peninsula of Washington State, where he was able to establish not only the former possession of a type of fish, the Ammodorhysus, but also to determine its use as a food resource in prehistoric times. This type of information can considerably alter our picture of early human economics and life style.

Blood crystal analysis may even shed light—or at least hope!—on the much debated question of mam- malian extinctions in the late Pleistocene. "What we're looking at in terms of extinction of animals I think is, not is some widespread, single-minded pursuit of mammoth by fluted-point users, but a process of hunting a wide range of animals simultaneously, one of which happens to be the mammoth. In that sense, man could seem to be an agent in extinction, but not solely— I would say he made very little difference, really," muses Loy.

Incidentally, the subject of mammoth points to another complication in the analysis of crystalized hemoglobin: namely how do you recognize the crystal pattern for extinct mammals? Loy is in the middle of working with desiccated tissue to figure out what mammoth crystals look like, as well as those of extinct bison. As for the former, he has not done his own compari- son studies of elephant hemoglobin, but older photographs published by others look quite different from those of the crystals he has produced from mammoth.

Loy remarks of his method that, "It appears to be more sensitive at the level of species. There are in fact local family and territorial differences from some of what isolated breeding populations: in themselves, they're not species or even sub-species, just geographic isolates. In the human population, for example, there are something like 300 different varieties of hemoglobin that all reflect local breeding populations. The interesting thing is that for animals, at any rate, and for the humans I've looked at, it's the species level that's (Continued on page 8)"
The archaeological significance of the Blackwater Draw site, near the eastern border of New Mexico, has been recognized for over half a century. It was here that E.B. Howard in the 1930s distinguished what is still thought to be the oldest documented and undisputed layer of habitation, the level of Paleoindian culture known as Clovis. After decades of investigation, Blackwater Draw continues to yield new information, as recent excavations in 1983 and 1984 by Dennis Stanford and Vance Haynes, among others, demonstrate. The challenge with the paucity of cultural material is to match them with their precise stratigraphic levels, to correlate geology with archaeology. This is by no means as easy as it might sound. There are seven strata, labeled A-G by Haynes. The basal unit, level A, is what Glen Evans termed "gray-white speckled sand." This is possibly pre-Clovis; intriguingly, there is no bone included in it. "No one to my knowledge," Stanford states, "has ever found whether it's cultural or not. E.B. Sellards hit at it one point, and our core hole work also hit it. I hope someday we can excavate down to that bone level and find out just what it is: is it Clovis or pre-Clovis, cultural or pre-cultural, or what?"

Levels BCDE are Paleoindian-related, and, "theoretically, the Clovis material should be in the B (called by Evans the 'brown sand wedge'), or right on top of it.... I hope we can dig down to the B, depending on who you talk to."

Since the Mammoth Trumpet interviewed Haynes last issue, the research team has received at least 20 of the 60-60 radiocarbon dates collected; so that a tentative chronology is possible, linking stratigraphic levels with periods of time as follows:

- B: 12,500–13,500 years
- C: 10,500 years
- D: 10,700–9,500 years
- E: 10,200–8,200 years

Stanford's task is to try to link these levels with the various cultural horizons; Crystal Morris at the University of Arizona is working on the various prob-

Dennis Stanford of the Smithsonian Institution talks with Center Director Rob Bonnichsen on a recent visit to the University of Maine.

One of the special features at Blackwater Draw is its great hero sandwich of cultural levels piled one atop the other.

