

THE L.S.B. LEAKEY FOUNDATION NEWS

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OUR ROOTS IN TIME SIGNIFICANT NEW HOMINID DISCOVERIES

by J. DESMOND CLARK

Department of Anthropology, University of California, Berkeley

In the fall of 1981, an international, interdisciplinary team of scientists went to Ethiopia to explore the Middle Awash area. The results of the expedition show the study locally to be one of the most important in Africa for assessing floral and faunal evolution during the last six million years. The discoveries there will throw fresh light on human origins.

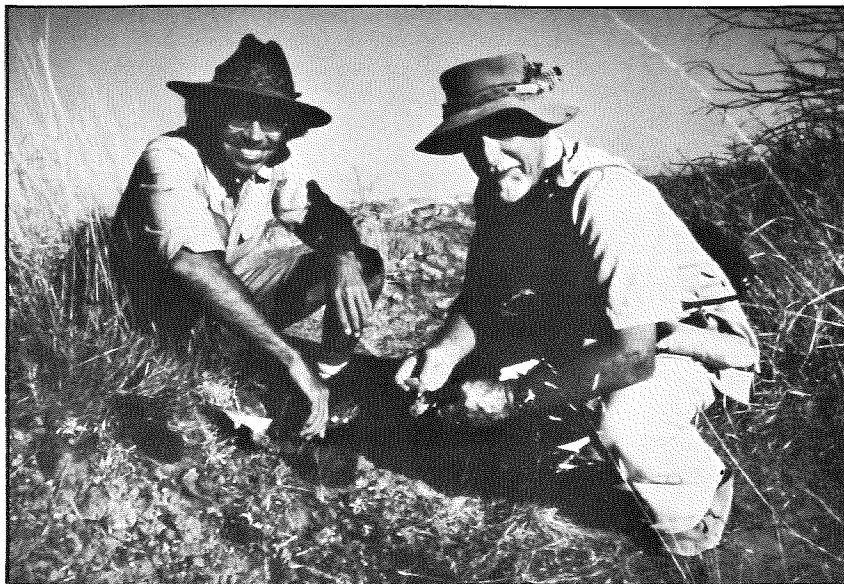
The Middle Awash Study Area, through which the Awash River flows from north to south, is extensive — some 80 km. by 40 km.

It lies approximately 45 km. to the south of Hadar. The Afar Rift Valley, in which the Awash and Hadar are situated, may very probably hold the key to the nature of our earliest hominid ancestors, to their behavior and capabilities, and perhaps also to what it was that turned a quadrupedal ape into a bipedal hominid.

The 1981 team members were from the University of California at Berkeley and the University of Addis Ababa in Ethiopia, together with other experts from Japan, Australia, Canada and New Zealand. These scientists had already had long experience in Africa and in particular on Plio-Pleistocene sites in the Rift and adjacent parts of the plateau.

Don Johanson's and Maurice Taieb's earlier finds at Hadar and those of Mary Leakey and Tim White at Laetoli have shown, as never before, the anatomy of the small-brained, small-statured, bipedal hominid, best exemplified by the skeleton of a single individual, the famous "Lucy", that was living in and adjacent to the Rift Valley some 3.5 to 3.7 million years ago. In 1981, two more hominid fossils were discovered, providing new and highly significant evidence on human origins.

Dr. Tim White, paleontologist from Berkeley, discovered part of a femur (thighbone) that belonged to an individual estimated to have stood about 4.5 feet (1.4 meters) tall. The fossil was found in the Maka area about six meters above a volcanic marker horizon called the Cindery Tuff. This footprint-bearing tuff has been provisionally dated by Dr. Bob Walter and his colleagues at the Geophysical Laboratory in Toronto to ca. 4.0 (± 0.1) million years, an age consistent with estimates made from the fossil fauna found associated with the femur.



Dr. Tim White and Dr. Desmond Clark at the Maka femur site.

The second early hominid discovery came from twelve meters below the Cindery Tuff. This fossil, found by Dr. L. Krishtalka of the Carnegie Museum, Pittsburgh, represents a previously unknown part (the frontal bone) of the earliest hominid skull. It is the oldest diagnostic hominid skull fragment known, twice as old as the Leakeys' most famous finds at Koobi Fora in Kenya and Olduvai Gorge in Tanzania.

Tim White has studied the new hominid fossils. The femur is from a creature who, like Lucy, was fully adapted to bipedal posture and locomotion at

this early time period. Internal and external anatomy of the leg bone is fundamentally different from that of a quadrupedal ape such as the chimpanzee or gorilla. The cranial fragment is, however, extremely primitive in its size and appearance. Although adult, the fossil skull bone is actually slightly smaller than the average size of the same bone in the chimpanzee.

The new fossils have also been examined by Drs. D.C. Johanson of the Institute of Human Origins in Berkeley and C.O. Lovejoy of Kent State University. These scientists, experts on the fossils from photo: J.W.K. Harris

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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.

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Gayle Gittins

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the L.S.B. leakey foundation news

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PRESIDENT'S MEMO

This is a memo of hello and goodbye.

Hello to Gayle Gittins as our new executive director. Already, she has demonstrated a dynamic grasp of the Foundation's business and an infectious enthusiasm that will be reaching out to cities where the Foundation has always had two or three fellows and friends, but so far not the basis for a strong chapter. Many of you, as supporters of the Foundation, will be meeting its executive director in the coming year.

There isn't room to list Gayle's many accomplishments as head of the Junior League in Salt Lake City, as radio writer, fundraiser, and as a field researcher with other scientists, including Louis and Mary Leakey in Tanzania.

I first heard of her resourcefulness from an English friend, who observed her at a hominid dig at Swanscombe. Gayle produced the final dinner for colleagues and workers. She couldn't clone a charity ball she had recently put on, so she announced a "weiner roast." It poured all day but she scrounged bed springs to put over a fire, some English sausages to barbecue, and some hot French mustard.

Our new deputy director was also selected by our hardworking trustee committee of Kaye Jamison, Gay Bradley, Ed Harrison, and Bob Beck, from the hundred or so applicants (53 with Ph.D.'s) across the United States. Deborah Spies is intelligent, poised, pleasant, and persevering. How else could you be Phi Beta Kappa at the University of California, Irvine, and an extremely well-liked program coordinator of the Caltech Alumni Association? While coxing the Irvine crew at a Newport Beach regatta, Ms. Spies was invited to cox a crew of intercollegiate coaches, many of them former Olympians. The "geritol crew" not only won without practice, but they all had a hand at the victory ceremony in tossing Cox Debby into the briny in front of the CBS camera. If both our new professionals are "pluvial" behind the ears, they have also had divers experiences!

In doubling our executive talent, we will be more active on the national level. In this respect, we are pleased to say hello to the large number of new members of the Leakey Society who have joined as part of our test mailing to those we identified from a broader group as possibly sharing our goals.

At the same time, we say goodbye to Mary Pechanec, who served the Foundation loyally and devotedly for twelve years of growth and success. Our hardest working trustee, Joan Travis, has also resigned. Joan has produced more than a thousand Leakey Lectures and given of her time and purse beyond my ability to praise. Louis Leakey had a great affection for Joan Travis and she more than justified his confidence. Fortunately, her capable assistant, Cathy Titus, was well trained in Joan's home office and has taken up the reins.

We are a little crowded now with additional professional staff, until we move into our new headquarters on the Caltech campus. But whether your interest is in lectures, symposia, the *News*, or the critically important financial support of scientists, you will find the new Leakey team fully prepared to serve you and to assist the trustees in carrying out the purposes of the Foundation.

Ned Munger

EXECUTIVE DIRECTOR'S MESSAGE

I should like to thank the Board of Trustees of the L.S.B. Leakey Foundation for my appointment as its executive director. I am finding the work challenging and fascinating. From my contacts with officers, trustees, members and staff, I am certain I shall enjoy working with every one of you.

Just a word about the Foundation. This is a time of reevaluation and dramatic change for most foundations, large and small. To cite one example, the Edna McConnell Clark Foundation, a sizeable organization with a 200 million dollar budget, states in its latest annual report:

"Foundations are in disarray. Look at some of the better-known foundations, not all of them in New York. They're either endlessly reassessing their directions or endlessly trying to find their first ones. Either way they're rather silent on the issues of the day."

By comparison with that gloomy description, I am pleased to note that our Foundation is in excellent shape. We shall reassess, but not endlessly. We know our overall directions very well, and our purposes deal with issues that are at the very core of the timeless concerns of humankind. Our origins, behavior and survival have been of central importance to our species over the millennia, and will continue to be for as long as we exist.

I believe that when we look back on this phase of the Foundation's history, we will see it as a period of timely reevaluation and of healthy growth. I intend to devote all my energies toward bringing this about, and with the help of all of you — we cannot fail.

Gayle Gittins

FOUNDATION UPDATE: BIGGER & BETTER



Gayle Gittins and Deborah Spies.

The L.S.B. Leakey Foundation is nearly fifteen years old and the time seems ripe for a reappraisal. We feel that congratulations are in order; the Foundation is bigger and better from all standpoints.

Faced with drastically fewer funds from the public sector, science now turns more than ever to foundations such as ours for help. The Leakey Foundation has risen immediately and successfully to the challenge. We will be able to meet our primary goal of granting funds to more scientists than ever.

First, through the generosity of our trustees, a Million Dollar Challenge Fund has been established. These monies will gradually be matched by individual and corporate contributions. Thus, the continuation of important field studies and critical research in human origins, behavior and the environmental future will be assured, even though the costs of such vital work have risen greatly.

