ANTHROQUEST

news of human origins, behavior, and survival

Number 29 | The L.S.B. Leakey Foundation News | Summer 1984

THE MASHCO-PIRO NOMADS OF PERU

Hillard Kaplan, Columbia University, and Kim Hill, University of Utah

Hillard Kaplan checking beach near wild banana grove for tracks of Mashco-Piro. Broken twig trails found here led to several recently abandoned camps.

The study of modern hunter-gatherers has been of considerable interest in recent years for several reasons. First, the causal factors underlying many human behaviors can be more easily studied in these relatively non-complex societies where options are fewer and variables of interest more amenable to empirical study. Second, ecological constraints can be seen to more clearly and directly affect behavior. Third, it is believed that contemporary foragers, by virtue of their reliance on the hunting and gathering lifestyle, still operate under many of the same constraints as those which shaped the behavior of our hominid ancestors. Unfortunately, however, the opportunities to study such groups have seriously diminished in the past three decades.

continued on page 13

THE L.S.B. LEAKEY FOUNDATION

The L.S.B. Leakey Foundation was established in 1968 by a group of eminent scientists and informed lay people who recognized a critical need to strengthen financial support for new multi-disciplined research into human origins, our evolving nature and environmental future. it was named in honor of the man who had become known as "the Darwin of pre-history," Dr. Louis S.B. Leakey.

The Foundation sponsors:

International research programs related to the biological and cultural development of humankind.

Long-term primate research projects which may help us to understand how we evolved as a species.

The training and education of students in these fields.

Conferences, publications of scientific papers, and educational programs designed to disseminate knowledge relevant to our changing view of humanity's place in nature.

The L.S.B. Leakey Foundation is a public foundation. All contributions are tax-deductible as provided by law.

THE L.S.B. LEAKEY FOUNDATION NEWS

Editor . . . . . Elizabeth P. Brady
Associate Editor . . . . . Elizabeth Waldron
Production Editor . . . . . Jan Slater

AnthroQuest is published by the Foundation as a service to its members. Single copy price, $1. L.S.B. Leakey Foundation, Foundation Center 1-7, Pasadena, CA 91125. Copyright 1984, L.S.B. Leakey Foundation. Telephone (818) 449-0507.

PRESIDENT'S MEMO

We are most indebted to Richard E. Leakey, the directors of FROM (Foundation for Research into the Origin of Man), and to its Fellows, Life Members and scientists for the gracious way they have enabled us to combine the work of FROM with the Leakey Foundation. Our thanks most warmly include Barbara Isaac, the editor of the excellent newsletter, INTERIM EVIDENCE.

The joining together of the two foundations was announced at a festive dinner in New York by Leakey Chair Gordon P. Getty. The Lotos Club was the venue with arrangements made by Leakey Trustees Norma Schlesinger and Ann Willis. Guest of honor Dr. Mary D. Leakey was presented with a metal sculpture derived from her new book, AFRICA'S VANISHING ART — THE ROCK PAINTINGS OF TANZANIA. The gift was created by Leakey Trustee Fred Myers of Denver, and awarded by Mr. Getty.

Directors, Fellows and Life Members of FROM were invited to be honored guests at the dinner, following the opening of the magnificent exhibit of "Ancestors: Four Million Years of Humanity" at the American Museum of Natural History. The Leakey Foundation contributed $10,000 towards the travel expenses of scientists involved in the academic part of the program. The exhibit closes September 9, 1984.

In the spring issue of ANTHROQUEST, you read two articles originally submitted to INTERIM EVIDENCE. We look forward to having former FROM authors as future contributors.

Mr. William P. Richards, Jr., a FROM director and close personal friend of Richard Leakey, has graciously accepted election to the Leakey Board.

Because most of the FROM Fellows and members — all of whom have received complimentary standing in the Leakey Foundation for the next year — happen to live in the eastern United States, it behooves the Leakey Foundation to continue the fine work of FROM in presenting "stones and bones" programs in the New York area. Fortunately, Ann Willis, who lives in New York and has extensive experience with non-profit organizations, has undertaken to produce a series of intimate discussions with leading scientists in the winter of 1984-85. These will be patterned on the "Winter Wednesdays" so successfully organized in Southern California for the past several years. These are open to Annual Fellows of the Leakey Foundation and their guests. If you are interested in the plans for New York, please let us know in the Pasadena office. Fellows of Leakey and of FROM will be notified individually about the programs.

Our national activities for the coming year include a symposium in Denver under the direction of Trustees Joan Donner, Philae Dominick and Fred Myers, who will follow the pattern of the highly successful Salt Lake City program organized by Frances Muir and Dr. Gayle Gittins. Mention of Salt Lake starts me laughing again, remembering some of Jimmy Stewart's "ham on wry" stories about his daughter Kelly's adventures in the Ruwenzori.

Chuckles are not science. But they are an integral part of the Leakey Foundation. Louis Leakey had a marvelous sense of humor and was a master storyteller. While our first thrust is science, we have always succeeded in a kind of euphonious erudition. Therefore, those who look forward to the New York evening discussions and to Denver may expect a lilt to the lectures.

These words come to you from the Serengeti Plain, where Leakey Fellows are enjoying a superb safari. For those who missed it, would you be interested next year?

Sincerely,

Ned Munger

IN BRIEF

Dr. Jane Goodall sends word that a chimpanzee born to Patti at Gombe, Tanzania, has been named Tita in honor of Dr. Goodall's good friend and our founding trustee, Tita Caldwell.

NEW FELLOWS

The L.S.B. Leakey Foundation is pleased to welcome as new Annual Fellows: Grace A. Tanner, Salt Lake City, Utah, Mrs. Samuel Bowlby, Pasadena, California, William M. Wirthlin II, Salt Lake City, Utah, Alfred Taubman, Troy, Michigan, Corinne Whitaker, Pasadena, California.

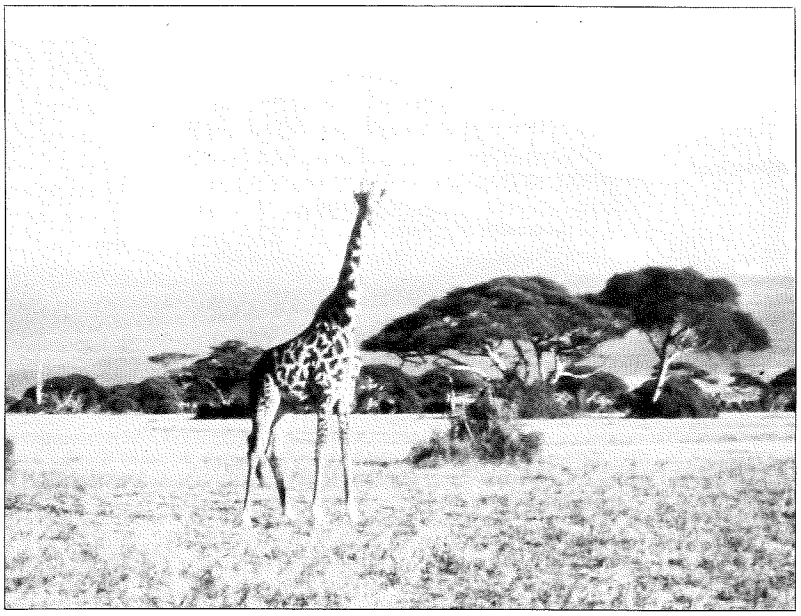
ASTRONOMY IN EAST AFRICA

The Borana-Cushitic Calendar and Namoratunga

Laurance Reeve Doyle
Space Sciences Division, N.A.S.A.
Ames Research Center, Moffett Field, California

While Western thought has always prided itself on scientific objectivity, it has often been found unprepared for such surprises as an intellectually advanced yet seemingly illiterate society. In the face of apparent primitiveness, the possibility of significant intellectual development may not be fully investigated.

This was certainly the case when, in the early 1970s, Dr. A. Legesse first found that the Borana people of southern Ethiopia were indeed using a sophisticated calendrical system based on the conjunction of seven stars with certain lunar phases. Previous calendrical investigations into the area up to this time had superficially stated that the Borana "attach magical significance to stars and constellations," incorrectly concluding that their calendar was based, as ours is, on solar motion.



A rare zoo-geological alignment of a giraffe with Mt. Kilimanjaro observed during the Namoratunga expedition.

What Dr. Legesse found was an amazing cyclical calendar similar to those of the Mayans, Chinese, and Hindu, but unique in that it seemed to ignore the sun completely (except indirectly by way of the phases of the moon). The workings were described to him by the Borana *ayyantu* (timekeepers) as follows.

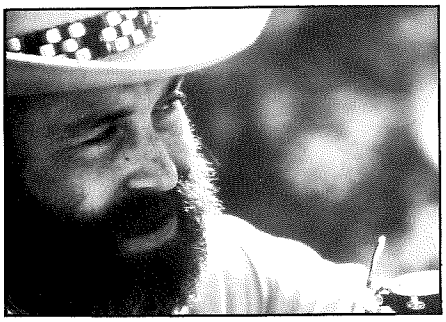
There are twelve months to a year, each month being identifiable with a unique (once a year) astronomical observation. The length of each month is either 29 or 30 days — that is, the time it takes the moon to go through all its phases. (This time is actually 29½ days and is called a synodic month, but the Borana only keep track of whole days). Instead of weeks, there are 27 day names. Since each month is 29 or 30 days long we will run out of day names about two or three days early in the same month. The day names can therefore be recycled and for day 28 we use the first day name again, the second day name for day 29, and start the next month using the third day name. Thus each month will start on a different day name. Whether the particular month is to be 29 or 30 days long would depend on the astronomical observations, which are quite ingeniously defined.

The seven stars (or star groups) used to derive the calendar are, from northernmost to southernmost, 1) Beta Triangulum — a fairly faint navigation star in the constellation of the Triangle, 2) Pleiades — a beautiful, blue star cluster in the constellation of Taurus the Bull, and sometimes referred to as the seven sisters, 3) Aldebaran — a bright, red star that represents the eye of Taurus, 4) Belletrix — a fairly bright star that represents the right shoulder of the constellation Orion the Hunter, 5) Central Orion — the region around Orion's sword where the Great Orion Nebula may be found, 6) Saiph — the star representing the right knee of Orion, and finally 7) Sirius — the brightest star in the night sky and the head of the constellation Canis Majoris, the Great Dog.

The new year begins with the most important astronomical observation of the year — a new moon in conjunction with Beta Triangulum. (This day is called Bittottessa and the month is called Bito Kara). The next month starts when the new moon is found in conjunction with the Pleiades. The third month starts with the new moon being observed in conjunction with the star Aldebaran, the next with Belletrix, then the area in between Central Orion and Saiph, and finally with the star Sirius. So the first six months of the calendar are started by the astronomical observations of the new phase moon found in conjunction with six specific locations in the sky marked by seven stars or star groups.

The method is now switched and the final six months are identified by six different phases of the moon (from full to crescent) being found in conjunction with only one position in the sky — the one marked by Beta Triangulum. Thus the whole Borana year is identified astronomically and when the new phase moon is again finally seen in conjunction with Beta Triangulum the new year will start again. Since there are 12 such synodic months of 29½ days each the Borana year is only 354 days long.

Now in the latter part of the 1970s another interesting development was to take place regarding the astronomy of this region. In 1977 Drs. B.M. Lynch and L.H. Robbins, who were working in the Lake Turkana area of northwestern Kenya, came upon what they believed was the first archeoastronomical site ever found in sub-Saharan Africa. At Namoratunga, it consisted of 19 stone pillars, apparently man-made, that seemed to align toward the rising positions of the seven Borana calendar stars as they had appeared quite some time ago. (Their suggested date from various archeological considerations, which still requires corroboration, was about 300 B.C.). Due to precession (the slow, wob-



The author at the Namoratunga site measuring the alignments and magnetic deviation of the pillars.

bling of the pointing direction of the rotation axis of the Earth), the stars will seem to move from their positions over the centuries, although the moon's position would not vary on this time scale. (Such an example is the alignment of certain features of the Egyptian pyramids with the star Thuban in the constellation Draco the Dragon, which was the north polar star about 5000 years ago; today it is Polaris and in several thousand years it will be Vega). If the date that Drs. Lynch and Robbins suggested was correct, the site would then correspond to the time of the extensive kingdom of Cush, referred to as Ethiopia in the Bible but actually centered about present day Sudan. One would then conclude that the Borana calendrical system was old indeed, having been developed by the Cushitic peoples in this area about 1800 years before the development of our present day Western Gregorian calendrical system..