It was the stratigraphic separation between Clovis and Folsom levels at the Draw which enabled E.B. Howard to distinguish them, and to learn that Clovis was indeed older than Folsom. Up to that time, Clovis had been regarded as a contemporary variant of the Folsom culture. Between the early excavations by Howard and the recent work by Haynes, Stanford, and others, there was a chaotic middle period in the 50s and early 60s in which the site seemed to be a sort of parody of the Darwinian competitive struggle for existence. Archaeologists competed with bulldozer operators working for a gravel-mining business; the bulldozers, like mechanical prairie dogs, Howells, and horses under; one of the operators claimed to have bulldozed over a human skeleton. At a crucial site, where human skeletal remains have yet to be found, this is like lighting one's pipe with the Declaration of Independence. To make matters worse, the scientists appear to have been possessed by their own version of the territorial imperative. Stanford says, "You have to remember that there were two neighborhoods of 17 institutions that worked out there over the years, many of them at the same time. Sam Sanders, who owned the mining operation and the geological bones, but no artifacts. In sum, we found no artifacts in the Folsom, Cody, or Agate Basin bone beds! We didn't have that much time: frantically, we were doing geology, trying to pin everything down." Arti-

factual speaking, therefore, the 1983 and 1984 sea-

sons were not exactly spectacular. Indeed, "After we left (of course) a Folsom point eroded out of the bone bed. But it was further up the bank from where we were excavating."

"We were doing geology, trying to pin everything down."

(Continued on page 8)
nevertheless could possess an identical underly- 
nerative structure. Consider, he says, the plots of the four 
following narratives:
1. A taur gives an eagle to a hero. The eagle carries 
the hero away to another kingdom.
2. An old man gives Susen its a horse. The horse 
carry susen its a horse. The horse carries 
the hero away to another kingdom.
3. Socrer gives Ivan a little boat. The boat takes 
Ivan to another kingdom.
4. A ringer gives a ring. Young men appearing 
from out of the ring carry Ivan away into another 
kingdom.

It is obvious that what appears here is a single nar- 
arrative pattern, or function, as Propp called it, with 
empty slots into which the storyteller can plug an eagle 
or a horse or whatever he pleases. “Even as a starting 
point that was interesting to me,” Landau says, 
be- 
cause as Propp was trying to see what all folktales 
had in common, she was trying to see what all writings 
on human evolution had in common.

I sat reading it in the Sterling Library at Yale, 
she remembers, thinking: “My God, he’s not just 
describing what goes on in fairy tales but what goes 
on in what I’ve been reading about ... human evolu-
tion.” I had never really focussed on the fact that it 
was a story that was being told; but his putting it in 
such explicit terms made it clear to me that, first, these 
writes were all storytellers, and, that second, they 
were all telling different versions of the same story— 
and that the story was a hero story.

For Propp went on to say that all folktales 
were formulaic: all of them could be reduced to some 
combination of the same 31 functions, which always 
occur in the same order, so that a universal narrative 
paradigm crystallizes around the figure of the hero.

In 1984, Landau published an article called 
“Human Evolution as Narrative.” Its most striking 
feature is a series of matrix diagrams. The first shows 
schematically how the narratives of early 20th-century 
archaeologists utilize four major episodes: 
band, brain and language development, terrestrial-
ity (from the trees to the ground), and civiliz-
ation (the development of technology, morals, 
and society). Because of differences in the order in which 
these four episodes occur, the theories seem quite dif-
ferent from each other.

However, in a second diagram, Landau shows 
how they share an underlying narrative paradigm built 
out of nine functions beginning with an initial situa-
tion of equilibrium, moving through departure, jour-
ney, trials, crisis, transformation, and resolution. In 
these earlier writers, the resolution follows the tradi-
tional division in literature between comic and tragic 
plots: between those that end with the hero’s success 
and those that end with his failure. In the former, the 
empowerment of the hero is unambiguously a special gift, 
acquired by a mysterious or magical donor, that 
enables the hero to triumph; this may be a weapon 
or talisman, an inherited character trait, or a combi-
 nation of the two. One is reminded of the arguments 
about whether human intelligence enabled developing 
toolmaking or toolmaking enabled developing human 
intelligence.

The effect of recognizing the story element in 
theory is to make theory seem less definitive and more 
hypothetical, less absolutely “true” and more creative 
and imaginative. There is no doubt that this can seem 
threatening and subversive in the context of orthodox 
scholarship; for science itself is often conceived as a hero 
myth in which we both inherit and create, with his miraculous 
special gift of objective reason, progresses towards a 
fina triumph which disputes and conflicts will 
withstand.