To broaden the base of our membership, a new program, the L.S.B. Leakey Society, has been created. Appealing to a much larger community of those interested in the Foundation's work, its dues are moderate. Please see the coupon on page 19. Those joining become a part of the growing team of men and women throughout the nation who make possible the great search into humanity's lost childhood and the study of our primate relatives. They share in the challenge and the discovery that are intrinsic to the efforts of the Foundation.

The office staff has been reorganized this summer to better expedite and administer the widening program. Our new executive director, Mrs. Gayle Gittins, has impressive qualifications. She received her M.A. in anthropology from Columbia University after graduate work in archeology

at the University of Utah and Oxford University. This year she is a doctoral candidate at the University of California, Los Angeles, in interdisciplinary archeology. Having completed all other requirements, she is finishing her dissertation entitled *Radiocarbon Chronometry and Archeological Thought*, the project for which she was recruited to UCLA from Columbia by the late Willard F. Libby, Nobel Laureate and inventor of the radiocarbon dating method. Mrs. Gittins' field work includes excavations at Fort Ternan, Kenya, and individual studies in typology of East African stone tool assemblages and sorting of lithic artifacts at the Center of Prehistory and Paleontology in Nairobi. All this work was supervised by Louis S.B. Leakey.

The Foundation's new deputy executive director also has a remarkable record. Not so long ago, Deborah Spies graduated *cum laude* from the University of California, Irvine, where she was elected to Phi Beta Kappa. Since then she has been program coordinator and sometimes acting executive director of the Alumni Association of the California Institute of Technology.

The Foundation feels very fortunate to have found such outstanding administrative leadership in Mrs. Gittins and Ms. Spies. They will aid greatly in a rededication to our efforts. We are also grateful that during the transition period the current staff — Marianne Boroditsky, Gail Chase, Kathy Galvin and Cathy Titus — have as usual worked hard and well to ensure continuity.

Finally, because our old office space is a great deal less than adequate for a larger staff and the files and accouterment of past and present projects, the Foundation will be moving its expanded entity into expanded quarters nearby this fall.

We look forward to a most productive future. Please stay with us. □

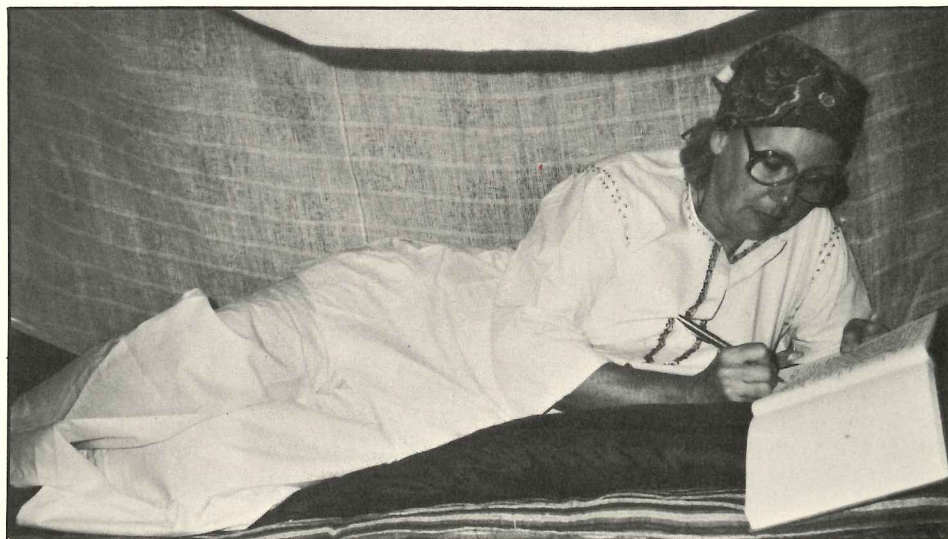
ROUGHING IT - LIFE ON A DIG

FRANCES MUIR is a trustee of the Leakey Foundation. The following notes are excerpts from her journal, written at an Indian dig.

During the first three months of this year I was in India as a member of a team from the University of California, Berkeley, working under the direction of Dr. J. Desmond Clark. We were excavating an Upper Paleolithic site of probably 10-15,000 years B.P. near Allahabad in the state of Uttar Pradesh.

January 2, 1982

My second day in India — I slept most of the first. We took a car here in New Delhi and drove to Agra to see the Taj Mahal. This was a day I shall never forget. It was my first exposure to the smell of millions of cow dung fires that hangs heavy in the early morning and evening hours. My burning eyes and aching head convince me



Fran Muir writing in her journal.



Dr. Desmond Clark.

that, in comparison, Los Angeles air is like a canyon breeze. The drive was spectacular. This was the India I've always heard about but never really believed existed. We fought for space on the road with pedestrians, bicycles, motorcycles, horses, camels, pigs, chickens, carts, oxen, cows, trucks, wagons and a dancing bear. I can now repeat the story of the Russian traffic experts with more conviction. It seems that the Indian government requested that a team of Russians be brought in to study the monumental traffic problems. They spent three days at one intersection in New Delhi. Their official report consisted of only one sentence: "Now we believe in God."

January 11

"There is only one India," wrote Mark Twain eighty years ago. "The one land that all men desire to see, and having seen once, by even a glimpse, would not give that glimpse for the shows of all the rest of the globe combined." But there is too much of everything for a Western mind. The sub-continent of India is about the size of Europe. The population is around 700,000,000 — that is, greater than the masses of all Africa, South America and Australia combined, and it increases by nearly a million people every four weeks. It is the world's largest democracy. One sixth of the world's population is here and one third of the animal population.

January 14

I am now in Allahabad with a team from the University of California headed by Professor J. Desmond Clark. We are joining with a team from the University of Allahabad headed by Professor G.R. Sharma and are now working at the University Museum, analyzing tools and getting our material ready to take into the field. Allahabad is located in the state of Uttar

Pradesh, which is smaller in size than Great Britain and has 20,000,000 more inhabitants.

January 16

Arrived in camp today, in the Son Valley in Madhya Pradesh. Lower, Middle and Upper Paleolithic sites have been located in this valley. The dig turns out to be a "luxury dig". The tent is a double one with an outside insulating cover and the inside ornate in the extreme with a floral pattern and fringe trim around the edges. It boasts its own covered patio, a mat on the floor and cots for the archeologists. Light comes from kerosene lamps. There is a fine "loo" with a seat, which apparently puts the seal of luxury on the appointments. We also have tubs for bathing and hot water.

January 19

Now I know what the British saw in India. I have so many people waiting on my hand and foot that I shall never be able to adjust to the "real world" again. Someone is always following me with a chair in case I want to sit, tea appears every time I do sit, my tent is swept, the dirt in front of my tent is swept, my laundry is done in a nearby stream and pounded on the rocks so that it comes back spotless and folded besides.

January 20

Walking in the hot Indian sun to and from the site will either toughen me or kill me. Dirt archeology is *hard* and not glamorous. After you eat dirt all day you really wonder why you're out there. But joy of joys, I uncovered my first stone tool today — maybe it's worth it.

January 30

Two of the students from Berkeley are down with dysentery. I'm sure my time will come. Oh well, I'll take one day at a time. They resurfaced our eating area with

cow dung and mud. I shall not think about it.

February 5

Two days ago I was caught at the site in a heavy rain. The clay here becomes so slippery that the usual narrow path is not passable. One of the Indian workers walked all the way back with me, breaking trail through bushes and weeds, all with his bare feet. One does feel like such an idiot at times.

February 8

While walking back from the site today, I had two lessons in ethnoarcheology. First I watched a man make clay roof tiles. Then, as Desmond and I crossed the river, we saw two women bathing. Each had left a bundle of wood on the bank. Desmond tried to pick up one of the bundles and looked so shocked that I also tried to lift it. I couldn't get it more than an inch or two off the ground, yet this is what the women carry around on their heads. We asked if these women were really the ones who had carried this wood. One frail little woman laughed and nodded "yes". At construction sites I have seen women with dirt pans on their heads. They walk back and forth loading and dumping, all dressed in beautifully colored saris and looking as though they were going to a garden party. I am simply staggered at the weight these small-structured people can handle and the miles they must carry everything. Just existing is a full time job in India and a back-breaking one.

February 14

Wives of the leaders of a nearby village came to call on us today. They were curious as they had never seen a foreign woman. Most of them were married in their early teens to men they had never seen. They left their villages to live with their husbands' families where they are literally slaves to their mothers-in-law.

February 18

The local workmen are now used to the sight of me digging in the dirt and don't stare quite so often. Actually we have all become friends. It started raining today and ten of the workmen grabbed a plastic sheet and held it over my head so I could continue excavating. I am the only woman at this site with about twenty-five men. I never had it so good.

March 3

The excavation is complete. We are now busy plotting each square and the artifacts are being washed *in situ* with cotton swabs in preparation for photographing. We examined every bit of dirt from every grid, tri-sieving it all after breaking up any lumps. Everything was examined, positions drawn in and photographed. The site itself was photographed from the top of a ladder held upright by our Indian helpers. Our next step is to lift the material and take it into the museum in Allahabad. After all this work the completed site looks very beautiful to me. I have discovered I really like dirt archeology! □

THE PLOT THICKENS:

Fifty Years of Studies on Human Evolution

by SHERWOOD WASHBURN
PROFESSOR EMERITUS OF ANTHROPOLOGY
University of California, Berkeley

There has been remarkable progress in the study of human evolution over the last few years. As has often been the case where there have been a number of changes in a variety of closely related fields, people forget how much change there has been. What I want to do, briefly, is to sketch how things were a few years ago and how things are today, and then show they are very much better today so far as our understanding of human evolution is concerned.