In 1982, a number of significant questions arose concerning the site, the calendar, and archeoastronomy of East Africa in general. The pillars were remeasured by an anthropologist in Kenya (Mr. R. Soper) and found to be magnetic in nature. The original measurements had to be modified but, again, alignments with the seven Borana stars were found. However, this brought up the question of whether pillar alignments are significant at all, since the Borana *ayyantu* certainly can recognize the phases of the moon and when it is in conjunction with the appropriate seven stars. It was time to approach the question astronomically, and ask the moon and the stars how the calendar worked.

First we could take the new year's observations, a new moon in conjunction with the faint star Beta Triangulum. What is meant by the term "conjunction" which is astronomically defined as the closest approach between two celestial objects? A new moon means that the moon is very close to the sun, being at best only a very small crescent, and therefore can only be seen just before sunrise or just after sunset. Interestingly enough, it turns out that during this twilight time the sky is too bright to be able to see the star Beta Triangulum so that seeing the new moon next to Beta Triangulum, the most important observation of the Borana calendar, was impossible!

In addition, assuming that the new moon and Beta Triangulum could be somehow seen rising together, the next month's new moon rises significantly behind Pleiades, the next conjunction star group. The third new moon rises with Belletrix, having skipped the third star, Aldebaran, completely. This is certainly not how the Borana described their calendar. If we were to continue to try to work the calendar in this way, by the start of the sixth month the new moon would be rising almost four hours after Sirius.

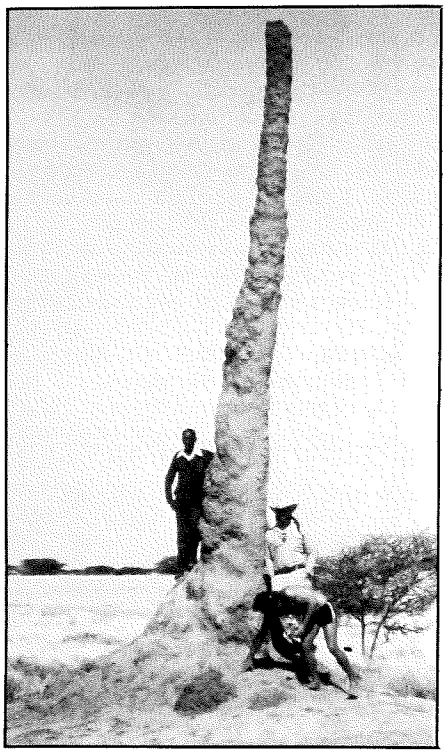
How could the calendar work then? Suppose (as we did), that one takes the term "conjunction" to mean "rising at the same horizon position" instead of "rising horizontally next to at the same time." Thus one could mark the horizon rising position of Beta Triangulum, with pillars for instance, and once a year a new moon will rise at that position on the horizon. Let us suppose that this astronomical event marks the start of the new year. We must add that we are taking the horizon rising positions of these seven stars as they were in or around 300 B.C., since present day Beta Triangulum has precessed too far to the north over the centuries and the moon will never rise there. However, the position of 300 B.C. Beta Triangulum, as well as the other Borana stars, was quite within the realm of the moon's orbit.

Now where will the next new moon rise? It turns out to rise at precisely the rising position of Pleiades! The next new moon, marking the start of the third month, rises at the Aldebaran horizon position, the next at Belletrix, the next in between Central Orion and Saiph, and finally the sixth new moon rises at the horizon position that Sirius rose at during the night. During the next six months one can tell what month it is only in the middle of the month, since one has to wait to see what phase the moon is in when it appears at the Beta Triangulum horizon position. During the seventh month, as described, a full moon will be observed at the Beta Triangulum position. The next month a gibbous waxing moon, then a quarter moon, and successively smaller crescents will be seen there until, at the time when the 13th or first month should start the new year again (exactly 354 days later), a *new* moon is again seen rising at the Beta Triangulum position on the horizon.

It is interesting that one can draw some significant anthropological results from the astronomical derivation of this calendrical system. It would appear that the calendar would have had to have been invented (to use the stars correctly) sometime within a few hundred years of 300 B.C., a time when the Cushitic peoples were dominant in this part of the world. Hence we would call it the Borana-Cushitic calendar. In addition, although the seven Borana-Cushitic stars no longer rise in the correct horizon positions to be correctly marked by pillars for observing the monthly rising positions of the new moon, the present day Borana people nevertheless use this system of timekeeping. The implication is that the Borana require ancient horizon markers in their present derivation of the calendar.

Concerning the site at Namoratunga, and considering that the use of pillars is

Site at Namoratunga showing alignment of pillars there. The stones on top of the pillars were placed there recently by the Turkana people that inhabit the region.



Termite mound in Turkana area; (not an archeoastronomical pillar although the mounds can be used for finding direction as they tend to orient northwest to southeast).

apparently necessary to the derivation of the calendar, such horizon markers as are found there may, indeed, have been an ancient observatory. Petroglyphs on the pillars at Namoratunga may also hold the possibility of being ancient and, if Cushitic, may represent the alignment stars or moon. Cushitic script has never been deciphered and any hints as to the meaning of its symbols could be significant clues with very exciting prospects indeed!

Thus, archeoastronomy in East Africa is still quite new and many discoveries await. From coming to understand, even in a small way, the calendrical reckoning and observational abilities of the ancient and modern astronomer-timekeepers of this region, Western thought should certainly not again underestimate the ingenuity and intellect present there. As for this Western thinker, this study continues to be a welcome lesson in perspective and humility, taught to him by his astronomical colleagues of long ago.

This is a summary of a talk delivered at Caltech for Ned Munger's African Studies class.

Photos by E. William Frank, who was a participant in the first Namoratunga expedition. □

PALEOANTHROPOLOGY: THE PAST QUARTER CENTURY

F. Clark Howell
University of California, Berkeley

Paleoanthropology is a kind of interest that people have. I don't think there is such a thing as a paleoanthropologist. I don't believe it is possible to be a paleoanthropologist. I think it is possible to be interested in paleoanthropology, which has to do with the origins and evolution of humankind in the very broadest sense. And consequently, it is impossible for any one person to combine all the necessary capabilities and disparate kinds of specialized knowledge and techniques to tackle any more than just a little part of that vast spectrum.

Paleoanthropology as a term really came into some kind of usage, as I remember, in the early 1950s. No one knows exactly where the word came from. Of course, "paleo" merely means old, or ancient, if you wish, and anthropology is the study of humankind. So it is the study of old humankind or the old study of humankind, whichever way you like it. We hope that it is the study of humankind in the broad sense, using scientific methods rather than other approaches, and that it seeks to place humanity into perspective of all other life on this earth, past and present, and in the framework of a changing earth in a very complex changing universe, about which you read in the papers every day.

Twenty five years is an easy figure; fortunately, it is 1984. Twenty five years ago was 1959, and 1959 was 100 years after the publication of Darwin's "Origin of Species," and there was an enormous series of events all over the world in 1959 celebrating the anniversary of the publication of that extraordinary book. One of these great celebrations was, in fact, at the University of Chicago, where I was then a young faculty member. There I was associated with and in proximity to some of the most remarkable people who ever existed in evolutionary biology, surely. That is very impressive to a young person who is trying to find his way, and I suppose I was becoming aware in a true sense of evolutionary biology.

Twenty five years ago I think we had the beginnings of paleoanthropology in a modern sense. I think it came out of many diverse backgrounds. We began to reach a critical mass. The Darwin centennial produced, at the University of Chicago, three extraordinary volumes called "Evolution After Darwin." The remarkable people brought together there for the celebration were in offices next to me and all around me. We had coffee with Julian Huxley and George Gaylord Simpson and Ernst Mayr and Ledyard Stebbins and Dobzhansky and all of those outstanding people. And there were a few youngsters like myself who were able to follow on the heels of these great men. Something, I think, rubbed off on us, or at least we think so.

Nineteen fifty nine saw, of course, a remarkable serendipitous occurrence in Africa — and we could use that as a point of departure because many people think that that was really what gave an enormous boost, a big momentum, to paleoanthropology as such — and of course that was Mary Leakey's discovery of a hominid skull, a human-like skull, at Olduvai Gorge. It was in place, not on the surface but in place in an excavatable context in association with a remarkable series of complex sedimentary and volcanic deposits, with a diversity of animal remains and with archeological associations. That kind of situation means that somebody has to go and tackle each of these problems separately. There are a lot of people involved in these things.

The extraordinary thing is that all of this happened, and it happened with that remarkable man, Louis Leakey, who did not find the skull himself but certainly capitalized on it. He went to the National Geographic Society and they — in their usual wise way — provided substantial amounts of money so that Mary Leakey could stay in the field and do extensive excavation, while Louis Leakey stayed in Nairobi and did paperwork and tried to run an up-and-coming museum. And without all of those things coming together at a certain moment, we wouldn't really have what has transpired in the last 25 years.

I think the developments have been across a very broad front. When I was a youngster in anthropology, just after World War II, I was in one of the biggest anthropology departments in the country, and it had six faculty members — the University of Chicago. It reached seven once I graduated and was called back to teach. The others were all old-timers, in their late 40s up to 60. Today, a big anthropology department like the one I am in at Berkeley has 35

or 36 people. The fields have become much more diversified. You have many people in many fields, because the fields have become so particularized and so specialized in terms of methodology, besides the jargonese that they also acquired. The linkages across with other disciplines are very, very important. Anthropology has always been a kind of central focus having to do with human studies, past and present, a kind of natural focus, a kind of core area, to which other disciplines that were appropriate could be linked.

Until the late 1950s, I think, it was possible, more or less, for human evolutionary studies and what we now call paleoanthropology to be a kind of one man show. Then it stopped being possible. The science comprised an extremely complicated set of techniques and approaches and a diversity of interests that somehow overlapped and bound people together as they came to tackle the problems in anthropology and related fields. The recognition of problems and then the utilization of field situations, which was vastly exploited in the early 1960s, meant that one could use field situations as a laboratory. This had never really been done before.

The idea of digging to dig, I think, really changed remarkably, even in countries like France, where literally the whole goal was to spend your life excavating sites or a site. Why? Because it was there, and one always wanted more, longer sequences, better examples of what people were doing in the past, and to look at their artifacts and things of this sort without any kind of real problem-solving involved. This attitude began to change remarkably. Many people became involved in the work who might otherwise not have been. One of these is Alan Walker, a medical doctor. (See his article on page 7.) He could easily have spent his life in an anatomy department — in fact, he has done a lot of that — but he had interest in zoology and geology.