This version of the hero myth is typically male; 
Landau notes dryly that “The male heroes in evolu-
tionary theories (women are often not spoken of at 
all) do not just reflect human beings; they are the 
archaeologists themselves involved in projection 
and identification with their subjects.” She points to 
the fact that paleoanthropology is a largely male 
field and that one of the reasons why there are 
plenty of women. Although not every scientific 
theory can be constructed as a hero tale, the “heroic” 
perspective fits with the frequent characterization of the 

The belief that objectivity is always a superior form of perception or knowledge is something that humanistic studies may begin to call into question.

Paleoanthropologists seems to realize intuitively 
that the study of fossils is an interpretive activity, 
Landau states elsewhere. It is remarkably how often 
they describe fossils as texts, using terms like “docu-
ments,” “testimony,” “deciphering,” “hieroglyphics,” 
“translating,” “reading,” and, most of all, “fossil 
record.” They would not all be entirely pleased, 
no doubt, to hear that some of the more radical versions 
of hermeticians, tracing their genealogy to Nietzsche 
and Freud, doubt that we can ever eliminate the sub-
jective element entirely and arrive at utterly objective, 
universally valid interpretations, of fossils or of any-
thing else. Still, everyone is aware of how quaint the 
elider writers now sound who, because of precon-
ceived notions, exaggerated everything apelike and 
brutish about Neanderthals. “A lot of paleoan-
thropologists are extremely hesitant these days about 
telling big stories, and it’s due to an awareness that 
human evolution is a ‘soft’ science. There’s a self-consciousness 
about that and a desire to make it more objective, 
on the model of chemistry and physics ... . I think that 
there’s been progress if you can conceive of progress as 
taking the form of stepping back and saying less about 
these things at a time; but I’m not sure what it does.

Are we going to be reduced to silence? At times, 
perhaps, it may be wise to admit that there are 
limits beyond which science as an objective discourse 
cannot speak. “If I try to emphasize,” Landau says, “that 
it’s precisely because there are versions that the theory 
of human evolution is science—unlike, say, the 
Biblical account. But also that many of the things that 

scientists have said about human evolution are un-
scientific because there’s no way to demonstrate them, 
no way to figure out whether they’re true or false. It 
doesn’t actually invalidate them, but questions like 
which things you might like to know about human evolution 
that cannot be known.”

“If I start off my course on human evolution”— 
Landau notes recently reenacted the scene in which 
he was a headless one reader who, requesting word 
for teaching at Boston University—“with a questionnaire 
that I ask my students to do before I’ve even intro-
duced myself. It takes the form of a quiz: do you think 
that it means to be human? and, how did we get that 
way? I say: these aren’t exactly the kinds of questions 
you’re ready for in the middle of the morning. Pre-
tend it’s midnight and you’re lying on a field . . . 
“... And the students have to give a story. It’s very 
interesting what they often list as human qualities: 
being able to love, being able to destroy ourselves, 
expressing emotion. (Very few of them say ‘being 
hipped;’ for example, or ‘having a big brain.’) Many 
of these things cannot be understood through the fossil 
record. To some extent they may be explored using 
comparative studies of primates and other animals, 
but many of the questions of human origin can’t be 
answered. That is a little thing that we’re trying to 
to give them some sense of in order that they 
realize might be something about how science works, 
what is within the realm of scientific inquiry and what 
is not. For example, when scientists ask us about 
us are aggressive because we always were and it’s 
biologically programmed into our genes, I tell them, 
‘You’re good at that kind of thing; there is no need to: 
but a case such assertions are very difficult to 
prove from a scientific perspective.’ ”

Scientists are not emotionless compilers of data; 
or do they live in isolation, doing science for science’s 
sake. “Paleoanthropologists do not just talk to other 
paleoanthropologists; they’re asked to talk to the 
public, and are aware of the kinds of questions that 
the public wants to know about—and they themselves 
want to know. They’ve been drawn to the field for 
a variety of reasons, but I can’t help but think that the 
native fascination of the subject itself, of those big 
questions, is part of the appeal,” Landau says. “Before 
a human being becomes a scientist he or she is a child 
and a watcher of television and a reader of fairy tales. 
Science and the humanities are both human activities,” 
she says, and practitioners on both sides have been 
formed by the same culture. What they derive from 
both deliberately and unconsciously, is not only a set of 
values but a set of story patterns and common 
metaphors.