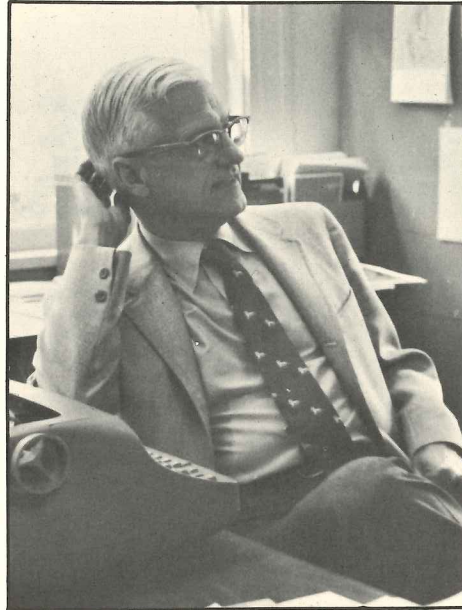
We have seen major changes in concepts of space, of time, and of the fossil record. There have been major changes in the study of evolution itself. The synthetic theory of evolution seemed to have won complete control of the field, to be as close to a proven fact as one is likely to get in science, and yet Theodosius Dobzhansky and co-writers four years ago pointed out that the classical theory was clearly invalid. In other words, major change was necessary in the basic theory of evolution itself.

The developments I will be discussing are not minor. It takes substantial change in the study of evolution to accommodate such advances, and it will take substantial change in the way our students are educated before they can take full advantage of the possibilities now being offered to them. Probably the most fundamental mistake in the history of evolution, particularly human evolution, was the belief that anatomy, embryology, and similar Nineteenth Century subjects were the powerful sciences that would settle the problem of evolution. I think it is now clear that molecular biology has assumed the role

“... between man’s supposed closest relatives and early human fossils, there was only the imagination of Nineteenth Century scientists.”

that anatomy used to have. Many of the questions that could not be answered by anatomy are most likely to be answered by molecular biology.

The early theories of human evolution are really very odd, if one stops to look at them. David Pilbeam has described the early theories as “fossil-free.” That is, here were theories about human evolution that one would think would require some fossil



Dr. Sherwood Washburn.

evidence, but in fact there were either so few fossils that they exerted no influence on the theory, or there were no fossils at all. So between man’s supposed closest relatives and early human fossils, there was only the imagination of Nineteenth Century scientists. For example, the scientists could not decide whether the original Neanderthal skeleton was a genuine fossil or a pathological specimen. Major scientists were on both sides of this debate, and it was not until a number of skeletons were found many years later that it was pretty well accepted that the Neanderthals formed a race of humans that lived in Europe before modern humans occupied that area.

The fossils of the 1920s were an odd lot. They included not only genuine specimens accepted by major scientists, but mistakes, fragments, fakes, and gross mis-constructions. If the early studies had been fossil-free, they were followed by studies that were nonsense-rich. The most careful scientists could not tell whether the fossils were genuine and well enough preserved to be useful or were simply misleading. The nonsense-rich era produced futile, often acrimonious debate. As Paul MacLean has observed, the emotional cerebration of the primitive brain has the same characteristic whether it is a question of science or of politics, the capacity to stand on both sides of any question.

These general problems may be illustrated by the famous Piltdown man. To Franz Weidenreich, Piltdown was a chimera, and this was the word he used. Notice that he took a word full of mythological implications; he didn’t simply say these bones don’t go together, he said this was a chimera. To Arthur Keith and Hooton, my teacher, Piltdown was the center of human evolution. To Elliot Smith, Piltdown was what we should have expected because he had a large braincase and a primitive face, which accorded with one of the fossil-free views of evolution. So the fossil-free era produced two major classes of theory. One was that the brain came first in human evolution and that the apes that came down through the trees were the intelligent apes. The other class of evolutionary theory held that locomotion came first and the brain long afterward, and that it was the material consequences of superior locomotion which laid the background for the evolution of the brain, for technology, and ultimately for civilization.

Piltdown was discovered over quite a long period of time: 1912 to 1914. What we now know, of course, is that the bones were put in the ground over a long period of time, but at this time the age of the earth was supposed to be only forty

“If the early studies had been fossil-free, they were followed by studies that were nonsense-rich.”

million years. This allowed three million years for the age in which the mammals have been dominant. Now suppose you are an Elliot Smith or an Arthur Keith, and you believe the brain came first. You believe there is a braincase like ours; what do you do with the rest of the three million years? It is quite impossible to make a rational arrangement of the fossils known at that time. But because the fossil record as then constructed included fakes, mistakes, and a lot of other things that were removed later on, it was very easy for people to say Piltdown was reasonable, and a great many people said that. It fitted in with the times. Lord Kelvin pointed out that it was impossible for evolution to have taken place in the time he allotted for the age of the earth, and it is said that his

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FIELD REPORTS

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

BELGIAN AND ETHIOPIAN STONE TOOLS

*Carole Sussman
Franklin Mosher Baldwin Fellow
University of California, Berkeley*

I was fortunate to spend the first ten days of my work session in Belgium assisting Dr. Daniel Cahen in the excavation of La Pierre Celtique, a small rock shelter located in the woods of Arlon. La Pierre Celtique is unique in that it is the only site known in Belgium to have evidence of occupation from the Mesolithic into medieval times. While I enjoyed learning new excavation techniques, I cursed the mud and the rain that continually found its way down the back of my neck. Although excavation time was severely limited, the site proved extremely fruitful and plans to continue excavation next year (under a permanent shelter) are in progress.

Amateur archeologists are plentiful in Belgium and the ones that I met welcomed me warmly into their homes, eagerly spreading out their surface collections of Mesolithic and Neolithic artifacts. Though they spoke no English and I speak very little French, our common interest in stone tools and archeology quickly bridged the gap and animated discussions (aided by extensive pantomime) ensued.

The next three weeks were spent at the museum in Tervuren working with Dr. Cahen. I began to study microwear analysis with Jo Guysels who has worked closely with Dr. Larry Keeley, the pioneer in the study of microwear. Together we spent hours peering through the microscope, conducting various experiments and comparing our results with archeological specimens from the Upper Paleolithic site of Verberie in France.

With this brief introduction to microwear and polish I was eager to continue experimentation and replication in the field in Ethiopia. In the Middle Awash region we found the vast majority of Acheulean artifacts to have been made of basalt. As no one, to my knowledge, has examined basalt for traces of use wear and polish, I set out a series of experiments which included cutting grass, stripping bark, cutting meat and bone, scraping hide and skinning goats with flakes and tools I made from the local basalt. While skinning a goat is a relatively easy task, even with basalt, it proved to be the least delectable of my experiments. The thought that "this is being done in the interest of science" kept me going — and the fact that we were going to eat the goat for dinner.

As part of the team I participated in extensive reconnaissance of the eastern side of the Awash River and assisted in three preliminary excavations. The area is an archeologist's and paleontologist's dream — fossils and stone tools abound everywhere.

Back in Addis Ababa we were asked to assist in setting up exhibits for the new National Museum due to open in a few months. I set up the showcase on lithic technology, complete with replicated artifacts.

Now that I am back in Berkeley I can continue my experiments and examine microscopically the pieces I used in the field to determine whether or not basalt retains traces of use (polish and/or striations). If use wear is found, this will be a major step forward in the study of tool function in the archeological record.

I am grateful to the Leakey Foundation for affording me this opportunity to pursue the exploration of the Plio-Pleistocene in the effort to uncover traces of human origins.

ARCHEOLOGY IN ZAMBIA

*Francis B. Musonda
Franklin Mosher Baldwin Fellow
University of California, Berkeley*

I was in the field in Zambia for two months during the summer of 1981, acquainting myself fully with the environmental setting of the research area as well as undertaking an excavation at one painted rockshelter. Earlier archeological fieldwork had only covered about half of the research area which extends over a territory of more than 1000 square miles. The survey has had to be very extensive, an objective being to sample as large a region as possible in order to obtain a large body of data on distribution of resources and the exploitation and land use patterns.

I made a complete survey on foot and by Land Rover, covering approximately 640 square miles of plateau, valleys, hills and a portion of the Muchinga Escarpment. The survey was oriented toward investigating and sampling rockshelter and cave sites, concentrating on rocky outcrops, ranges of hills and the slopes of the escarpment. Several sites were discovered and investigated but only six showed any clear indications of prehistoric occupation. Four of these are located on the plateau and two in the Muchinga Escarpment. The caves in the escarpment must have provided ideal shelter for prehistoric communities. Their locations make them suitable strategic points

for viewing game in the Luano Valley. Unfortunately, the floors in these caves are covered by bedrock and no cultural deposit has accumulated. However, a few animal bone fragments, potsherds and stone artifacts were found on the surface. Two of the plateau sites contain deep cultural deposits; they are in a range of hills which overlook river valleys that may have provided suitable grazing grounds for wild game. Two other sites are underlain by bedrock and are used by modern hunters who sleep there during hunting seasons.

The floors and the talus slopes at the Mufulwe and Cinshinshi shelters were strewn with Late Stone Age artifacts and rockpaintings are also a common feature. However, due to limited financial resources, it was decided to excavate only the Mufulwe shelter. The site is accessible and located at the top of the hill. The surface materials included animal bones, potsherds and lithic artifacts which appear to offer considerable research potential. The presence of rockpaintings both inside and outside the shelter implies use of the site and probably the exploitation of the surrounding region.