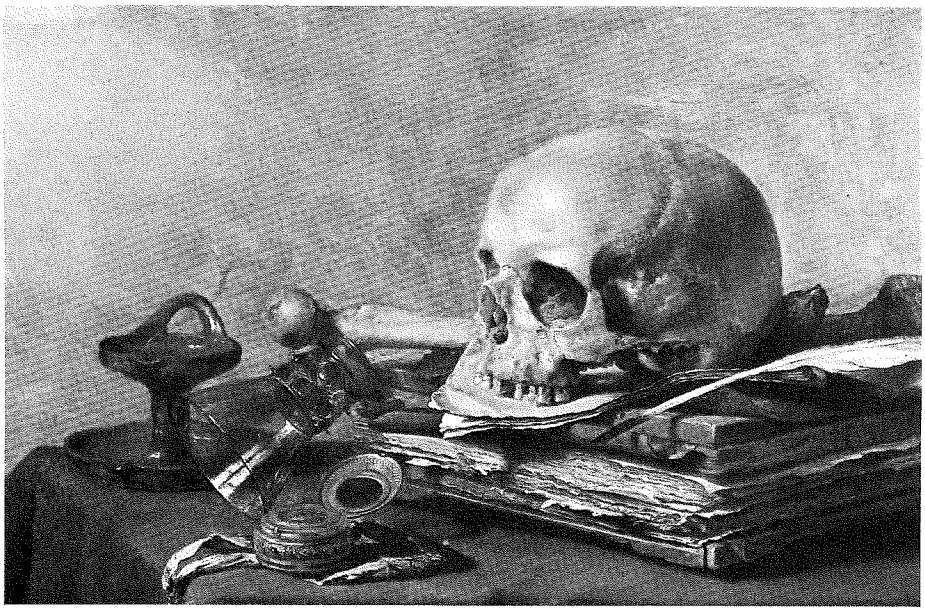
Anatomy has always been a critical focus in human evolutionary studies because you cannot understand and appreciate the biological and other aspects of the human condition unless you have an appreciation of structure and physiology. So morphology is a basic critical part of biological anthropology. But it is only one part; there are many, many others. We are able to understand how things work mechanically far better than we ever could before. We are able to use zero x-ray radiography, for example, or electromyography to find out how and when muscles move and what happens when they don't work correctly. We are able to do a lot of different kinds of things of this sort that we never did before. All of this is a part of the very complex story of trying to understand the human condition and how it came about, of trying to put some flesh on the bare bones.

I was once accused, and probably rightly so, of saying that really paleoanthropology is all stones and bones. It certainly is not. Stones happen to be there sometimes, and they are fashioned into artifacts, but lots of artifacts aren't made of stone. There is a lot more to bones, a lot more to living organisms than the bones that we usually have to deal with. We try to cope with these things from the point of view of living organisms by looking at those which are counterparts to extinct organisms. Paleoanthropology isn't stones and bones and it isn't a dead subject; it cannot possibly be dead.

I really wonder where paleoanthropology is going to go. I wonder if it has gotten as far as it can. Those of us who have worked a lot in the field sometimes think that things are sort of worked out, perhaps because we ourselves are worked out a little, because we combine teaching and research, almost always in the university context. We have to teach and do lab work at home but the field is our laboratory, too. Without the field and the field work we don't go anywhere. That's new. There used to be field people and non-field people.

That system broke down, it seems to me, 25 years ago. We feel strongly now that students cannot do one thing or the other; they must do both. We insist on it. Someday universities will recognize that their traditional structures, including departments and the way faculties are separated, are a completely artificial and — frankly, in the modern world — a kind of barren way to run things. Universities do not like change; bureaucracies do not like change. But science changes, and science will force these other changes sooner or later.

This article is an adaptation of Dr. Howell's remarks at the Leakey symposium in Salt Lake City last February. □



'Vanitas' still life by Peter Claesz (1596-1660).

CALL FOR PAPERS

A planning committee from the Southwest Museum, the Southern California Historical Society, and the Los Angeles Public Library invites scholars to submit abstracts for papers to be read at a one day symposium on Charles Fletcher Lummis to be held on February 2, 1985, at the Southwest Museum in Los Angeles. This date marks the centennial of Lummis' arrival in Los Angeles. The symposium will examine Lummis' role in creating and promoting what has been called the "fantasy heritage" of Spanish California and the Southwest, and identify what was of lasting importance in his work as photographer, editor, folklorist, ethnographer, museologist, librarian, historian, etc.

Send abstracts of not more than 100 words by October 1, 1984, to:

Romaine Ahlstrom, Collection Development Manager
Lummis Symposium Committee
Los Angeles Public Library
630 W. Fifth Street
Los Angeles, CA 90071

For more information write, or call (213) 626-7555 x 207. □

PROMISES AND PITFALLS OF THE FOSSIL RECORD

Alan Walker
Johns Hopkins University, School of Medicine
Baltimore, Maryland

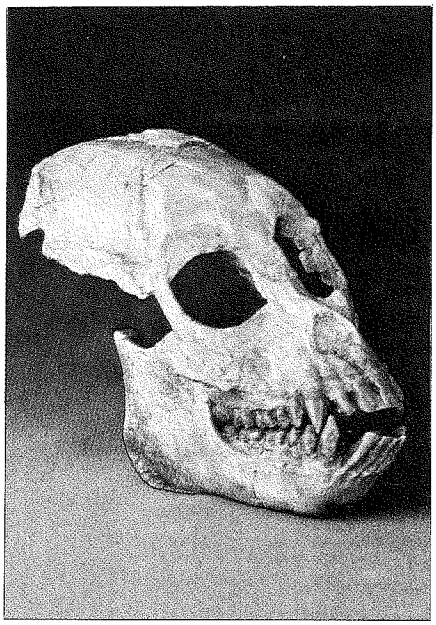
There are dangers in the fossil record. For instance, if we went to Africa and looked at the density of animals, we would see that it differs with the species. There is one elephant to an area versus how many mice? If the fossil record preserved everything, it could very well be leading in dead mice. Similarly, if we looked at the reproductive rates, we would find that an elephant has one baby at a time while numbers of mice are born at once. Again, the world should be leading in mice. But that is not what a fossil record tells us. It often gives us lots and lots of elephant bones and hardly a mouse bone at all. That is because mice are edible completely and elephants are not edible easily. You can't take any elephant and swallow it and destroy it all.

So, the fossil record is biased and we must remember that.

When the past is different from the present, it is difficult to interpret the past. A fossil mouse, 20 million years old, has a bizarre-looking scapula bone and overlapping rib plates which form a sort of flat armor. There isn't an animal like this alive today so we have no living analogy. All we can do is make sort of fairy tales about it. So it sometimes happens that even the processes of the present won't help us to understand the past.

Some of the recent discoveries in the field give a little overview of the new happenings.

For instance, Elwyn Simons' team has been collecting fossils in the Fayum Depression, south of Cairo. They collect fossils in a very simple way, brushing off the desert pavement, the crust of stones and fossil wood that was left there after the wind blew everything else away. They brush this off and overnight the wind comes again and fossils are exposed. The team has found a lot of remarkable fossils. One turned out to be not what it appeared. It is the jaw and teeth of a thing called *Parapithecus*. The animal was supposed, because of its bilophodont teeth, to be extremely close to the ancestry of monkeys. But it has recently been found that the incisors are milk teeth. The two canine teeth came together to make tusks. This is not anything like any modern monkey and this cannot be in the ancestry of monkeys anymore.



The well-preserved skull of Proconsul africanus, *a dryopithecine ape of the Miocene from Kenya.*

The most famous fossil that Elwyn Simons discovered in the Fayum is *Aegyptopithecus*, the earliest apelike creature, about 30 million years old, from the Oligocene. Its teeth are very much like the Miocene ape teeth found further south in Kenya and Uganda. So it has been called a dental ape.

Recently, Simons and his team have found several more fossils of this creature. They found more complete males, showing the most extraordinary feature, sagittal crests of bone that start right at the front of the skull and go straight up. The crests are quite enormous, bigger than any male gorilla's. They are there because of the very, very large teeth relative to a small skull. The large teeth had large muscles to drive them.

Aegyptopithecus is becoming much better known. One of the fascinating things about it is that now that there are a lot of specimens, *Aegyptopithecus* is shown to have been sexually dimorphic. That is, the males and the females looked different in a number of different ways. The major difference is that the males had a long, strong, pointed canine tooth and the females did not. Simons has pointed out that this fact says something about the social structure of these early apelike creatures, or ape ancestors; it says that probably there was a certain amount of male-male competition in their societies and that there were probably not single pair-bonded groups.

Mary Leakey found the very famous skull of *Proconsul* in 1948 in Kenya. However, the back of the skull was missing, so one could not get a clear idea of the brain size. Just recently, a colleague of mine noticed in Louis Leakey's field notebooks for the year before Mary found the skull an entry in Louis' scribble giving the site number and asking, "Primate skull fragments?" So he went to find those fragments and discovered them in a box of little scraps of turtle bones in the museum. Those pieces are from the back of the skull. They enable us to follow the bone all the way down to the foramen magnum, where the spinal cord joins the brain. Now we can make a pretty good estimate of the brain size of *Proconsul*. Although a small animal, weighing about 25 pounds in the females, it had a brain volume as large as the largest male baboon today. Ape ancestors were pretty brainy, I suspect, as primates go, 20 million years ago.

Louis Leakey was working in western Kenya in the 1940s and '50s. One of the fossils he found turned out to be very important because it was a partial forelimb skeleton and some scraps of skull of a single *Proconsul africanus* individual. The monograph that was written about it was very influential; it was a most important piece of work.

A few years ago, a student at the University of Bristol in England was sent all the Miocene pig fossils from the

museum in Kenya to study. One of these pig fossils was a block of rock with brown bones in it. The student took one look at it and said, "That's not a pig," and he put it to one side. When the fossil was returned to Kenya several years later, the bones were recognized immediately as those of a primate foot. It had been sitting in the University of Bristol for years, not being studied because it wasn't a pig.

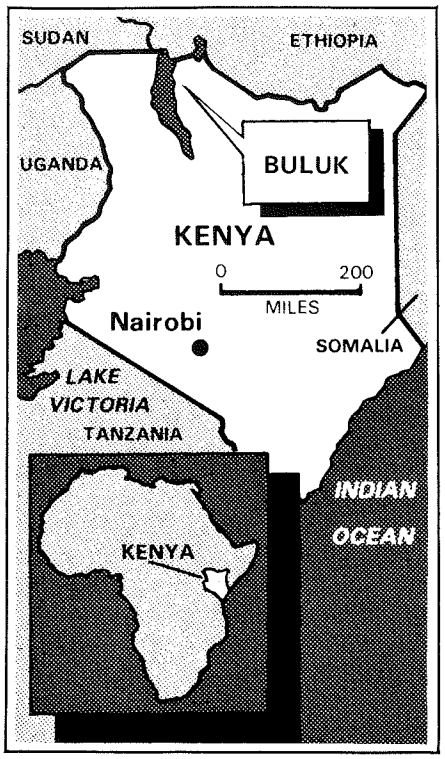
When I saw it, I saw that not only was it a primate foot but a foot of that same individual from which the forelimb came. The site had been quarried in blocks and the blocks taken to the museum. We realized that this "pig" might not be the only missing bone so we went through the museum fossils from that site — every bone, whether it had been called a lizard, a bird or a rat. We were able, by mirror-imaging, to reconstruct the limb proportions of *Proconsul* and to get a good estimate of the body weight for the first time.

Richard Leakey and I have just been given a National Science Foundation grant to go back to the same site at Rusinga and find the rest of the missing parts. There are 15 tons of broken blocks with bones still on the site. We hope to find the pelvis. We hope to see if the creature had a tail. We hope to find the missing parts of the knee.

When we went to Rusinga to check the site, we found the foot skeleton of one the larger *Proconsul* species, an animal the size of a chimpanzee. To our surprise, we found that the animal was remarkably like the modern chimpanzee. The results of the original analysis of the fore-limb skeleton had said, behaviorally, that it was rather like a monkey. When we looked at the hind-leg skeleton we have now, it looked much more apelike. Here is a curious amalgam of features that are not present in that combination in any modern species. We have to reanalyze the locomotion of *Proconsul*.

There are some small pieces of primate fossils at Fort Ternan from thick-enameled primates called *Ramapithecus*. All the higher primate fossils in Fort Ternan could fit in the palm of your hand; despite the fact, they are very important. They are about 14 million years old.

There are about 12,000 identifiable fossil mammals, some of them spectacular, from Fort Ternan. The most abundant, about 90 percent of the fauna, are of antelopes — horned antelopes of two main species, one of which was a browsing animal that lived off bushes, the other a grazing animal, eating grass. They left their dung behind in piles, classified in the museum as seeds. When we went back to the site, we could see that they were antelope dung piles, characteristic of open or woodland antelopes, not forest antelopes.



We must not give anyone the impression that Africa is the only place where anything exciting goes on; that is not true at all. David Pilbeam from Harvard has been working in Pakistan, and he recovered a magnificent specimen of the Asian *Sivapithecus*, eight million years old. It was very, very much like an orangutan, with a brow jutting over the anterior parts of the face, a sort of dish face.