The point now is: storytelling is not always a bad 
thang. In the beginning, I wondered, and said, ‘Well, 
maybe what we should do is get away from story-
telling, to try to capture moments.’ I had this idea that 
we should turn to landscape and the landscape of the 
world of eight million years ago, rather than how it 
changed. Yet that’s what evolution is about, change 
through time . . . One of the problems in narrative is 
that you’re always trying to get to the ending, so the 
account becomes very teleological. In writing a story, 
you often have a sense of the ending even before you 
have the beginning.”

It follows that “An awareness of narrative might 
even be a liberating tool for paleoanthropologists to 
explore other possibilities,” other patterns than the 
diachronic and the causal. Scientists are not only 
trained to seek certainties, not possibilities; at the same 
time, it is conceded that the really creative scientists, 
like Einstein, or even the paleoanthropologists, 
should be creative artists: through an intuitive perception 
of similarity amidst differences, leading to the use 
of analogies and metaphors often borrowed from outside 
the immediate area of study.

Evolutionary theorists might at least consider the 
possibility of abandoning the search for single, ab-
soiute, other-than-or-all others, and to explore 
the narrative-like the stories by the South American 
writer Borges in which several possible endings 
are presented as what one story tells a “garden of forking 
paths.” What Landau is suggesting is an exploration 
of the creative aspect of scientific thinking, which 
could lead to whole new ways of theorizing.

—Michael Dolzi
A PRIMER OF PALEO POINTS

**New materials reviewed by the Center library.**

**ARTICLES**


*Alden, John R. 1986 In Search of the Wooly Mammoth. Natural History, September 74-75.

*Alden, Marion J. 1985 Chief's Ancient Mummies. Natural History, October 75-78.


*Gell-Mann, Murray 1987 First Word. Omni, 8:.


**NEW REFERENCES AND RESOURCES**


**BOOKS**


**ARCHAEOLOGY IN THE CLASSROOM**

Although still in its infancy, the growing field of K-12 archaeology education is showing vigor. Two recent contributions are worthy of note.

*Discovering Maine's Prehistory Through Archaeology: An Interdisciplinary Curriculum Unit for Grades 5-8 was prepared by author Diane Kopce in February, 1987 at a workshop in connection with the Center for the Study of Early Man's week-end conference, The Humman Story: Bringing Prehistory to Life."

Organized around a six-week unit plan, this 144 page document highlights activities, discussions, audiovisuals and tests about: "What is Archaeology?;" "Doing Archaeology: The Archaeologist and Methods;" "Doing Archaeology: Prehistory;" "Doing Archaeology: Excavation and Interpretation;" "Living Archaeology;" "Native Americans Today;" and "You and Archaeology."

Diane Kopce, Curator at the Robert Abbe Museum, Bar Harbor, Maine, and Arthur Spies, Prehistoric Archaeologist with the Maine Historic Preservation Commission first surveyed what other educational materials existed through the SHPO network. Diane has incorporated in her curriculum materials ideas developed in the following sources: Studying the Prehistory of Man in Kentucky; Anthropology and Education Quarterly; Native American Source Book (Concord Antiquarian Museum); Frontiers in the Soil: The Archaeology of Georgia; A Teacher's Guide to Project Outreach: A Public Awareness Program in Vermont Archaeology; and Classroom Archaeology (Louisiana), which is an outstanding resource in this field described below.