Work there consisted of excavations, mapping and drawing of rockpaintings. Finds from a two meter deep cultural deposit with three distinct cultural levels include several thousand stone artifacts made mainly of quartz, potsherds, beads made of stone and shell, animal bones, iron tools, fruit kernels and snail shells. Charcoal samples for radiocarbon dating and soil samples were collected from all cultural levels.

Analysis of finds is still in progress. However, a casual inspection of the collection shows a number of important features. A high percentage of shaped tools consists of backed pieces (geometric microliths) which are traditionally associated with hunting activity whereas scrapers and other tool types appear in lesser numbers. A heavy duty tool component consisting of bored stones, hammerstones, anvils, grindstones and bola stones is well represented. The commonest raw material for large tools is sandstone, followed by quartzite; smaller tools are made of quartz.

The presence of fruit kernels of *Parinari curatellifolia (impundu)* in all levels is suggestive of seasonal use of the shelter. These fruits, which are very popular among the present inhabitants of the area, are ready for harvesting during November and December. Their presence at the site would therefore probably imply use of the site at the time these fruits were ready for consumption.

Animal bones tend to suggest hunting of small antelopes such as the common duiker. Bones of warthog were also found. They are regularly hunted in the area today.

A study of potsherds from the Mufulwe shelter and the surface collections from the Cinshinshi shelter shows a wide range of similarities with those collected from Iron Age sites previously excavated. These sites

are dated to the Third Century A.D. This distribution of pottery with similar characteristics over such a wide area is interesting when we are considering exploitation and land use patterns.

Several rockpaintings of schematic type were located during the survey, mainly concentrated in the Mufulwe range of hills. Although their real meaning cannot easily be deciphered, they undoubtedly provide an indication of self expression as they are symbolic in character. Their meaning may be of spiritual or ceremonial significance. The distribution of paintings in the area may also reveal something about the patterns of movement and land use of the artists.

During my spare time while in the field, I collected oral traditions on how historic communities exploited the surrounding environment and how village settlements were spaced in relation to resource availability. I was also interested in information about the animals present in the area and how the distribution has changed through historic times, butchery practices and the hunting habits of the people. During the last twenty years hunting of wild animals has been considerably lessened by government restrictions but small antelopes and warthogs are discreetly hunted. Domestic stock provides much of the protein that the people need.

The results of archeological surveys and excavations that have been carried out in my research area since 1977 have far reaching implications. Apart from providing a link between sites in the north and those in the south and east of Zambia, the data will reveal something of the exploitation and land use patterns of prehistoric communities who lived in the area. It is envisaged that the Mufulwe shelter will provide data on seasonal movements of game and prehistoric populations in the region. Selected artifact categories have been shipped to Berkeley for detailed study.

SOCIALIZATION OF IMMATURE VERVET MONKEYS

Phyllis C. Lee
Dept. of Zoology,
Cambridge University

I successfully completed my Ph.D. thesis and my examination and was approved for my degree in February. I would like to thank the Leakey Foundation for sponsoring my research on vervet monkeys through the L.S.B. Leakey Studentship at Cambridge University.

In my field observations at Amboseli National Park, Kenya, I used the patterning of the social relationships of immature vervets in three study groups to define the social context within which they were formed and maintained.

All of the animals spent the greatest



Young vervet monkeys.

photo: Phyllis Lee

proportion of their days feeding and foraging. Social interactions were few and far between, especially during the dry season. The quality and nature of their diets varied considerably from season to season but was relatively restricted. During the dry season, animals concentrated on small, widely dispersed food sources which led to a reduced density of animals, reducing in turn the opportunities for immature monkeys to interact with others. When the quality of the diet was low, as measured by the amount of protein, and the time spent in procuring food great, there was a general reduction of the relatively more energetically costly activities of play, aggression and competition. Differences in the quality of the diet between the groups produced differences in the nature and frequency of social interactions, with the group having the poorest quality diet having also the lowest frequency of social interactions.

The timing of weaning varied between the groups, with mothers in the poorer habitats tending to reject their infants at an earlier age than those in the better quality habitats. These differences in the time course of weaning did not appear to affect the nature of the mother-offspring relationship which was maintained through grooming, associating, and supporting each other in aggression. However, mothers in the stressed habitats appeared to invest more in their sons; they were allowed to suckle longer and received more grooming from the mothers after weaning than did daughters.

The major effect of the ecological factors appeared in the frequency of social play among the immature animals. During the dry season, when food was scarce, lower in protein and probably less digestible, play was reduced in all three study groups to about one minute per day. Friendly social contact was limited to grooming, the majority of which took place not between unrelated immatures but between mothers and offspring and between siblings. The relaxed and friendly

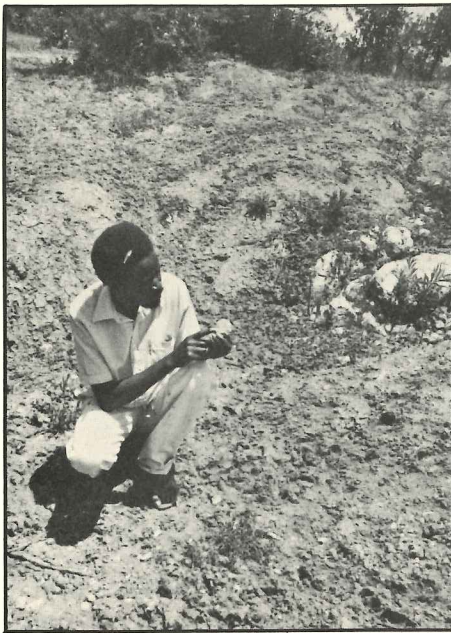
grooming between the members of a family may have provided alternative social experiences to those derived from play, but reduced play may have some undetected long term effect on the physical or social skills of adults.

Throughout the period of this study, there was high mortality and a low birth rate in all groups. Family size was small and there was a large number of orphans. Thus immatures had few close kin; support and alliances were concentrated on the few members of the family who were available, and families stood out as a distinctive social unit within the group.

The low birth rates also had the effect of reducing the number of infants that each juvenile female would be able to contact and to care for, thus perhaps limiting valuable experience which might help her care for her own infants later. Infants were handled and cared for more by kin than by unrelated individuals and an infant's first familiarity with individuals other than its mother was probably with other members of its family.

In the distinctive family unit members fed together, foraged in the same clumped resources, were rarely aggressive or competitive with one another, groomed primarily with each other, and frequently supported each other during aggression with unrelated animals. Grooming was the most frequent form of interaction and may be the most important factor in forming and maintaining kin relationships.

Although the mother often served as a focus for the members of her family, especially when she had a new infant, the siblings within the family had relationships distinctive from those between unrelated immatures. The uniqueness of a family stemmed both from the relationship between the mother and her offspring throughout immaturity and also from the relationship between siblings. Even those families with no mother to act as a focus appeared to be distinctive social units within the group.



Simiyu Wandibba.

ARCHEOLOGY OF BUNGOMA DISTRICT, KENYA

*Simiyu Wandibba
National Museums of Kenya
Franklin Mosher Baldwin Fellow*

Bungoma District is an undulating plain which slopes gradually to the west and north until it rises again to the foothills of Mt. Elgon. The general altitude ranges from about 1370 to 1525 meters above sea level. Mt. Elgon, known locally as Lukulu Iwa Masaba (the Mountain of Masaba) is the most conspicuous single feature of the whole district. Rising over 4,420 meters, it is the source of numerous streams which bisect the plain.

Two types of survey are being undertaken here. The first is ethnographic in nature and involves examination of certain aspects of the Bukusu pottery industry. The Bukusu are the largest ethnic group inhabiting Bungoma District. The research involves an attempt to trace the origins and development of this industry before the imposition of British rule in the area. It also includes examination of the methods of production and acquisition of pottery both in the past and the present.

The preliminary results indicate that the pottery in this area has always been hand-made. A few changes, however, are noticeable in the fields of quarrying clay and the duration of the drying period. Previously no women were allowed to quarry clay; this is generally no longer the case. In the past clay quarries were communal property with free access to all; now potters have to pay for clay.

In order to determine the extent to which pot making has been affected by the introduction of western technology, a questionnaire was drawn up which required the respondent to show the nature and

number of receptacles in his or her household. One interesting result is the fact that the number of pots in a particular household seems to be directly proportional to the standard of education of the head of the household.

The second aspect of the survey aimed at determining the quantity and nature of archeological sites in the district. Casual observations in the past had indicated that most of them would be either caves or rockshelters. Local informants were asked if they knew of such sites. This led to the location of many with archeological remains. In all, forty-nine sites have so far been found and recorded. Except for two, they are either caves or rockshelters. The two exceptions are open air sites in imbedded river sediments on the Sirare. Most of the sites are of the Late Iron Age as evidenced by the decorative technique of the pottery remains. However, Late Stone Age sites also seem to be represented. The two open air sites have typical Middle Stone Age artifacts. It appears, therefore, that the prehistory of this area can be reconstructed from at least the Middle Stone Age to the Late Iron Age.

Most of the artifacts collected in the survey consist of ceramic finds, mainly pottery. Nearly all the sherds came from necked vessels. Some of the rims of these have ledges, indicating that they probably had lids. Two of the sherds are from a bowl and a gourd-shaped vessel. Thus three vessel shapes are represented. The decoration almost invariably consists of roulette impressions made with plaited cord. One of the specimens shows roulette impressions made with woven bark; another one exhibits what appear to be twisted cord impressions.

Three of the ceramic finds consist of smoking pipe fragments bearing an incised line decoration executed in a band of cross hatches.

The second main group of finds consists of stone artifacts. Some of these belong to the Middle Stone Age while others appear to be of the Late Stone Age. The former includes typical Levallois cores as well as points. The Stone Age artifacts are dominated by various microliths.