Last summer, Richard Leakey and I were working at a site about 17 million years old in Northern Kenya called Buluk. Here a valley has been filled in by one big river and sealed off by ash and some lava that has been dated. There were many animals there but the best specimen we found was that of a thick-enameled apelike creature, an associated upper jaw and lower jaw of what everyone now agrees is *Sivapithecus*. It is the same fossil genus as that from Pakistan. Leakey, Pilbeam and I were recently at Harvard, comparing specimens.

What does this say about evolution? Does this mean that orangutans branched off from the African apes 18 million years ago? Or does it mean that the early group out of which both orangs and African apes evolved looks much more orang-like than we ever thought? Could it be that the features that we thought were special to orangs are actually primitive, and that African apes have done more evolving than we thought, and that they are not primitive but more derived? Thus, in a way, some of the features of modern orangutans could be taken to make orangs living fossils.

Whether this theory happens to be right or wrong doesn't really matter. We are thinking in new and different ways.

I want to finish with a few remarks about some work that I have done — at least, that has been done by Pat Shipman and Margaret Schoeninger who work with me in Baltimore. It has something to do with how we can recognize the earliest finds.

There have been claims for well over a million years ago at a site called Chesowanja in eastern Africa, including the use of fire. Some pieces of burnt clay were found there, clay burnt at quite high temperature. I was one of the first people to work this site. Everywhere I went across the whole region, in an area of about 30 or 40 square miles, I found mounds of red clay, tubes of red clay that looked baked, rising above the surrounding soil and rock. They had been baked, for eventually we found some with burnt tree roots still inside.

So we asked the local people when it was that a forest burned down and they said, "Oh, 1938," the year that the war came to East Africa. There had been an acacia woodland all over this region and it burned out in 1938 and left tubes of red clay going deep into the ground. And that makes me nervous about the evidence of fire over a million years ago at Chesowanja. The burnt red clay there could have been caused in this way.

There is another way that Pat Shipman and Margaret Schoeninger have been looking at bones. After awhile, all the free carbon in a burnt bone can disappear and it won't be black. So, if a bone was thrown into a campfire — and that is a very natural thing to do after eating — after awhile it wouldn't show any free carbon and you wouldn't know it had burned.

However, there are a variety of ways you can look for burning in bones. One is studying the morphology of the bone in a series, with scanning electron microscopy at very high power, to see the ultrastructural changes in bone under different temperatures, which is what Pat did. Another is looking at the x-ray diffractions of the bone, which is what Margaret did. With electron microscopy, if the temperature of the bone is raised to something like 700, the bone mineral changes and becomes very crystalline. Even if there is no free carbon, the ultrastructure can be checked to see whether the bone was burnt. And you can look at the x-ray diffraction patterns to see if it has changed mineralogically. When electron microscopy and x-ray diffraction techniques are used together they can tell you at which temperature a bone was burnt and that can tell you if the bone was thrown into the campfire, even a million and a half years ago.

So, you see, if we try hard enough with the new technology, we can get all

sorts of information about behavior out of the fossil record. The bones are not just a list of names in time and space.

This article is adapted from Dr. Walker's presentation at the Leakey symposium in Salt Lake City in February. □

AGING FAST?

Out of Africa there is always something new.

—Aristotle

Are we, as humans, a million years older than we have thought? David Pilbeam, professor of anthropology at Harvard University, and his colleagues at work in Kenya think so.

A small hominid fossil bone fragment — a piece of lower jaw and two molar teeth — discovered in late February at Tabarin in northern Kenya is believed by Dr. Pilbeam to be five million years old. Until now, the oldest known hominids were those of the species *Australopithecus afarensis* whose remains were discovered in Ethiopia and dated at between three and a half and four million years.

The new fossil was discovered by Kiptalam Chepboi of the National Museums of Kenya which are under the direction of Richard Leakey. Chepboi was a member of the expedition sponsored by Harvard University and the National Museums of Kenya, part of an ongoing project on the origin and evolution of humans directed by Dr. Pilbeam.

The jaw specimen was found at the edge of what was a lake five million years ago, near Lake Baringo, 200 miles northwest of Nairobi. Other fossil animals found with it "show clearly that it is older than four million years," Pilbeam stated. Volcanic rocks at the site, with others in the region, "suggest it is nearer five million than four." These rocks have already been dated at the University of California by the potassium-argon method.

"There are a number of other sites in Baringo of the same age as Tabarin which have not yet been investigated in any depth," Pilbeam said. "It is probable that further hominid fossils will be discovered there in the future." The same group of scientists plans to return to northern Kenya early next year to look for more fossils. □

FIELD REPORTS

Excerpts from reports by Leakey Foundation grantees on their work in progress.

THE EARLIEST BONE TOOLS: Re-assessing the Evidence from Olduvai Gorge

By Pat Shipman
Johns Hopkins University
School of Medicine
Baltimore, Maryland

Seven sites at Olduvai yielded the peculiar bones. From DK at the bottom of Bed I (nearly 2 million years old) to BK at the top of Bed II (about 1.7 million years old) came a small but persistent proportion of bones that were oddly broken, flaked or damaged. Some of them showed rounding and polishing on their broken edges or points. In 1971, Mary Leakey suggested in her monograph on Olduvai Gorge that these 125 specimens were actually bone tools, shaped and utilized by early hominids at Olduvai.

The evidence to convince Dr. Leakey's skeptics was hard to find. Anyone can recognize bone tools from the Upper Paleolithic, some 35,000 years ago; these include harpoons and carved figurines. But the proposed Olduvai bone tools were more than a million years older and so much more crudely shaped that their identity as tools was questionable. For this reason, her suggestion, and similar suggestions based on material from other sites, remained highly controversial.

I decided to re-evaluate the Olduvai bone tools using a new approach. Other researchers, notably Lawrence Keeley of the University of Illinois at Chicago Circle, had been very successful in identifying microscopic traces of wear on stone tools. Would a similar approach work with bone tools? A set of experiments making and using bone tools, and inspecting their edges at high magnifications using a scanning electron microscope (SEM), showed that utilization was clearly recognizable at the microscopic level. The microscopic features of utilization were distinct from the microscopic appearance of fractured but unused bones. They also differed strikingly from the microscopic features seen on bones that were broken and then abraded by streams or by windblown sediments. When more recent bone tools, made and used by Eskimos, were inspected under the SEM, they showed features similar to the experimental tools. Thus, I had a new and more objective means of identifying bone tools. An added benefit was that the microscopic wear also indicated whether the bone tool had been used on a soft substance — like meat or hide — or in tasks on a mixed substance — such as digging or butchering a carcass, in which both soft meat and hard bone particles are encountered.

With the help of my technician, Jennie Rose, and a graduate student, Julie Cohn, I traveled to the National Museums of Kenya in 1983 to examine the possible bone tools from Olduvai. We made careful notes on the types and orientations of fractures on the tool sample and made high-quality replicas of the edges or points that had apparently been utilized. We also made notes on and replicas of a comparative sample of other Olduvai fossils, matched to the tools by body part and species. The comparative sample would indicate what "normal" breakage and damage were like. Further, to evaluate the possibility that carnivores had damaged the possible bone tools, we made replicas of and collected data on a sample of bones taken from a modern hyena den by Andrew Hill.

Back in the U.S., Jennie and I examined the replicas of the bone tools and the comparative samples and compared them with the known bone tools. Forty-one of the 125 possible tools were confirmed by SEM studies. Three general types of tools could be identified: 1) anvils, which were large, chunky bones with nearly flat surfaces pierced by some sort of sharply pointed tool; 2) soft substance implements, that were usually small or medium sized bone fragments used to process soft substances; 3) mixed substance implements, that were often much larger, heavier fragments of bone used to carry out tasks that might have included digging or butchery. One of the most revealing findings was that not all of these types of tools occurred at all of the sites bearing tools. For example, the anvils first appear at the oldest site in Olduvai that has yielded stone awls and only occur at awl-bearing sites. Whatever these awls were being used for — Mary Leakey suggests it may have been hide-working — the anvils may have well served as "working companions" in the same task. The soft substance implements show up at all seven sites yielding bone tools, but the mixed substance implements are almost all found at BK II. Finally, there is one extraordinary

bone tool that so closely resembles stone bifaces (handaxes) from Olduvai as to fool many an anthropologist from across the room. Its point shows the effects of repeated utilization on soft substances.

Once the SEM studies had identified the genuine bone tools in the original sample, I could analyze the differences between the bone tools and the comparative samples. I also used Dr. Leakey's original data on the total bone assemblages. The bone tools are distinctive in several ways. First of all, large and very large animals (elephants, hippos, rhinos, and giraffes) are dramatically over-represented as bone tools relative to their representation in the whole assemblages. Second, there is a strong bias towards the major bones of the limbs in the bone tools and there is an equally strong bias against other, more common body parts, like vertebrae and ribs. Finally, the bone tools include a much higher percentage of flaked bones — and out of those that show any flaking at all, a higher percentage of bones with many flakes removed — than does the comparative sample. What this information suggests is that the hominids deliberately selected particular bones, and bones of particular animals, for use as tools. Probably, many or all of these bones were then shaped by flaking to make them more useful tools. Since flaking is the major technique used in creating stone tools in Beds I and II of Olduvai, it seems likely that the hominids were transferring familiar stone-working techniques to a new raw material: bone. Viewed in this way, the deliberate selection of large animal limb bones makes sense; the shaft of these bones is made of thick, dense, cortical bone that is excellent for flaking. The association of smaller bone fragments with soft substance tasks, and of larger fragments with mixed substance tasks, also seems reasonable. In activities like digging or butchering carcasses, it is useful to have a large implement of substantial weight; for finer tasks, a smaller implement permits better control.

This project, funded in part by the Leakey Foundation, has yielded a fascinating glimpse of early hominid behavior. I have been able to confirm Mary Leakey's original contention that there were bone tools at Olduvai as ancient as the earliest stone tools and made by similar techniques. This work also suggests that early hominids were skilled and knowledgeable tool makers, capable of selecting raw materials most suitable for the tasks to be performed even when those raw materials were uncommon.

Mary Ellen Morbeck

FOSSIL BONE RESEARCH IN EAST AFRICAN MIOCENE HOMINOIDS

Mary Ellen Morbeck
University of Arizona

Fossils are the ultimate test for our ideas about when, where and under what circumstances humans and our close living relatives evolved. Just as teeth tell us about potential diets of fossil species, postcranial bones (those of the trunk and limbs behind the cranium or skull) help us to interpret locomotion and posture. Understanding potential locomotion is crucial to understanding the animal as a whole. It also can be important in scientific classification. For example, our own scientific family, the *Hominidae*, is defined in the fossil record primarily on the basis of postcranial bones that show structure for bipedal behavior.

Fossils tell us about body structure and about related movement capabilities. Movement occurs within joints, the areas where two or more bones meet. Sizes and shapes of the joint surface areas, along with soft tissue, permit particular directions and ranges of movement. Limb bones are links between joints and are moved by muscles that cross joints and attach to bones. Using this joint-link approach, we can tell what an animal is capable of doing but not exactly what it does in a given environment. Fossil bones that clearly are part of one individual and are associated with teeth are most important. Information about different body parts can be pieced together to reconstruct how an animal moved and appropriate features can be used to assign it a scientific classification.

Lucy and other specimens from Ethiopia (ca. 3 M.Y. or more) are the earliest fossils to show structural capabilities for hominid bipedalism. Later Plio-Pleistocene fossils show similar structures. But what came before Lucy and her relatives? The Middle-Late Miocene fossil record includes scattered limb bone fragments. We have to go back to the Early Miocene, to 17.5 million year old fossils of *Proconsul africanus* to find a relatively complete skeleton that can provide clues about a diverse group of early hominoids, ancestors of apes and humans.