Nancy W. Hawkins, the author of Classroom Archaeology, has brought together under one cover the following: activities, games, and units on recording, interpreting and excavating a site, a listing of recommended books divided by elementary, junior high and high school levels, and three pages of vital information about "Materials That May Be Purchased From Other Sources." Addresses are included.

To order a copy of Diane Kopce's work, write Maine Historic Preservation Commission (under whose auspices it was developed), 55 Capitol Street, State House Station 65, Augusta, Maine 04333. Nancy Hawkins' Classroom Archaeology was produced by the Division of Archaeology, Department of Culture, Recreation and Tourism, State of Louisiana. It can be obtained by writing to: Division of Archaeology, P.O. Box 44247, Baton Rouge, LA 70804.

—Marilyn Roper
CONFERENCES

UPCOMING

October 22-25, 1987 NINETEENTH ALGONQUIAN CON-
ERENCE, Museum of Natural History, Smithsonian Institution, 
Washington, DC 20560. 
Contact: Ives Goddard, NHB Run 81, Smithsonian Institution, 
Washington, DC 20560.

October 26-29, 1987 GEOLOGICAL SOCIETY OF AMER-
ICA, Annual Meeting, Phoenix, Arizona. 
Contact: Jean Kinney, GSA Headquarters Box 9140, 1300 

November 1-3, 1987 MAMMOTH, MASTODONS 
AND HUMAN INTERACTION SYMPOSIUM in conjunction 
with the Annual Meeting of the TEXAS ARCHAEOLOGICAL 
SOCIETY, Waco Hilton and Waco Convention Center, Waco, 
Texas. 
Contact: Albert J. Rodier, Central Texas Archaeological Society, 
4229 Mitchell Road, Waco, TX 76710.

November 5-7, 1987 AMERICAN SOCIETY FOR ETHNO-
HISTORY, Annual Meeting, Claremont Hotel, Berkeley, CA. 
Contact: George Collins, Prov. Chair, AES 1987, Cit. for Latin 
American Studies, 382 Alexander Row, Stanford University, Stan-
ford, CA 94305: 617-723-4444.

November 12-15, 1987 CHACMOL CONFERENCE, 20th 
Annual, University of Calgary, Canada. 
Contact: 1987 Conference Committee, Department of Archaeol-
ogy, University of Calgary, Calgary, Alberta, Canada T2N 1N4.

November 18-22, 1987 AMERICAN ANTHROPOLOGICAL 
ASSOCIATION, 86th Annual Meeting, Chicago Marriott, Chi-
icago, IL. 
Contact: Victor Golla, George Washington University, Wash-
ington, DC 20052: 202-676-6073.

John Fox (Baylor University) Waco Mammoth 
Site 
Joel T. Gunn (University of Texas at San 
Antonio) Clovis Site Distributions and 
Fluctuating Climates 
Gary Haynes (University of Nevada) African 
Elephant Herd Sites As Behavioral Analogies 
Ernest Lundelius (University of Texas at Austin) 
Paleofauna 
Jeffrey Saunders (Illinois State Museum) Boney 
Springs and Blackwater Draw 
Calvin Smith (Baylor University) Waco 
Mammoth Site 
Dennis Stanford (Smithsonian Institution) 
Lewisville, Texas, And The Dalton And Selby 
Sites, Colorado 
Gentry Steele (Texas A&M University) Dwueall-
Newberry Site 
David Webb (University of Florida) Evolu-
tional Adaptations of Probecosidea

March 17-23, 1988 11th Annual Conference of the Society of 
Ethnobiology, Mission City, Mexico. 
Contact: Robert Bye, Jardín Botánico, U.N.A.M., Apdo. Post. 70-614, 04510 Mexico, DF, Mexico or Jan Timbrook, Santa Bar-
bara Museum of Natural History, 2599 Puesta del Sol Road, Santa 
Barbara, CA 93105.

March 9-12, 1988 Northeast Regional Meeting, GSA, Port-
land, ME. 
Contact: Dr. Stephen Pollack, Dept. of Geology, University of 
Southern Maine, Gorham, ME 04039.