Four sites were selected for test excavation. All are situated in the Wabukhe Hills. Many sites in these hills appear to have been destroyed as a result of numbers of people settling in the area.

From both the survey and the test excavations a few general conclusions can be drawn about the archeology of Bungoma District. First, it is possible to reconstruct the cultural history from the Middle Stone Age, i.e., about 100,000 years ago, to fairly recent times. Secondly, both the prehistoric and modern pottery are generally decorated in the same tradition. Two explanations could be postulated here — either that the prehistoric pottery is fairly recent or that there is continuity in the manufacture of prehistoric and modern pottery. I am inclined to accept the latter explanation; dating could of course clarify

the matter and samples for dating have been collected from all the test excavations.

The third general conclusion that can be drawn from the work done so far is that the occupants of these rockshelters knew the art of smelting iron. This is evidenced by the presence of both iron slag and tuyere fragments on the excavated sites.

Fourthly, these people engaged in some form of exchange with the people living near Lake Victoria. This is evidenced by the presence of beads and earrings made of the shell of burtoa, a species that only occurs around the lake.

Lastly, most of the fauna remains are from domestic stock; the animals represented include cattle and goats. There are also wild animal bones, indicating that these people probably supplemented meat from their domestic animals by hunting.

SIX MONTHS AT THE SMITHSONIAN

*Amina Said Mdahoma
Lamu Museum, Kenya*

My work last year at the Smithsonian in Washington was very enjoyable and meaningful. I spent three months working in the Natural History Museum where my "legacy" remains: a small box depicting a Swahili kitchen. It has been placed in the Discovery Room. I took a great deal of pride in my work because I know that others will get a small glimpse of Swahili culture as a result. My last three months were spent at the Museum of African Art in the Department of Education, where I attended many seminars and, as an outreach program project, prepared a Swahili dish for an African food festival during Black History month. I developed a lecture on the Lamu Museum with slides, a film on Kenya, a coconut grating, and a Swahili dress demonstration. My first lecture was so successful that I was asked to repeat it several times. Again, I had the chance to share my culture with others.

I now have a wealth of information and ideas which will be extremely useful in Lamu and other museums in Kenya. I have completed the text and format for the brochure for the Lamu Museum. I am very excited about that because for the first time people will have a chance to follow the exhibits without a guide and know the details of what they are seeing. I have also completed the preparation of materials on the dhow sailing ship and ornaments for Kenya teachers to use in their schools.

The information gained in the Smithsonian seminars has been very helpful and I am looking forward to putting it to use in Lamu and sharing my experiences with my colleagues in other museums in Kenya. I am happy to know I will return to my country better equipped to improve education programs because of what I have learned.

PLANT RESOURCES FOR EARLY HOMINIDS

Jeanne Sept
Dept. of Anthropology
University of California,
Berkeley

I spent last year in Kenya, with Leakey Foundation support, collecting data that should lead to a better understanding of early hominid ecology. Archeologists and anthropologists working over the years in East Africa have gathered abundant evidence to tell us that Early Pleistocene hominids commonly frequented semi-arid lake margin and river floodplain environments. But although there is growing documentation of the types of animal communities that the hominids exploited for food, few data exist on the types of plant resources that may have been available to them in these habitats. Since wild plant foods play an essential role in the diets of all large primates and human foraging groups in Africa today, I wanted my research to help correct the meat-plant imbalance in our knowledge of early hominid feeding behavior.

Where would hominids have been most likely to find edible tubers in the dry season? Would shrubs with edible fruits have been evenly dispersed, or would they have occurred in clumps so that hominids could have foraged for fruits in predictable local areas? What types of different plant foods, such as fruits, green shoots, or corms, would have been available in different seasons? Even partial answers to these sorts of questions would help to discern the types of strategies hominids may have adopted when foraging for plant resources.

I undertook studies of several modern semi-arid riverine plant communities in Kenya in conjunction with studies of some of the Early Pleistocene archeological sites at Koobi Fora, Lake Turkana. I wanted to clarify the range of problems and opportunities that these fringing and discontinuous riverine habitats may have offered foraging hominids when compared to surrounding non-riverine areas.

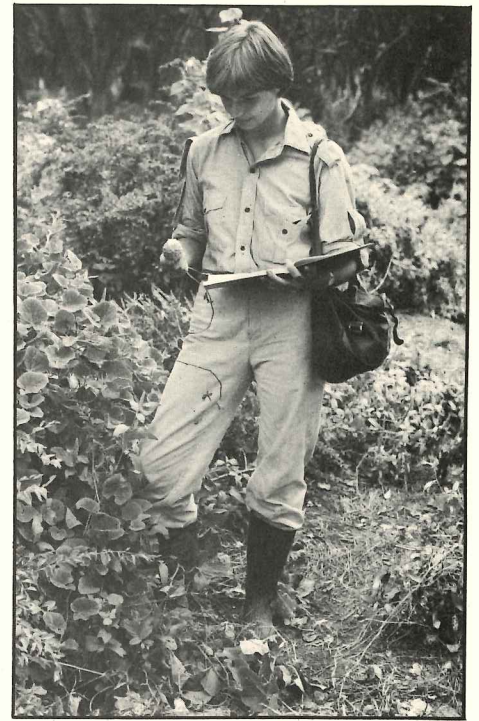
My plan was to search for predictable patterning of plant resources in such habitats in relation to riverine geographical zones. The zones were defined on the basis of sedimentology, topography, and geomorphological structure in a way to make them comparable to the reconstructions of paleogeography at our archeological sites. Within each zone I measured the relative abundance and diversity of plant food resources and tried to document striking spatial patterning and the timing of seasonal availability. I will analyze this data in terms of classes, or grades, of resource "value" — species of plants grouped by common qualities such as nutrient content, physical texture, or need for processing. I want to describe the variation in abundance and predictability of the various grades of plant foods in each of the geographical zones in which they occur. I

hope to derive implications from this information for the "consumer ecology" of early hominids.

Well — easier said than done! My need to do comparative work in different parts of Kenya meant that a lot of footwork was in store for me, both the preliminary and the on-the-job variety. My mental image of Nairobi is actually a map charting the quickest routes to numerous government offices, wholesale distributors of food and camping supplies, and dealers in Land Rover spare parts. My travels around the country have put me on a first name basis with most of the pot-holes in the pavement. And "measuring the relative abundance and diversity of plant food resources" has meant long hours of concentrated efforts: jotting numbers into notebooks; bending over a tape measure; filling bags with berries; weighing tubers; plucking thorns out of fingers; scraping layers of mud off boots; swatting mosquitoes. But it has also meant being face to face with relatively "wild" parts of East Africa that are disappearing or changing fast.

Riverine habitats in semi-arid regions are sensitive to their variable water supply, whether it is a major river or just a sandy seasonal stream channel. The plant life is lush, denser, and often more diverse there than in the drier surrounding countryside. More shade and shelter are available in these fringing habitats, as are a different range of plants, and, of course, more water. Modern animals love it, especially in the dry season, but I'm not sure they love me, tromping around with my notebooks and tape measure.

As yet I can only guess what a Pleistocene hominid would have thought of it all.



Jeanne Sept.

Riverine habitats are certainly lands of opportunity; but they are also localities of risk. (This thought flashed through my mind one afternoon when a leopard came bounding down from a tree that I was recording, and landed on my measuring tape.) I hope that my research will help to define better the nature of the problems and opportunities facing a Pleistocene hominid seeking to forage in such habitats — one more step towards a better understanding of early hominid ecology. □

AN ALTERNATIVE THEORY OF EVOLUTION

A Foundation member, Richard Halada, has conceived what he calls "The Marxist Theory of Pre-History."

Briefly stated, it is a method of visualizing the natures of the various groups of possibly co-existing hominids between two and four million years ago.

"First," he says, "we have Homo neanderthalis, with a familiar stooped gait, heavy brow ridges with bushy eyebrows, and, probably, a good deal of facial hair including a bushy mustache. If we can picture him strolling through the savanna munching a banana while glancing nervously about, we realize his stong resemblance to Groucho. Indeed, excessive use of one-liners may have accelerated his early demise.

"Australopithecus afarensis on the other hand, was a light creature. Being of a more ancient vintage, he probably was more ape-like in terms of language: i.e., virtually

mute, except for an occasional hoot or honk. Would not Australopithecus harpo be more descriptive?

"Homo habilis was a more inventive proto-human — nay, in view of his success in overcoming the dangers of the times, cunning would be a more accurate description. His were probably the first garbled attempts at language, and I don't believe that Chico would have found them particularly alien.