A partial skeleton of *Proconsul africanus* was found in 1951 by Thomas Whitworth, a geologist who was working with Louis Leakey at Rusinga Island in Kenya. In 1959 the anatomists John Napier and Peter Davis described the skull fragments, jaws, teeth and limb bones of this not-quite-adult individual. Many joint surfaces are included. Napier and Davis combined their anatomical description with comparisons with living primates and concluded that: "The upper limb bone of *P. africanus* shows many primitive and generalized features that provide evidence of a quadrupedal arboreal heritage; associated with these characters are others that appear to be adaptive for a brachiating mode of life" (1959). Their interpretation of these forelimb bones and Napier's subsequent publications on primate locomotion provoked considerable discussion and controversy about how bone structure relates to locomotor (and postural) function and how (or even if) primates can be classified in terms of locomotor types. Although in terms of Miocene primate samples, the fossils are a bonanza and can provide conclusive information, paleontologists, anatomists and

anthropologists still argue about locomotor capabilities and expressed behavior of *P. africanus*.

Since 1970 when I first went to Nairobi to study the *Proconsul* and other Early Miocene fossil limb bones, I have been active in the *Proconsul* debate. Based on limited data, "brachiation," arm-swinging, knuckle-walking, quadrupedalism and climbing each have been proposed as primary locomotor behavior by different researchers during the past decade. I suggested that this individual showed a mosaic of features as recognized by John Napier and the detailed anatomy of the wrist and grasping hand indicated probable weight-bearing in palmigrade (palms down) locomotion and posture. Many of us longed for more fossils so we could put together our knowledge of the joints of the forelimb with joints and links of the rest of the body.

Exciting things have happened to the *Proconsul* story during the past few years. Our wishes have been granted (but, of course, we still want more fossils). Much of the remaining skeleton has been recovered from the collections in the National Museums of Kenya by Alan Walker and Martin Pickford. In addition, by using Whitworth's field notes, which for a long time had been unavailable to researchers, they have relocated the fossil site. Future excavations may reveal even more of this 17.5 million year old individual.

I had the good fortune to return to Kenya, with the support of the L.S.B. Leakey Foundation, in January and February of 1983 to study the new elements of the skeleton and another new set of fossils from Rusinga Island, a nearly complete foot from a larger *Proconsul* species, probably *P. nyanzae*. My primary focus is on the size and shape of joint surface areas and related limb morphology in order to determine direction and range of movement within joints and infer possible locomotor and postural capabilities. In addition, since body weight is linked closely to physiological function and structural design, I hope to be able to predict individual body weight from postcranial fossil remains. My comparative sample includes humans, apes and monkeys with data on individual body weight, skulls, teeth and postcranial bones of the trunk and limbs. I combine more traditional linear and angular measurements of joints and links with joint surface area data.

The recently recovered fossils, which along with the original specimens are designated as KNM (Kenya National Museum) – RU (Rusinga Island) – 2036 (museum identification number), include: 1) additional forelimb bones with part of a scapula (shoulder blade) with an attached shaft of the humerus (upper arm bone), radius and ulna (forearm bones) and more hand bones; 2) previously unknown hindlimb elements including parts of both femora (thigh bones), tibiae and fibulae (leg bones) and an almost complete foot; and 3) a bonus of three vertebrae and a rib. Walker and Pickford briefly describe these fossils in a recent publication (1983). The new fossils confirm the uniqueness of *Proconsul* morphology and remind us to be careful in our interpretations of each joint complex as it relates to whole body adaptations, possible locomotor and postural capabilities and speculations on expressed behavior and environmental parameters.

I have not yet completed my analysis of the relationships among individual body weight, linear and area variables in living primates. My preliminary results show that tooth measurements, which have been relied upon by paleontologists to predict body weight, are poor indicators of weight if compared to a variety of postcranial linear and surface area variables in modern primates.

While continuing to work with data from my contemporary sample, I have focused on that part of the *Proconsul* skeleton for which I already have detailed comparative data, the ankle and foot complexes. I have compared linear, angular and joint surface area measurement values to those collected and analyzed for modern humans, gorillas, chimpanzees and orangs by Gomberg in his dissertation research and also have started to collect and analyze the same kind of data for other primates.

The foot had capabilities for powerful grasping, movement within the transverse tarsal joint and stability in dorsiflexion (bending the foot toward the leg) of the ankle joint. Integrating what is now known about the structures of forelimb, ankle and foot joints and limb proportions, it seems likely that *Proconsul* was an eclectic quadruped capable of a variety of locomotor and postural behaviors which emphasized grasping hands and feet. We will never know how much time was spent in different activities or in different places. However, with detailed work aimed toward understanding the anatomy of the joints and assuming that the soft tissue anatomy was similar in pattern to that of modern primates, we can be reasonably sure of what this fossil species was capable of doing.

This leaves a lot of important questions unanswered. In particular, what happened between the Early Miocene and the first appearance of hominids? How does *Proconsul* relate to modern apes and humans? Data from molecular biology indicate a probable separation of African apes and hominids of only five or six million years ago. *Proconsul*, since it is more than ten million years earlier, thus loses its former status as a probable direct common ancestor. In addition, some researchers are uncertain if *Proconsul* even can be considered a true hominoid since its postcranial skeleton is unlike that of modern apes and humans. Still, *Proconsul* is among the most important fossil primate discoveries. We must take advantage of such a special set of fossils. The more we can learn about *Proconsul* and other Miocene hominoids, the better we will be able to interpret existing and new fossils that may help us to reconstruct a model or baseline for hominid origins.

ORANGUTAN RESEARCH IN BORNEO

Kim A. Bard
Georgia State University, Atlanta

After receiving funding from the L.S.B. Leakey Foundation in April, 1982, for my research project on free-ranging orangutans, it was another 13 months before I obtained my visa. I arrived at the Tanjung Puting Reserve, Kalimantan Tengah, in June, 1983. Immediately upon landing from the slow boat that brought me to the Orangutan Research and Conservation Project, directed by Dr. Biruté Galdikas, I found myself face to face with an orangutan. Unfortunately, wild orangutans are not so easy to find; this was one of the rehabilitants which frequently sleep along the bridge that runs from the river to camp. The first months there were spent gathering general information about the two populations of orangutans, wild and rehabilitant, and about the study area. This progress report covers the period from June through December, 1983.

The main thrust of my research project is the development of object manipulations in wild orangutans. After initial observations, I prepared a field manual and finalized my data collection methods. Observations were made on the manner in which infant and juvenile orangutans interact with all the objects they encounter – branches, fruit, flowers and whole trees. The complexity ranking of these manipulations is based on the Piagetian theory derived from observations of children primarily up to the age of two years.

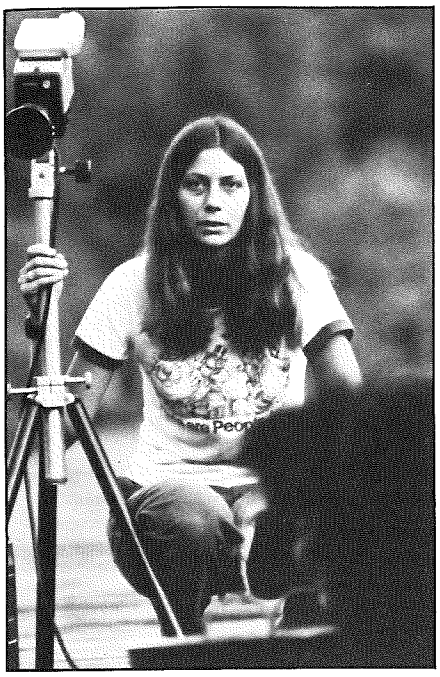
The quantitative data from this study have yet to be totally extracted from the collected naturalistic observations of seven wild mother-offspring pairs, three of which were followed a second time three to five months later. Observations

totaled almost 300 hours and spanned 32 different days of which 26 were whole days. Whole day follows mean that the pair was followed from the time mother and offspring departed from the nest in early morning until it built and entered another nest for the night.

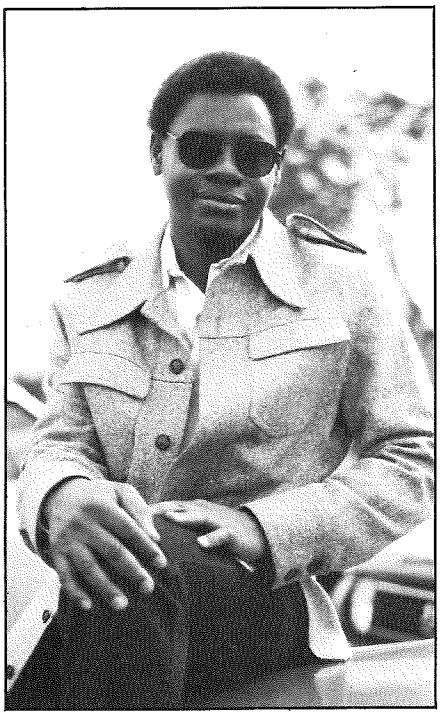
It is clear that manipulative behaviors most frequently observed in wild orangutans between the ages of three and eight years include the following: 1) Single actions such as grasping or waving a branch; 2) goal-directed behaviors such as intentional releases of objects (as seen, for example, when the peel of a fruit is removed within the mouth and looked at on the lower lip before it is dropped), and use of available means to obtain a desired object (the bending inwards of a branch from the stem, for example, in order to obtain the fruit on the far end); 3) multiple actions directed toward a single object (detaching a branch, for example, waving it, taking pieces off with the mouth, etc.). In addition, behaviors indicative of more complex cognitive functioning were also observed, but to a much lesser extent. These more complex manipulations include the following: 1) Complex relations which consist of manipulating at least two objects in a specific relationship to each other. For example, during the eating of lurangan fruit, usually more than one piece is taken from the tree branch and held in the hand. Then the open palm holding the fruit is repeatedly rubbed against either the back of the other hand, the arm or foot, or a branch (thus involving yet another object in the functional complex). This action removes the many small and sticky burrs on the outside of the fruit. 2) Experimentation consists of the repetition of actions on objects with graduated variations each time, usually to attain some not easily reached goal or some not easily accomplished activity. This occurs most often during the orangutans' search for termites or locomotion between trees. 3) Object-force relations which consist of manipulating an object in relation to forces such as gravity. For example, in the crossing of a gap between two trees, a third tree is utilized. The orangutan may throw its weight forward and slightly upward toward the more flexible parts of the third tree, effecting a slow crossing of the gap.

On a few occasions even more complex cognitive processing occurs, evidenced by planning, a period of mental activity prior to overt action.

In addition, Dr. Galdikas and I agreed to an adjunct project – the observation of food-sharing among the rehabilitant orangutan mothers and offspring. This involves videotaping food-sharing interactions every month for microanalysis in the States.



Kim A. Bard



Ndessokia Prosper

FROM A NEO-ECOLOGIST TO A PALEONTOLOGIST-IN-THE-MAKING

Ndessokia Prosper
Franklin Mosher Baldwin Fellow
University of California, Berkeley

I was born 32 years ago and brought up in Marangu, a village situated at the foot of Kilimanjaro, the highest mountain in Africa. At the early stage of my education I attended government school in Tanzania. In 1973 I received a diploma in Wildlife Ecology and Management from Mweka (CAWM), Tanzania. For the next seven years I worked as a wildlife ecologist. In 1980, after graduating from the University of Dar-es-Salaam with a B.Sc. in ecology-zoology, I developed an urge to do evolutionary studies.

Tanzania is a custodian of a rich and diversified cultural heritage, some of the most important aspects of which are the archeological sites containing faunal and hominid remains. These are the testimony to the history of mankind, his origin and evolution, his cultural and technological development, and his interaction with the environment. Sites such as Olduvai Gorge, Laetoli and Peninj in Tanzania are famous, and research activities in these areas will contribute greatly to our knowledge of the origin of man and evolution. They offer us a good opportunity to explore the world into which Darwin led us.

With all these potential sites, Tanzania does not have a single qualified research paleontologist. In order for Tanzania to effectively cater to research (and perhaps to be able to introduce paleontology and related subjects in her local university), the country requires trained and qualified professionals to conserve and preserve this unique cultural heritage.