May 25-28, 1988 GEOLICAL ASSOCIATION OF CANA-
ADA - MINERALOGICAL ASSOCIATION OF CANADA - 
CANADIAN SOCIETY OF PETROLEUM GEOLOGISTS 
Joint Annual Meeting, St. John's, Newfoundland. 
Contact: John Fleming, Newfoundland Dept. of Mines and 
Energy, P.O. Box 4750, St. John's, Newfoundland, Canada AIC 
117: 709-776-2766.

May 29-June 3, 1988 WORLD CONFERENCE ON WATER 
RESOURCES, Ottawa, Canada. 
Contact: Secretariat, 6th World Conference on Water Resources, 
Univ. of Ottawa, 648 King Edward Avenue, Ottawa, Ontario, 
Canada KIN 6N5.

July 4-8, 1988 6TH INTERNATIONAL CONGRESS OF 
AMERICANISTS, Amsterdam, Holland. 
July 24-31, 1988 12TH INTERNATIONAL CONGRESS 
OF ANTHROPOLOGICAL AND ETHNOLOGICAL SCI-
ENCES, Zagreb, Yugoslavia. 
Contact: Linda Bennett, Amer. Prov. Coord., Dept. of Amer., 
Memphis State Univ., Memphis, TN 38112.

August 2-5, 1988 5TH INTERNATIONAL CONFERENCE 
ON PERMAFROST, Tromso, Norway. 
Contact: VCOT, Norwegian Road Research Laboratory, P.O. 
Box 6300, Trondheim, N-6016 Oslo 6, Norway.

September 1988 ARCHAEOLOGICAL WOOD SYMO-
SIUM, Los Angeles, CA. 
Contact: Dr. Roger M. Russell, USDA, Forest Products Laboratory, 1600 Gifford Pinchot Dr., Madison, WI 53705.

September 22-25, 1988 19TH ANNUAL BINGHAMTON 
GEOMORPHOLOGY SYMPOSIUM, Brock Univ., Ontario, 
Canada. 
Contact: K.J. Tinkler, Brock University, St. Catharines, On-
tario, Canada L2S 3A1: 416-948-5550, Ext. 3486.

October 31-November 3, 1988 GEOLICAL SOCIETY OF 
AMERICA, Annual Meeting, Denver, CO. 
Contact: Jean Kinney, GSA Headquarters Box 9140, 1300 

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Date: October, 1987
To: All subscribers
From: Center publications staff
Re: New

Current Research in the Pleistocene (CRP) 4, 1987 has already been 
mailed to all prepaid subscribers. This volume has 76 papers and many 
illustrations, 2 indices, and a reference map. The Special Focus sec-
tion features South America, with 7 papers from regional specialists. 
Back issues of volumes 1, 2, and 3 have been reprinted and are now 
available. If you would like to have CRP 5, 1988 mailed directly to you 
as soon as it becomes available, fill out the card inserted in CRP 4 and 
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TASTING A HERO SANDWICH

(Continued from page 4)

"Jeff Saunders was able to get money from the National Science Foundation to prepare some mammoth bone that had been excavated in the 60s. That material had never been out of its jacket; most of it’s not even prepared. We hope to be able to publish an updated version of that earlier work as well as go back and test or, preferably, have a full-scale excavation."

Blackwater’s biggest draw — so to speak — is that it is the most likely of known sites finally to disclose to us something more about the little-known people called Clovis. “We just barely know that Clovis existed, and that’s about the state of our knowledge. We know they made Clovis points!” Most else is conjectural. "We know they probably hunted mammoths" — but even there Stanford qualifies. He thinks a mammoth feast was likely to have been quite a rare event: very possibly there were Clovis individuals who never tasted one. The usual Clovis diet was probably bison, deer, frogs, toads, snakes, lizards, etc.