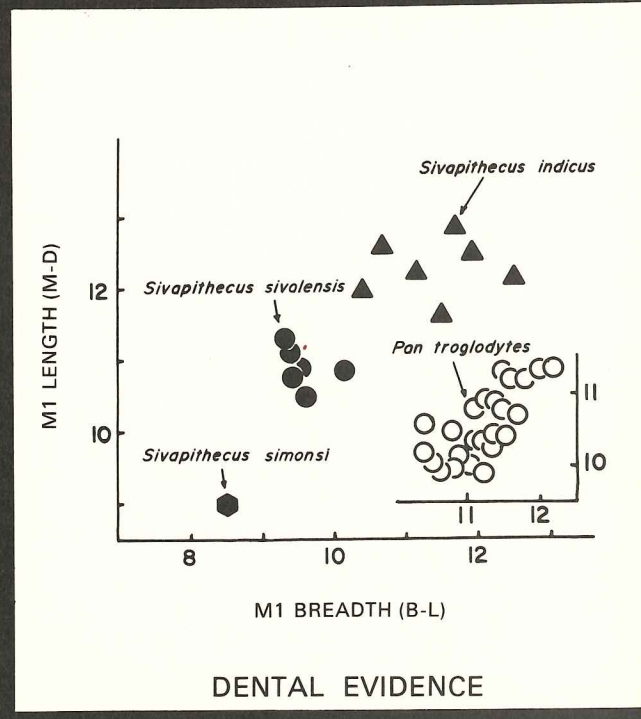
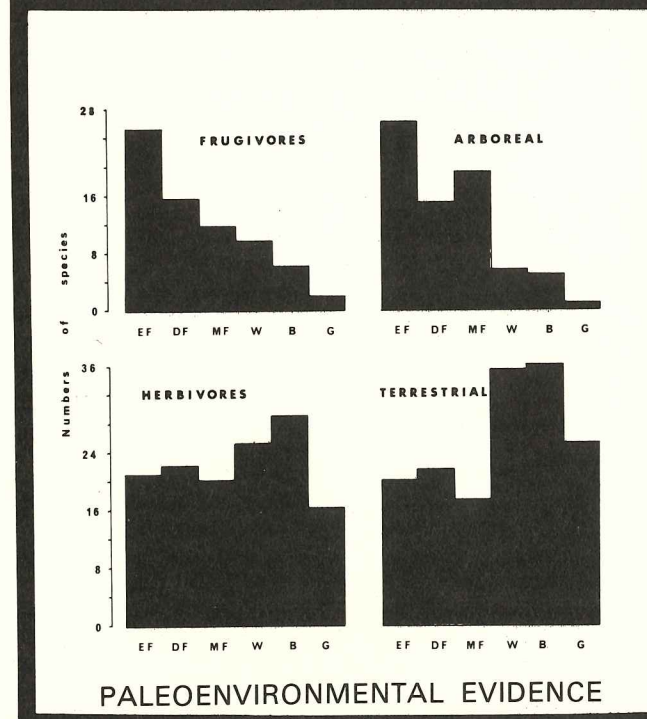
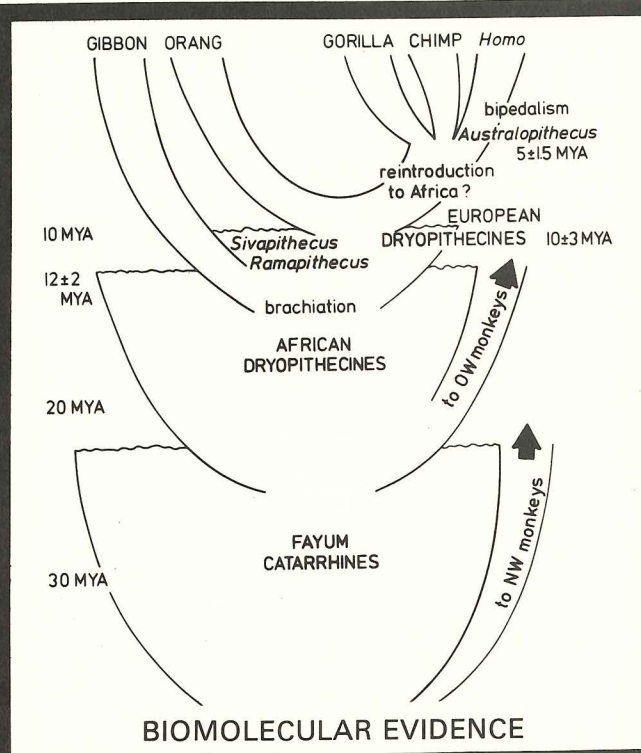
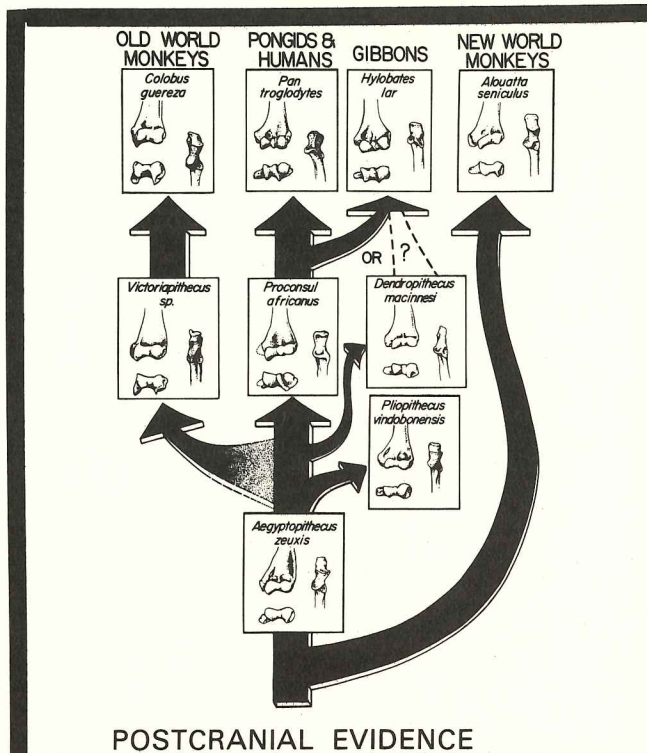
"Modern man is more nearly akin to Zeppo sapiens, however, and I believe his evolutionary success was ensured by his ability to always 'get the girl'.

"The exact mechanisms of social interaction among the various hominids will be described in my forthcoming paper, The Tri-Stooge Theory of Hominid Interaction."

It should perhaps be noted that the contributing "scientist" is from Texas. □

NEW INTERPRETATIONS OF APE AND HUMAN ANCESTRY

EDITED BY RUSSELL L. CIOCHON AND ROBERT S. CORRUCINI



NEW BOOK AVAILABLE

In July, 1980, the L.S.B. Leakey Foundation sponsored an international symposium entitled "Miocene Hominoids and New Interpretations of Ape and Human Ancestry" which was held in Florence, Italy (see *Leakey Foundation News*, Number 17, 18). This symposium was successful in setting the stage for the development of a new paleoanthropological volume entitled *New Interpretations of Ape and Human Ancestry* now scheduled for release by Plenum Press this fall. In its thirty chapters and more than 700 pages, this volume presents 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 to the hominoids of the Miocene. The thirty-seven contributors consider a variety of interrelated subjects in their respective analyses. Among these are (1) the branching order (cladogenesis) of the hominoid primates, (2) the structural components (morphotype) of the last common ancestor of humans and the living

apes, (3) the timing and geographical placement of the ape-human (pongid-hominid) divergence and (4) the adaptive nature and probable scenario for the initial differentiation of hominids from pongids.

A broad approach is taken in this analysis of ape and human ancestry which includes data from biomolecular studies, cranio-facial anatomy, cladistic methodologies, dental anatomy and histology, dental metrics, dietary adaptations, embryology, geochronology, karyology, paleoecology, paleomammalogy, paleoneurology, parasitology, postcranial anatomy and locomotor adaptations, postcranial morphometrics, Popperian historicoscientific analyses, traditional descriptive analyses and zoogeography. Central to all analyses in this volume is the reconsideration of the evolutionary position of Miocene hominoids (including their Oligocene ancestors and Pliocene descendants) vis a vis modern apes and humans.

The illustration above graphically presents four sources of evidence considered

in this volume. The upper left diagram is taken from a chapter by J. G. Fleagle, upper right is from J. E. Cronin, lower left is from P. J. Andrews and lower right is from a chapter by R. F. Kay and E. L. Simons. Other contributors to this volume include: M. L. Baba, R. L. Bernor, N. T. Boaz, L. de Bonis, S. R. K. Chopra, R. L. Ciochon, R. S. Corruccini, L. L. Darga, R. Dehm, D. Falk, D. G. Gantt, M. Goodman, L. O. Greenfield, D. C. Johanson, W. H. Kimbel, A. G. Kluge, A. L. Kortlandt, J. M. Lowenstein, L. L. Mai, M. E. Morbeck, H. M. McHenry, M. Pickford, D. R. Pilbeam, K. N. Prasad, M. D. Rose, V. M. Sarich, G. H. R. von Koenigswald, A. C. Walker, S. C. Ward, T. D. White, M. H. Wolpoff and A. L. Zihlman. The editors of this volume, R. L. Ciochon and R. S. Corruccini, wish to gratefully acknowledge the support of the L.S.B. Leakey Foundation throughout all phases of the preparation of this work. Clearly, without the Foundation's support, this volume would never have been published. □

GRANT SPOTLIGHT

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?

Hillard Kaplan—Kim Hill \$3,000 needed

RESOURCE REDISTRIBUTION AMONG HUNTER-GATHERERS

This project is aimed at describing food sharing among the Ache, a hunter-gatherer group in eastern Paraguay. The Ache represent one of the last of such groups, and possibly the only non-desert, non-arctic group for which good quantitative data exist on foraging returns.