With this in mind, I decided to pursue paleontology. To be frank, I did not know where to start until May, 1980, after joining the Department of Antiquities. I was posted to the Olduvai Gorge Archeological Research Center, where I worked under Dr. M.D. Leakey. It took me a couple of months before I got the feel of this fascinating field. What was more fascinating was to learn from Dr. Leakey at this early stage of my new career. From her I learned more than she realized.

My experience at Olduvai suggested to me that further training was a prime necessity if I was going to stay in this field. I received a study grant in 1982 from the L.S.B. Leakey Foundation and in September I joined UC Berkeley for my graduate studies in paleontology.

Ever since, I have studied under talented professors from both the paleontology and anthropology departments. I hope after successful completion of my studies to go back home where I will be responsible for the coordination and undertaking of interdisciplinary research work in the related fields of paleontology, paleoecology, geology, archeology and physical anthropology. In addition, I will be involved as a curator of paleontological material and in teaching at the local university during sabbaticals. □

Jimmy Stewart, Grace and Obert Tanner at Salt Lake Symposium.

SALT LAKE SYMPOSIUM

The Leakey Foundation all-day symposium, "Search for Our Ancestors," held at the University of Utah in Salt Lake City on February 25, was most enthusiastically received by a community that had been largely unacquainted with the Foundation. "Over and over again we were given heartfelt and sincere compliments on the speakers and everything else." reported Trustee Frances Muir who coordinated the event for the Leakey Foundation with the aid and cosponsorship of the anthropology department at the university.

The speakers were Drs. Frank Brown, J. Desmond Clark, F. Clark Howell, Richard Wrangham, C. Owen Lovejoy, James O'Connell and Alan Walker. Mrs. Grace Adams Tanner was honorary chairman of the symposium committee. Her very generous donation went far toward making the weekend a sound financial success.

A dinner on the eve of the symposium was held at the Salt Lake Country Club. The Honorable Scott M. Matheson, Governor of Utah, and Mrs. Matheson, and Mr. and Mrs. James Stewart of Beverly Hills were honored guests. Mrs. Stewart has long been a member of the Leakey Foundation Associates.

A number of Utah residents attending the symposium are so enthusiastic that they are planning to continue work with the Leakey Foundation, forming a chapter in their city. This kind of dissemination of anthropological information is one of the aims of the Foundation. Guests attended from every Western state including Alaska and Texas and from Washington, D.C. □

continued from page 1

Virtually all known groups that are still classified as hunter-gatherers have considerable contact with the outside world. As a result, most have undergone significant changes in both subsistence-related activity and social organization, and all have adopted new technologies. While such changes do not eliminate the possibility of acquiring important data on foraging peoples, they do limit the types of questions which can be productively studied, and serious problems must be confronted in the interpretation of the data collected with these groups. In addition, many of the groups classified as "foraging peoples" do not currently spend any more time in subsistence foraging than do most tribal horticulturalists or peasant peoples of the third world. For these reasons, we felt that it was important to personally investigate rumors of full time uncontacted hunter-gatherers using stone tools in the region of Manu National Park in southeastern Peru.

Manu National Park is one of the largest national parks in the world. Along its western border, the park reaches elevations of almost 4000 meters, and then drops precipitously to about 2000 meters in only a few kilometers. From this point, one slowly descends from upland jungle to lowland tropical forest at elevations under 500 meters near the Manu River. The park is bounded to the west by the steep slopes of the Andes. To the north and east lay vast tracts of unexplored lowland tropical forest. *continued*

The climate near the Manu River is similar to that found in much of tropical South America. While the temperature fluctuates very little throughout the year, changes in monthly rainfall are dramatic, creating marked wet and dry seasons. May through September is the driest part of the year; the wet season runs from October through April.

Princeton University has been conducting biological research at the Cocha Cashu research station in Manu Park for more than ten years. Dr. John Terborgh, director of the Princeton ecological research team, has described the area as one of the richest in floral and faunal diversity and density in lowland South America. In addition to the common presence of tapirs, peccaries, jaguars, deer, large rodents and other typical South American fauna, the park has 13 species of primates (the greatest number in South America), over 500 species of birds, and some of the rarest animals in the world, such as the giant otter.

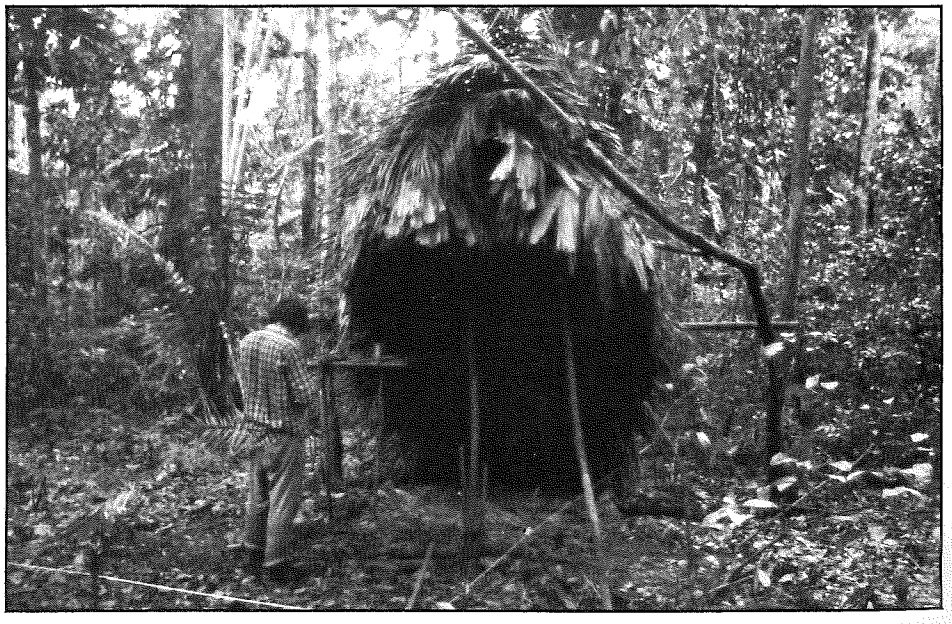
Although the banks of the lower Manu River were sparsely populated by Peruvian frontiersmen earlier in this century, all of these inhabitants left the area during the collapse of the rubber boom, or later when prices of hardwoods fell dramatically. The entire area within the park and reserve has been inhabited only by indigenous populations for the past 10 to 15 years, and only a small handful of scientists and tourists are given permission each year to enter the area. Although it has been known for some time that several uncontacted tribal horticultural groups (Amahuaca, Yaminahua, Machiguenga, and others unidentified) inhabit the park and surrounding areas, rumors of nomadic foraging people only recently came to our attention.

By late 1982 we had enough information, hearsay, and rumor to warrant personal inspection of the situation. In addition, it began to appear as if the people in question were on the verge of making some sort of peaceful contact with local peasants and acculturated indigenous communities, so we felt the situation was urgent.

In the summer of 1983 we received research funds from the L.S.B. Leakey Foundation and the University of Utah Research Committee to do an exploratory survey in southeastern Peru. The four primary research goals were as follows: 1) to determine the cultural, linguistic and demographic affiliation of newly discovered people in Manu National Park; 2) to verify reports that the economic base of this group is indeed full time hunting and gathering; 3) to determine the size and number of closely related groups and their approximate location; and 4) to assess the possibilities for future in-depth research in this area.

Park guards stationed on the Manu River in the mid-1970s had often seen signs of native inhabitants. Both guards and indigenous peoples seemed to avoid all encounters, fearful of the outcome. Nevertheless, on several occasions, the guards sighted three naked women who fled upon encounter. Their tracks were also frequently seen on the beaches of the Manu River during the dry season when turtle eggs were plentiful. Through a series of increasingly friendly encounters, the guards finally made permanent peaceful contact with the women in 1979. The women continued to forage along the banks of the river but moved their camp permanently to a site across the river in front of the Pakitza guard station in late 1979 or early 1980. At Pakitza, they received clothing from the guards and a Catholic priest, as well as frequent handouts of food from the guards and any tourists who happened to pass by. Although we were not absolutely able to confirm their reports, several of the park personnel informed us that the women did not have fire when contacted (the women also corroborated this account).

The three women of Pakitza standing in front of their camp on the Manu River eating cochiklu palm fruit, the major vegetable staple during late dry season.

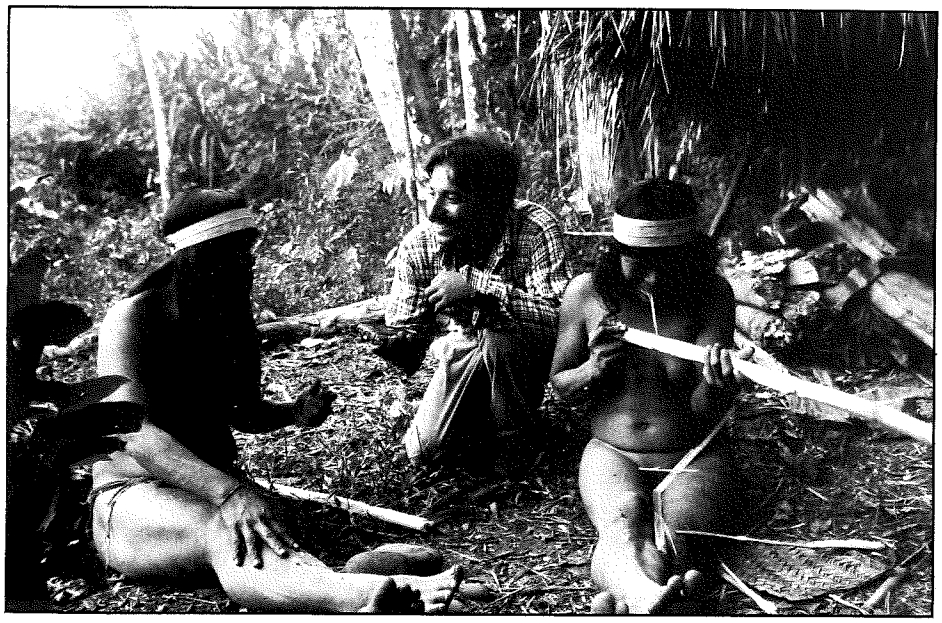


Hillard Kaplan measuring and surface-sampling the recently abandoned Carpio camps. Dense bone scatter indicated heavy reliance on hunting.

The three women are referred to by local Indians as "Mashco-Piro." They call themselves "Mashco" but clearly speak a dialect closely related to Piro. Our translator from the Piro village of Diamante insisted that their speech was very similar to ancestral Piro as it was

spoken by his own mother. Nevertheless, he had great difficulty carrying on extended conversations with the women. In addition, although there were, in fact, Piro settlements on the west bank of the Manu River earlier in this century, metal tools were abundant and all of these groups made peaceful and permanent contact with Peruvians.

Kim Hill inspects recently abandoned Mashco-Piro camp.



Hillard Kaplan tapes an interview with the two younger women of Pakitza.

Therefore, the precise cultural affiliation and historical background of the Mashco-Piro remain a mystery.

The status of the three women is also mysterious. They have been seen alone for eight years and appear to have no contact with other members of their previous group. By their own account, the eldest (approximately 50 years old) is the mother and the two younger women (approximately 28 and 22 years old) are her daughters. They report that their group lived near the headwaters of the Panagua River before they were exiled. Their behavior often appeared to us to be irrational and erratic in comparison with other South American Indian groups we have had the opportunity to observe. Nevertheless, they do provide clues about both the economy and sexual division of labor among the people with whom they originally lived.

By the time we arrived in October, 1983, the women had already collected a large number of items of modern manufacture, although they were unfamiliar with the usage of some. In order to acquire a basic picture of the women's daily activities and diet, we spent 12 days recording detailed data on time allocation and subsistence effort. During this time they left camp on 10 days to do some foraging. They spent relatively little time out of camp, however. The time in camp was spent primarily eating and processing food (about four hours per day), sitting, talking, singing or sleeping. We did observe them to occasionally harvest plantains from the nearby field (planted and cleared by park guards), but they spent no time doing any garden labor despite the fact that the gardens were overgrown with weeds.