Even at Blackwater Draw there is more speculation than evidence as yet concerning Paleoenadian cultural patterns, partly because there are so few artifacts dating to Clovis times. One reason for the scarcity of stone tools, no matter what the period, is that the people who made stone tools undoubtedly did not throw them away casually when they took so much trouble to make. In addition, sources for good-quality stone may have been quite distant. Hence, what is likely to turn up are the damaged projectile points, halves broken from processing game, and the like. Stanford infers that “Most of the tools are going to be where they fell in their animals or parts of animals out of the buggy swamp onto dry ground. . . . We know where those sites are, but by and large, most of the camp sites have been blown around and redeposited on the rock surface. People are some areas that might be promising, though.”

However, the major reason for the dearth of cultural remains is surely that most of them were made out of perishable materials, particularly wood and bone. It surprises Stanford that so few bone tools are discovered even when bone is preserved. It leads him to think that the favored tool material might have been wood. For example, there are somewhere between 60-100 Folsom sites (90% of them surface sites); only about 4-5 of them have bone tools.

Disappearance of the perishable artifacts erases much of the individuality of a culture. That the various culture levels were very similar (based on their similar stone tools) is probably an illusion. As Stanford explains: “Stone is a limiting medium. There are only a few ways you can break it, and most groups discovered those ways. Except for fluting. That’s unique, a real North American invention. It does not occur anywhere else in the world. But everybody makes end scrapers look about the same; the same for flake knives. Where we would really see cultural differences, and where we really need data, is with the perishable artifacts!”

One of the special features that would justify ongoing work at Blackwater Draw is its great hero sandwich of cultural levels piled one atop the other: it is extremely rare to find substantial preservation of so many at once, and it is by no means only the Clovis and pre-Clovis possibilities that are attractive. There is significant and abundant material from the Archaic period, for example; “and it’s also interesting,” Stanford adds, “that during the Archaic times, when apparently the spring was really dry, seasonally at least, the Archaic people dug wells. These beautiful wells go right down through the earlier stratigraphy. Recently, David Meltzer found more of them at Mustang Draw, near Midland, Texas, and elsewhere which have been found in Texas by Glen Evans.”

“We think the site is so special that what we would like to see happen there is a permanent structure with a permanent and ongoing work, as at Dinosaur National Monument, where a visitor can come in and, from an air-conditioned building which is also a museum, watch excavators at work. Then we share with the public the Real, but distant at the moment: ‘What’s needed is a large funding commitment, something difficult to achieve these days.’”

— Michael Dolzani

BLOOD FROM A STONE

(Continued from page 3)

being differentiated by hemoglobin-crystal analysis. The problem is that you can’t go any higher on the taxonomic ladder.”

That is why Loy has been looking into supplementary procedures. “There are other techniques for species identification that I’ve been using,” he says. “Some of them take a longer time, but they’re absolutely in elegant in the sense that they give an absolute ‘yes’ or ‘no’ answer. I do a technique called isoelectric focusing that holds tremendous promise. It separates the proteins electrochemically and sorts them into small bands depending on their native pH. The gel that I do the separations through has a series of chemicals that set up a pH range from pH 10 to pH 3. As the sample migrates across the gel, it responds to the electric charge and I end up with a ladder of bands that become a fingerprint identification. There are, admittedly, a lot of problems with sample preparation and elimination of contaminants. Also, I think that to be really effective, it will have to be computerized, because it’s simply too tedious and time-consuming by hand.”

In addition, Loy is delving below the molecular level into the analysis of blood on the atomic level. It is known that the blood’s stable carbon and nitrogen isotopes can be used to look at an animal’s diet distinguishing carnivores from herbivores. An Italian scientist a few years ago found that differences can be discerned in the stable oxygen isotopes as well, depending on the drainage basin from which the animal came; it thereby becomes possible to study the movements of animals or people from one drainage basin to another. Using a mass spectrometer, Loy can also determine something about the mean annual temperature in the month that an animal died, although he is careful to check it against other temperature indicators for that time before drawing conclu-

— Michael Dolzani