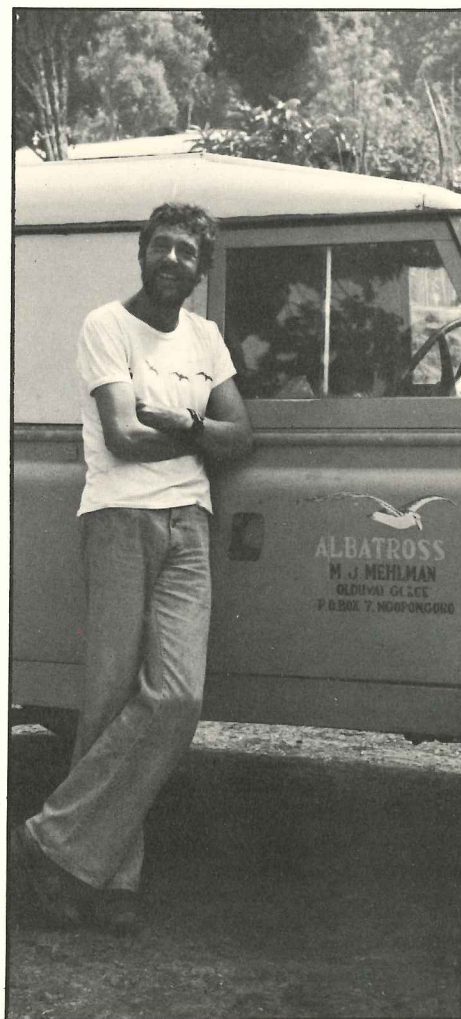
Most of human experience has passed in societies dependent on hunting and gathering. Since aspects of behavior which are

regarded as uniquely human were initially shaped in this context, the origin and subsequent development of human behavior can only be understood in the light of knowledge about the requirements for success in hunter-gatherer societies. Modern hunter-gatherers are one of the most important sources for such knowledge although they are not living replicas of the past. Nevertheless, if the general principles underlying their behavior can be adduced, they will provide the strongest basis for making predictions about changes in behavior over long periods of time — behavior which can now only be traced in archeological residues.

Patrick Mehlman \$2,000 needed

SOCIOECOLOGY OF THE BARBARY MACAQUE (*Macaca sylvanus*)

Earlier research in the Middle Atlas Mountains of Morocco has demonstrated that the Barbary macaque is unique among the *Cercopithecoidea* in both social organization and ecology. The Barbary macaque lives in large polygamous groups but exhibits a high degree of male involvement in the care of infants, a behavioral trait usually associated with monogamous species of primates. Its major ecological adaptation, that of surviving rather harsh mountain winters in a temperate-forest environment, has only one other known



Patrick Mehlman.

parallel among non-human primates — the Japanese macaque.

Mehlman's research project will deal with *M. sylvanus* in the Jbela region of the Rif Mountains, northern Morocco, primarily because of ecological and geological reasons. Its focus will be on the examination of pre-cultural or traditional behavior, with a primary goal of investigating behavioral plasticity as an adaptive evolutionary strategy.

Martin Pickford

\$3,000 needed

GEOLOGY AND PALEONTOLOGY OF THE IKORO-KANIAMWIA AREA, WESTERN KENYA

This project is an on-going geological and faunal survey. During the last year, Dr. Pickford has added significant new detail to previous results in the area. A new fossil area on Maboko Island was located, containing ramapithecines, *Climacoceras*, bovids, hyrax and other fossils and also a rich gastropod assemblage. Gastropods are proving to be of great value in paleoenvironmental reconstruction. New areas were mapped, yielding assemblages which help to fill the faunal gaps, and old ones remapped. Dr. Pickford is confident that the team will obtain a superb set of dates in a very important sequence.

Donald C. Johanson

\$10,000 needed

PALEOANTHROPOLOGICAL INVESTIGATIONS IN THE HADAR-GONA REGION AND SUBSEQUENT LABORATORY STUDY

The International Afar Research Expedition, for which Dr. Johanson is a co-leader, has recovered, since 1973, a unique collection of Pliocene fossil hominids from the site of Hadar in the Afar region of Ethiopia. It represents at least thirty-five individuals which date from 3.5 to 4 million years, now recognized as a new species of hominid, *Australopithecus afarensis*, the earliest known representatives of the family of man.

During the fall of 1982, the team will conduct an intensive survey in Hadar and Gona to recover additional hominid remains. These sites offer extraordinary opportunities for augmenting our knowledge of early hominids, their cultural adaptations, their environmental settings and their faunal contemporaries.

Biruté M.F. Galdikas

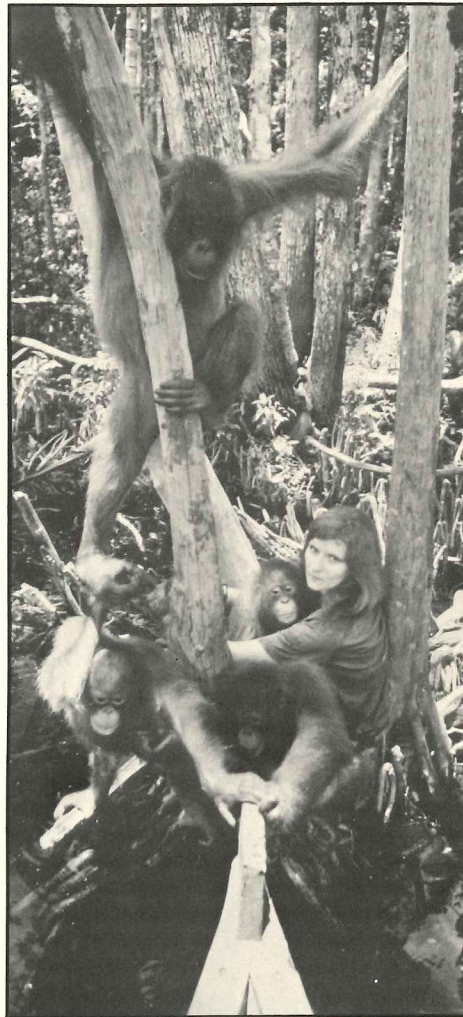
\$8,000 needed

ORANGUTAN AND PROBOSCIS MONKEY ADAPTATION AT TANJUNG PUTING RESERVE, BORNEO

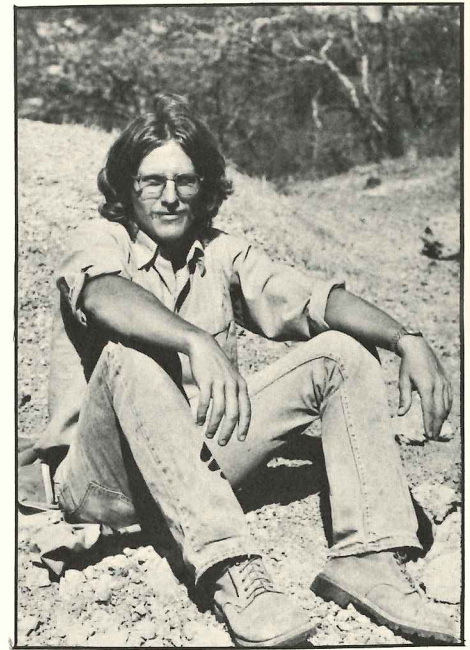
Dr. Galdikas has completed a decade of research on wild orangutan (*Pongo pygmaeus pygmaeus*) behavior and ecology at the Tanjung Puting Reserve, representing the longest, most detailed, uninterrupted study of any wild orangutan population ever undertaken. She, her assistants and students have systematically collected data on all aspects of orangutan behavior.

Her research plan for 1982 consists of continuing the long-term monitoring of both habituated orangutans and tropical forest phenology with a view to explicating differential reproductive strategies among males and females more fully, as well as relating the distribution of available food resources to foraging patterns. She wishes to systematically collect data on mother-infant relationships and infant development in foster parent units.

Dr. Galdikas has also initiated a study of the little-known and highly endangered endemic monkey, the proboscis (*Nasalis larvatus*).



Biruté Galdikas in Borneo.



Peter Meylan at Laetoli, 1979.

Peter A. Meylan

\$2,220 needed

PALEOECOLOGY OF OLDUVAI GORGE BASED ON FOSSIL SNAKES AND LIZARDS

Only a cursory examination of the fossil squamates (lizards and snakes) from Olduvai in Tanzania has been made, yet they may prove quite useful in reconstructing the paleoenvironment of the area. They can be used in determining the plant community in which they once lived. Data from the fossil squamates will provide strong evidence for the support or rejection of the existing paleoenvironmental reconstruction of Olduvai made on the basis of geology and mammalian paleontology, and will lead to a more complete understanding of the environment of early humans.

The identification phase of the study will be undertaken at the Kenya National Museum in Nairobi which holds all of the fossils and a good comparative skeletal collection.

Alyn R. Brereton

\$3,000 needed

COPULATION INTERFERENCE IN FERAL BABOONS (*PAPIS ANUBIS*)

Mr. Brereton, a Ph.D. candidate at the University of Stirling, Scotland, will work with Dr. Shirley Strum at Gilgil, Kenya. The primary objective of his research is to test a new hypothesis of "social affiliation"

which attempts to explain the cause of copulation interference noted in non-human primates. The hypothesis predicts that interference occurs most often when a third party intruder has a well established affiliation with the mounted female. A single troop of 135 olive baboons will serve as subjects. □

GRANT GUIDELINES

The L.S.B. Leakey Foundation supports studies relative to human evolution. Priority is given to research into environments, archeology and human paleontology of the Miocene, Pliocene and Pleistocene, into the behavior of the Great Apes and other Old World primate species, and into the ecology and adaptations of living hunting-gatherer peoples. Those wishing to apply for a grant outside the immediate areas of interest of the Foundation are advised to submit a two-page proposal stating succinctly the aim of the project and the methods to be employed.

Grants are normally made to scientists with professional qualifications and demonstrated capability. Applications from graduate students working for an advanced degree will be considered if accompanied by a letter from their faculty adviser or similar appropriate sponsor. The average award is \$4,000.

The Franklin Mosher Baldwin Fellowships for the Study of Early Man in Africa permit the Foundation to offer three or more fellowships each year to support African field studies for African archeologists or graduate-study fellowships in the U.S. American specialists are awarded fellowships to conduct field research on African sites in cooperation with African scientists. Senior and postdoctoral researchers are encouraged to apply. It is anticipated that the maximum grant will be \$8,000.