The most remarkable feature of the food acquisition pattern we observed is the lack of meat relative to vegetable products (meat calories account for less then 1 percent). Virtually the entire diet was vegetable, consisting of nuts, fruits, larvae, and garden products.

During the period of observation, the three women were unable to acquire any game. Although they did carry a bow and several arrows on most days, they rarely attempted a shot and when they did, the arrow always fell far wide of the mark. They often attempted to hit birds with a throwing stick, but were never successful. Despite this, the women appeared to be quite alert to the presence of game and frequently followed fresh tracks for some distance, but were unable to acquire any of the animals whose presence they had detected. While one could conceivably postulate that the women did not truly desire to eat meat, this appeared not to be the case. When our guide provided fish and game, they ate it ravenously, even consuming rotten and flyblown meat on two occasions.

The question of whether the women had come from a group of full time foragers is somewhat more complicated. Again, they initially claimed that they themselves were presently planting gardens, but after three days of being "unable" to find them, they admitted that no gardens existed.

Experiments and observations led us to conclude that the women had no knowledge of horticultural practices. There was no evidence that they performed any agricultural labor around their camp nor in the garden originally cleared and planted by the park guards. They would have been able to harvest a great deal more from the garden if they weeded it and planted tubers to which they have access through gifts.

We decided to turn our attention to reports of another group of Mashco-Piro some 60 kilometers away on the Alto Madre de Dios River. Our study of the women encouraged us that the larger group that they had come from were probably hunter-gatherers, did not have

any contact with outsiders and continued to use stone axes.

In 1980, two peasant families and Indians from the Piro settlement of Diamante began seeing signs of unknown people on the north bank of the Alto Madre de Dios River, between Diamante and Cruz de Mayo. This area is totally unpopulated except for the two peasant families mentioned (Diamante is on the south side of the river, but men sometimes hunt or fish on the north side). The signs indicated that the people were collecting turtle eggs, wild bananas and bamboo for arrow points along the river coast. Many broken twig trails were found, along with a few very small camps that had been recently abandoned.

During several weeks in the winter of 1983, we did extensive surveys of the forest adjacent to the north bank of the Alto Madre de Dios. We found that there were numerous signs of the Mashco-Piro people in the area over a distance of some 30 kilometers. Although signs of people near the river itself were sparse, a major trail system was encountered running parallel to the river about a two hour walk northward directly into the forest. This trail system was primarily marked by broken off branches and wide foot paths, but occasionally signs of the newly acquired machete were seen. Along the trail system we discovered three camps. One was recent and allowed us to get a good look at an intact Mashco-Piro camp.

Further search revealed no fresher signs of the Mashco-Piro and local inhabitants speculated that they had gone inland to higher ground because the rainy season was beginning to set in. The rainy season also made our searches more difficult as the mosquitoes became ferocious, and we were forced to walk through waist deep swamps in many areas of the forest. Although we could have continued our search deep into the forest in higher country, we felt that such an approach might be unsafe and unwise without prior peaceful contact near the river's edge. As a result, we decided to finish our field session by concentrating on the recent intact living camp that we had found.

This camp was located about one and a half hours walk from the river near the Carpio family farm. It was a clearing in the forest where small trees and undergrowth were cleared by hand or with a stone axe, although there were a few small trees that had been cut by machete. The camp consisted of four huts and an ambiguous area including a fire pit and palm leaves spread on the ground. Each hut was a lean-to, constructed by tying a cross-bar to two upright posts, and then planting long palm leaves in the ground to one side of the cross-bar and leaning up against it at an angle. Long forked poles kept the far ends of the palm leaves from sagging. The huts contained one or two fire pits on the outside edges, and a "smoke rack" above one fire pit of each house. All huts had sleeping leaves (beds) on the ground and cracking stones in the corners. Pieces of broken bamboo (arrow points and water containers) were scattered about, and at the far south end of the camp we found a pile of cut human hair. Discarded carrying baskets and partially rotted palm mats were also evident. Interestingly, there were large piles of firewood which had been cached on the sleeping leaves of each hut. This would seem to indicate that the camp's inhabitants planned to return at some point in the near future.

In order to obtain more precise dietary and settlement data on the people who inhabited this camp, we collected a surface sample of the trash and artifacts it contained. Since we had also collected surface sample data on the women's camp at Pakitza and on the camps of Ache foragers in Paraguay, we hoped that the comparative data would give some insights into settlement patterns, food acquisition strategies, and the sexual division of labor among these people.

Inspection of the food trash found in the camp reveals some very interesting patterns. First, the ratio of faunal to vegetable remains is quite high both in terms of diversity and quantity. The remains of 11 different species of animals were found in the camp whereas five species of nuts were the only vegetable remains found.

The importance of meat becomes even more dramatic when the refuse recorded is translated into caloric figures. According to our data, at least 82 percent and possibly more than 97 percent of the calories consumed in the camp came from game animals.

Visual inspection of the faunal remains and their stage of decay provided some suggestive data on the settlement pattern of the camp's occupants. Differences between bones in terms of their stage of decomposition suggested that the camp was recently occupied for at least one month and had been occupied in previous years as well. The fact that the camp had been occupied previously, that stores of firewood were left in the huts (presumably in anticipation of future occupations), and that there were no current signs of the people when our survey was conducted, might indicate that the area is visited on a seasonal or some other cyclical basis.

The final point of significance concerning the archeology of the Carpio camp was the complete lack of any evidence of domesticated plants or agricultural implements.

Perhaps the most dramatic contrast between the Carpio and women's camps is in the relative contributions of meat and vegetable to the diet.

It is interesting to note that in all the Mashco-Piro campsites we visited, each hut contained a rack for smoking meat. It may be that Mashco-Piro foragers acquire larger game at infrequent intervals and, for that reason, employ storage techniques which enable them to weather periods of time in which no game is found.

Although the Manu region is rich in terms of both primate density and diversity, relatively few remains of primates were found in the Carpio camp sample. This is especially interesting because, during our survey of the area, we encountered primate troops three to five times a day on average. Monkeys represent less than 4 percent of the meat calories in the Carpio camp.

We noticed that our Piro guides do not chase monkeys after the initial encounter is made. Monkeys were shot when encountered low in the trees but were not pursued if they escaped to the upper forest canopy. Our guides reported that the trees in the area were difficult to climb so that arrows were frequently lost when hunting monkeys. We also noted that trees of 30 meters or more in height are common in the Manu region; tall trees may enable monkeys to escape and render extended pursuits unproductive. Our guides also claimed that they only actively hunt monkeys following the wet season when they are fat. The Carpio camp was occupied during the late dry season and that may explain the lack of primate remains found.

While a sample derived from a single occupation site cannot, without further verification, be generalized to provide information about the overall diet of the Mashco-Piro, it does raise a number of very interesting questions about the relationships between ecology, diet, the sexual division of labor and settlement pattern. Further behavioral research with the Mashco-Piro of the Manu region could provide important data for understanding the factors which shape the hunting and gathering way of life.

We are certain that there are people living in the described region, and that they have no contact with outsiders and that they do indeed use stone tools and traditional technology. Whether they are full time foragers is a more difficult question.

The data we were able to obtain concerning the Mashco-Piro economy suggest at least three alternative interpretations. The first is that the Mashco-Piro camps we surveyed represent living sites of a group of tribal horticulturalists who have temporarily abandoned a more permanent village with gardens in order to spend some time "on trek," living off wild forest products. The second possibility is that the Mashco-Piro have an economy similar to that

reported for the Siriono, which is characterized by foraging most of the year and spending only a few months each year at semi-permanent garden sites. The third possible interpretation of the data is that the Mashco-Piro are full time hunter-gatherers, practicing no agriculture at all. All three of these patterns have been reported for other groups in lowland South America.

The most persuasive reason for believing that the Mashco-Piro are trekking horticulturalists is based upon a straightforward probability argument. The vast majority of all lowland South American groups practice some form of horticulture and all known native groups in the Manu region are horticulturalists. Nevertheless, there are groups such as the Ache of Paraguay who were full time hunter-gatherers surrounded on all sides by tribal horticulturalists.

The empirical data gathered in the field all tend to suggest that the Mashco-Piro are full time foragers. Most trekking groups take along and consume some garden products while on trek. The women's lack of knowledge of horticulture, the archeological remains in the camps, and our inability to find any evidence of gardens throughout the area that they inhabit and the fact that no horticultural foods were present, all suggest that the Mashco-Piro are full time foragers.

Whether other bands of Mashco-Piro inhabit the area remains an open question. It is very likely that many uncontacted people live in the region, but we cannot as yet identify them. Similarly, size estimates of the population are impossible because we were unable to acquire reliable information from the only informants (the three women) who were available. Using the range of density values for lowland South America, there may be between about 2,500 and 12,000 people in Manu Park.

The Manu Park area seems to hold great promise for future anthropological research. The Peruvian government has an active policy of preserving the area and its native inhabitants from commercial exploitation. The size of the park along with its isolation renders it highly likely that some human groups will continue using traditional technologies and techniques of subsistence for some time to come. □

The Grant program of the L.S.B. Leakey Foundation, under the guidance of the distinguished Science and Grants Committee, depends upon public support for its success. Every penny of your contribution dollar directly supports the grant awards. Members and donors are invited to designate their gifts in support of specific research projects.

Won't you take this opportunity to direct your contribution to the grant project of your choice?

GRANT SPOTLIGHT

Peter Andrews *$5,000 needed*

EXCAVATION OF MIDDLE MIOCENE DEPOSITS AT PASALAR, TURKEY

This excavation will be done in cooperation with specialists from the University of Ankara. Earlier work indicated that the locality is rich in hominoid fossils.

James J. Moore *$2,870 needed*

SAVANNA CHIMPANZEE SURVEY IN MALI

The purpose of this research is to investigate adaptation to the savanna environment in hominid evolution. Most of the previous studies of chimpanzees have been of forest dwelling groups. Would studies of savanna chimps give a more accurate comparison with early humans? This project is expected to provide important new information about primate adaptation to arid regions.

David P. Watts *$1,500 needed*

ECOLOGY OF THE MOUNTAIN GORILLA SOCIAL SYSTEM

These funds will continue research of the mountain gorillas at Karisoke in Rwanda begun in 1983, including the collection of data concerning habitat use pattern, feeding ecology and intergroup relations.

Anne Vincent *$3,000 needed*

AN ASSESSMENT OF THE CONTRIBUTION OF TUBEROUS PLANTS IN THE EVOLUTION OF HUMAN DIET

Ms. Vincent is asking for additional funding to continue her research in Tanzania and Botswana, exploring certain aspects of how early hominids may have learned about and used tuberous plants. The work involves sampling vegetation to determine the ecological distribution and seasonal abundance of tuberous plants.

Philip L. Gibbard *$450 needed*

MIDDLE THAMES TERRACE PALEOLITHIC SURVEY

As a result of the remeasurement of the terraces of the Thames for recent highway development, geological deposits of famous Acheulian and Clactonian sites have been redated. A small amount of additional field work is required.

H. Stephen Green *$1,500 needed*

THE EARLIEST HUMAN SETTLEMENT IN WALES

Funds are requested to continue field research and for post-excavation analysis at Pontnewydd Cave where *in situ* living floors are expected to yield hominid remains and artifacts dating to approximately 250,000 years ago. Investigation will also be made of a Middle Paleolithic site at Coygan Cave and the Late Upper Paleolithic cave, Little Hoyle. Please see back page for notice of this grantee's book dealing with his earlier research.

Richard Wrangham *$1,020 needed*

PILOT STUDY OF CHIMPANZEES IN THE KIBALE FOREST, UGANDA

Dr. Wrangham will make a preliminary visit to Uganda to determine the feasibility of making an in-depth study of chimpanzee ecology. He will work with a Ugandan researcher, Isabirye-Basuta, in organizing a system of data recording for the long-term study which can be used by any researcher.

Nicholas Toth *$3,000 needed*

TAPHONOMIC EXCAVATIONS AT A MIOCENE SITE IN SAN BERNARDINO COUNTY, CALIFORNIA

This project is designed to assess whether any of the criteria used to infer hominid modification of animal bone may be found in non-human contexts. Samples of bone remains from a well-preserved California Miocene locality will be studied.

Fredrick Edward Grine *$5,000 needed*

PERMANENT DENTAL MICROWEAR OF SOUTH AFRICAN EARLY HOMINIDS

Dietary considerations are central to the construction of models of early hominid evolution, adaptation and ecology. Previous research indicates that a clear difference existed between the occlusal wear patterns of "gracile" and "robust" forms of *Australopithecus*. The goal of this present research is to test earlier hypotheses on a much larger sample. Epoxy replicas of the permanent teeth of South African early hominids will be analyzed by scanning electron microscopy.

Yusuf McDadly Juwayeyi *$2,000 needed*

LITHIC TECHNOLOGY AND SUBSISTENCE STRATEGIES DURING THE HOLOCENE IN MALAWI

Funds are requested for site survey, excavation, site catchment and artifactual analyses related to the Late Stone Age in Malawi.

Peter J. Sheppard *$500 needed*

STUDY OF THE MIDDLE STONE AGE LITHIC ARTIFACTS FROM KALAMBO FALLS

Dr. Sheppard will prepare a systematic description of artifacts from Kalambo Falls, Zambia, including typology, technology, and raw materials.

Francis Van Noten *$4,500 needed*

THE KAPTHURIAN PROJECT

This application is for funding of three students doing research at the Kapthurian Formation, Kenya. Francis Van Noten is the principal investigator. The three students are:

Elisabeth Cornelissen, who is excavating at Acheulian sites in the Formation and studying the accumulating artifact assemblage housed in Nairobi;

Hilde Uytterschaut, who is studying the primitive Kapthurian hominids; and

Joseph Gysels, who is excavating at Kapthurian to research early hominid living sites and the possibility of the use of fire.

Cornelia Wolf *$3,000 needed*

COMPARATIVE ANALYSIS OF MIDDLE, UPPER AND EPI-PALEOLITHIC FAUNAS IN THE LEVANT

This project will test the long-held view that the transition from the Mousterian to Upper Paleolithic represents a marked change in human adaptive patterns. Faunal remains from archeological sites can provide important information about the behavior and ecology of early peoples.

Katherine Milton *$3,000 needed*

DIGESTIVE EFFICIENCIES AND FOOD PASSAGE OF THE COMMON CHIMPANZEE

This research will quantify the degree of efficiency of the common chimpanzee in digesting meat and dietary fiber. Such data will help clarify modifications in the hominid gut as the move to a more omnivorous dietary niche took place. The abilities of the common chimpanzee to bite off, chew and digest pieces of raw meat will be assessed in four controlled trial diets offered to seven chimps at the Yerkes Primate Center in Atlanta.

Amini Aza Mturi *$1,000 needed*

LAKE NATRON ARCHEOLOGICAL RESEARCH PROJECT

This grant is for ongoing interdisciplinary research at two recently discovered Acheulian sites near Lake Natron, Tanzania.

J.W.K. Harris *$2,920 needed*

EXPLORATORY ARCHEOLOGICAL FIELD STUDIES, SEMLIKI AREA, WESTERN RIFT VALLEY, ZAIRE

Dr. Harris plans to conduct exploratory test excavations of Plio-Pleistocene deposits. Oldowan-like artifacts dating to this time have been found in previous excavations. The goal of the present research is to recover cultural materials with fine scale microstratigraphic documentation.

Nicola Stern *$1,600 needed*

MICROSTRATIGRAPHIC CONTEXT AND CHRONOLOGICAL RESOLUTION OF ARCHEOLOGICAL–PALEONTOLOGICAL OCCURRENCES IN NORTHERN MALAWI

This research will initiate a pilot dissertation study to explore the extent to which the spatial and temporal location of sites can be determined in the sedimentary record. □

BERKELEY CONFERENCE

UC Extension in Berkeley is presenting an anthropology conference, SCIENCE AND HUMAN EVOLUTION, on October 13, 1984. Sherwood Washburn is the conference director and its faculty will include Phyllis Dolhinow, Katharine Milton, Vincent Sarich and Tim White. The program is designed to educate the general public on anthropology's contribution to a better understanding of human evolution and to stimulate interest in and appreciation for that contribution. □

MY WORK

The joy of finding
Is plentiful in my work:
The joy of knowing,
The joy of being the first.
My work is interesting,
My work is involving,
Working from dawn 'till dusk,
And yearning to work more.
The hominids breaking the barriers
Of time with their footprints.
Each footprint is walking us
Farther back in time,
Each bone turning another page
Of a never ending book.
Learning –
That's the joy of my work.

Annie Beles (age 11)

This poem was inspired by a class called "Mary Leakey's Footprints," part of the Wildlife School program at the Oakland, California, Zoo. This sixth grade student has imagined how Dr. Leakey must feel about her work.

BOOKS

THE ROCK PAINTINGS OF TANZANIA by Mary Leakey. Doubleday, New York, 1983. 128 pp. $50.

Drs. Mary and Louis Leakey first saw the prehistoric art of Tanzania nearly fifty years ago. She later made meticulous tracings of some 1,600 of the paintings on the sheltered surfaces of cliffs and rock faces. In this book, profusely illustrated with many color plates and photographs, Mary Leakey speaks of what these long-ago works of art tell us of Stone Age man and his life, and of her worries for the future of these unique paintings.

CONFORMITY AND CONFLICT: Readings in Cultural Anthropology, edited by James P. Spradley and David W. McCurdy. Little, Brown and Co., Boston, 1984. 390 pp. Paperback. $11.95.

This is the revamped fifth edition of a book first published 14 years ago, with the addition of 16 new articles. The coverage of non-Western and Western cultures is balanced. Most of the new articles deal with language and communication, sex roles, cultural ecology, economic systems, and religion, magic and world view.

THE MAKING OF A CONTINENT by Ron Redfern. Times Books, New York, 1984. $27.95.

This book begins the story of the forming of North America in Iceland where the North Atlantic Ridge separates the North American and Eurasian Plates. Each subsequent chapter describes various types of terrain in order to illustrate how the separate parts have formed the whole landmass.

Beautifully illustrated with many fine photographs.

L.S.B. LEAKEY FOUNDATION AND SOCIETY MEMBERSHIP COUPON

MEMBERS RECEIVE:

**Invitations to special MEMBERS ONLY EVENTS.*
**CHOICES OF PREMIUMS for many categories of membership and a 10% DISCOUNT on books and tapes.*
**Advance announcements of all symposia & lecture programs & AnthroQuest, the Leakey News.*

SEND A GIFT MEMBERSHIP TO:

_____

_____

_____ ZIP_____

PLEASE DESIGNATE MY GIFT TO SUPPORT:

_____

Research Project Title or Scientist.

MEMBERSHIP CATEGORIES		ALL MEMBERSHIPS ARE TAX DEDUCTIBLE
Active Member	**$ 15.00**	
Contributing Member	**$ 25.00**	*Human Evolution Coloring Book*, A. Zihlman; OR, Foundation Notepad
Supporting Member	**$ 50.00**	*Lucy*, D. Johanson; AND Foundation Notepad
Sponsor	**$ 100.00**	*By the Evidence*, L. Leakey; AND Foundation Notepad
Patron	**$ 250.00**	*Missing Links*, J. Reader: AND Foundation Notepad
Annual Fellow	**$ 500.00**	*Maasai*, C. Beckwith & O. Saitoti; AND Foundation Totebag
Research Grant Benefactor	**$ 5,000.00**	*Vanishing Africa*, M. Ricciardi; AND Foundation Totebag

NEW MEMBER ( ) RENEWAL ( )
PREMIUM CHOSEN: book ( ) tote ( ) send no premium ( )

Every penny of your tax-deductible membership dollars supports LEAKEY FOUNDATION GRANTS to international scientific research programs.

PLEASE ENROLL ME AS A _____ MEMBER. I enclose my check for $ _____

Charge to my ( ) Mastercharge or ( ) Visa Number _____

Authorized signature _____ expiration date _____

NAME _____

ADDRESS _____ PHONE _____

CITY _____ STATE _____ ZIP _____

Please make checks payable to the L.S.B. LEAKEY FOUNDATION, Foundation Center 1 - 7, Pasadena, California 91125. **N29**

PONTNEWYDD CAVE by H. Stephen Green. National Museum of Wales, Cardiff, 1984. 217 pp. $40.

This splendid book reports on Dr. Stephen Green's archeological work from 1978 to 1983 at the earliest recorded humanly occupied site in Wales, a Lower Paleolithic settlement near the north coast. This cave has yielded not only the tools made by hunters at least 230,000 years ago, but also remains of the hunters themselves.

The research was partially funded by the L.S.B. Leakey Foundation, which will continue to support Dr. Green's ongoing Welsh projects (see page 17). The Foundation also congratulates him on this admirable "first report."

The book is profusely illustrated by graphs, maps, drawings and black-and-white photographs.

ASCENT TO CIVILIZATION by John Gowlett. Knopf, 1984. 208 pp. Paperback.

John Gowlett, director of the Oxford University Radiocarbon Accelerator Unit, focuses on the revolution of human culture from the time of the australopithecines three million years ago to the invention of the written word and the wheel. He discusses at length the procedures used to acquire knowledge of the cultural past. He offers abstracts of the principal positions on such controversial subjects as the beginning of the use of tools and fire, making a straightforward case for those he prefers. The book includes many photos, paintings and charts.

THE AZTECS by Brian M. Fagan. W. H. Freeman and Co., New York, 1984. 360 pp. Cloth, $27.95, paperback, $14.95.

Brian Fagan, an archeological writer and teacher, here presents for the layman an account of the highly organized Aztec Indian society from its startling rise to its tragic destruction. He has drawn from history, anthropology and archeology to construct a history of early life in Mexico. Illustrated.

FOSSILS AND THE HISTORY OF LIFE by George Gaylord Simpson. Scientific American Books, Inc., New York, 1983. 218 pp.

The highly respected paleontologist George Gaylord Simpson shows how evolution has brought about enormous numbers of different kinds of organisms, past and present. He uses the study of the earth's fossils, combining historical geology and historical biology, to tell the story of organic evolution. Many photographs, drawings and graphs.

ROCK ART OF THE JEBEL UWEINAT by Francis Van Noten. Graz, Austria, 1978.

Dr. Van Noten, of the Musée Royal de l'Afrique Centrale in Tervuren, Belgium, presents the pictographs he discovered in the Uweinat Mountains of the Libyan Sahara. A handsome book, it should interest both the expert and the layman who want to learn about prehistoric art. There are 244 figures, including black and white and color photographs and engravings.

Dr. Van Noten is a grantee of the Leakey Foundation.

NEW INTERPRETATIONS OF APE AND HUMAN ANCESTRY, edited by Russell L. Ciochon and Robert S. Corruccini. Plenum, New York, 1983. 843 pp. $95.

A synthesis of the latest facts, theories and opinions concerning the origin of the human lineage and its evolutionary relationship to the African and Asian great apes and the hominoids of the Miocene. Many major researchers in the field of paleoanthropology have contributed to this volume, providing a broad approach to the analysis of ape and human ancestry. □

CALENDAR

Monday, September 10, 1984
Allen O'Brien Memorial Lecture
"DART, TAUNG AND THE 'MISSING LINK': SIXTY YEARS AFTER,"
by Dr. Phillip Tobias
The California Academy of Sciences, San Francisco. 7:30 p.m.

Saturday, January 26, 1985
Members' Symposium,
"HUNTER-GATHERERS IN THE NEW WORLD: IMPLICATIONS FOR UNDERSTANDING HUMAN EVOLUTION"
Southwest Museum, Los Angeles

Only members will receive invitations to this day-long symposium co-sponsored by the Leakey Foundation and the Southwest Museum. If you are not a member and wish to attend, please join us now. Detailed information on the symposium will be available later. □

ANTHROQUEST
news of human origins, behavior, and survival

foundation center 1-7, pasadena, ca 91125

address correction requested

NONPROFIT ORG.
U.S. POSTAGE PAID
PASADENA, CA
PERMIT NO. 712