For further information and application forms, contact the Leakey Foundation, Foundation Center 13-83, Pasadena, CA 91125. Application deadlines are May 15, Sept. 15, and Jan. 15, annually. Applicants wishing their proposals to be considered at the Foundation's Annual Meeting are advised of the special deadline of Aug. 1.

BALDWIN GRANTS AWARDED

The Franklin Mosher Baldwin Fellowships, instituted in 1977, provide funds for the Third World that are available from very few other sources.

The following Baldwin Fellowships were recently awarded:

Pamela Rae Willoughby,

a Ph.D. candidate in anthropology at UCLA, has been granted \$2,500 to study spheroids of the African Early and Middle Stone Age technology, examining their manufacture, possible uses and distribution.

The two best known Plio-Pleistocene archeological localities are Olduvai Gorge in Tanzania and Koobi Fora in Kenya. Spheroids are abundant at Olduvai, totally absent at Koobi Fora. This study will attempt to explain this anomaly.

Anne Vincent,

a graduate student in anthropology at Berkeley, has been awarded \$3,000 to assess the contribution of tuberous plants in the evolution of the human diet. The project will involve fieldwork in northern Tanzania and Botswana.

Amini Aza Mturi,

Director, Ministry of Information and Culture, Tanzania, will receive a \$5,000 Baldwin grant to reinvestigate the Lake Natron Pleistocene deposits which are rich in archeological remains, vertebrate fossils and a wide range of paleoenvironmental data. This is an interdisciplinary research project involving American, French and Tanzanian scientists. Dr. Mturi will coordinate the project in collaboration with Professor Glynn Isaac and Dr. Maurice Taieb.

Giday W. Gabriel,

a lecturer in geology at the university in Addis Ababa, Ethiopia, will receive a Baldwin grant of \$7,700 to permit him to attend Case Western Reserve University in Cleveland, Ohio, as a Ph.D. candidate. It is anticipated that his research will concern the volcanic geology of the Awash region of Ethiopia's Afar Triangle.

Peter R. Jones,

archeologist on the Olduvai Gorge Research Project in Tanzania, has been awarded a \$2,000 Baldwin grant to continue excavation of the Acheulean sites at the gorge. Part of the study will be experimental work as a means of interpreting the lithic assemblages and the many bones found with cut marks. Other experimental work will be carried out on animal butchery, work that is of fundamental importance not only at Olduvai but at all sites where fauna are preserved.

Kathy D. Schick,

a graduate student at Berkeley, has been granted \$2,500 to work in conjunction with Prof. Glynn Isaac's Lake Natron project in Tanzania. Ms. Schick will carry out a preliminary study of the contexts of the Early Acheulean archeological sites in the basin, with the aim of bettering our understanding of how these sites have been preserved in the record, the impact geological forces have had on them and their consequent behavioral implications regarding one of the early stages of human evolution.

Kathleen A. Rubin,

a doctoral candidate at the University of Pennsylvania, will receive a \$2,500 Baldwin grant for research at two open air sites of the Middle Stone Age in southern Africa. One site is at Florisbad in South Africa, the other in the Kalahari of Botswana. Ms. Rubin will study the archeology, environments and tool industries of these localities and compare her results with those from other Middle Stone Age sites, most of which are in caves. □

GRANT OPPORTUNITIES

The Smithsonian Foreign Currency Program, a national research grants program, offers opportunities for support of research in Burma, Guinea, India, and Pakistan in the following disciplines:

Anthropology, Archeology and related disciplines, Systematic and Environmental Biology, Astrophysics and Earth Sciences, and Museum Programs.

Grants in the local currencies of the above listed countries are awarded to American institutions for the research of senior scientists. Collaborative programs involving host country institutions are welcome. Awards are determined on the basis of competitive scholarly review. The deadline for submission is November 1 annually. For further information write the Foreign Currency Program, Office of Fellowships and Grants, Smithsonian Institution, Washington, D.C. 20560, or call (202) 287-3321. □



... coming down from the trees to the ground; becoming bipedal; becoming intelligent; finally achieving civilization and learning to drive.

THE PLOT THICKENS

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arguments were very persuasive because they were replete with figures and the biologists' arguments were not.

In any event, he was right. If the age of the earth were forty million years, biological evolution would have been impossible. But look at what happened: The age of the mammals expanded from three million years to sixty-five million years; the age of the earth expanded from a few tens of million years to four and one half billion years. The change in the age of the mammals was thus on the order of twenty times. What corresponding changes were made in the diagrams of the fossils of human evolution? None. None at all. If people believed before this that man had separated from the apes in the Miocene period or the Oligocene — on the order of thirty million years ago, according to the new dates — if they had believed that, they continued to do so. Their belief was not altered by the fact that the dating had changed by a factor of twenty. Emotional cerebration again.

Notions of the age of the earth began undergoing revision in the 1920s, but terrible mistakes were made and the new estimates were not very rapidly accepted.

"Continental drift was suggested in 1912. It was supported by virtually nobody and was widely ridiculed."

In 1931 the National Academy published a report suggesting that the age of the earth was at least two billion years. The idea of these much longer ages spread very rapidly

after that. There were still very few dates, however, for the age of the mammals.

The flooding of the Mediterranean basin marked the beginning of the Pliocene. Cores from the sea floor show conclusively that the Mediterranean had been a dry desert area until it was flooded by the Atlantic Ocean five and one half million years ago. The flooding of the Mediterranean basin was part of the general pattern of continental drift. What other major changes happened as the continents drifted? Continental drift was suggested in 1912. It was supported by virtually nobody and was widely ridiculed.

One of the remarkable facts derived from the continental drift theory is that North America and South America were about as far apart thirty to thirty-five million years ago as Africa and South America. Now how are we going to get South American monkeys to South America? It didn't worry anybody if they came from North America because that's where there were fossil prosimians, that's where tradition said they had come from, and that's where anatomy proved they had gone. So the assumption that they had made a very difficult set of crossings from North America to South America was acceptable, but to suggest that they had come from Africa was something that ran contrary not only to tradition, but contrary to the notion that anatomists can compare monkeys of South America and monkeys of Africa and come to reliable conclusions. Now look at the order of this mistake — it's at least thirty million years. Many of the problems of traditional evolutionary thinking arise from the fact that comparative anatomy is basically a primitive, Nineteenth Century science that has

not been reorganized, and in my opinion cannot be reorganized, without first accepting molecular biology and working with a set of bases and problems very different from those the traditional comparative anatomist worked with.

Why should we look for the origin of New World monkeys in Africa? We should do it because of the work of Morris Goodman, of Vincent Sarich and Allan Wilson. These people, who have studied the immunology of these animals, find that the

"Nothing . . . holds back progress more effectively than good teaching."

South American monkeys are close to what we would expect of African monkeys some thirty to thirty-five million years ago. You can do this with immunology; you can't with comparative anatomy. Adding immunology, molecular biology, and so on to comparative anatomy has some very remarkable consequences for the study of human evolution. Whether you take DNA comparisons, immunological comparisons, the comparison based on electrophoresis or the comparison based on sequence of amino acids in proteins — it makes no difference which one of these you take — human beings, chimpanzees, and gorillas are about equally related.

I think this shocked everybody. In the first place, it showed that the comparative anatomists again had made some terrible mistakes. It was "obvious" to everyone that human beings are not closely related to either the chimp or the gorilla. So this finding goes contrary to common sense, to comparative anatomy, to the Nineteenth Century, and to the way most students have been taught. Nothing, I might add, holds back progress more effectively than good teaching.

How can we reconcile what Allan Wilson has called "evolution at two different levels"? Evolution at the molecular level seems to have been going at relatively constant rates, and to have a clocklike character. Evolution at the phenotypical level has been going according to natural selection, but not in a clocklike manner; it is going rapidly sometimes in some places and slowly sometimes in some places. So we have the notion of neutral evolution, evolution largely determined by stochastic events, which is contrary to the basic teachings about human evolution. It is evolution on two levels that allows anatomical comparisons which show chimpanzees and gorillas are very similar to each other but equally similar to human beings.

Consider how great a change this is. What are the theories about our separation from our closest relatives that have been held by responsible major scientists? (1) Separation occurred in the tarsier period fifty million years ago. (2) Our ancestors were monkey-like forms, which

involves thirty to thirty-five million years of separation. (3) Our ancestors were early apes, twenty million years of separation. (4) The molecular view — our ancestors were apes closely related to the African apes, which means only four or five million years of separation. This list exhausts all the possibilities. Fifty million years is near the beginning of the age of the mammals, and four million years is close to the date of the bipedal footsteps I will discuss shortly. In other words, responsible experts could defend the origin of human beings from primates at almost any time during the age of the mammals.

In this sense, although many fossils have been found and many animals studied anatomically, the latest theories still have the peculiar characteristic of being fossil-free. There isn't enough anatomy, there are not enough fossils, to force people to come to relatively restricted conclusions. Any estimate from four million years of separation to more than thirty-five million years

“People wanted to believe in evolution, human evolution, and this affected the results of their work.”

of separation can be supported on the basis of comparative anatomy and the fossil record. People dissecting the same parts of the same animal could come to opposite conclusions because they are looking at different things, emphasizing different things. When Sarich and Morris Goodman do their immunological studies, by contrast, they do not lead to divergent conclusions. Different techniques, different laboratories, yield the same results.

W.K. Gregory in *Man's Place Among the Anthropoids* made a very convincing argument that man's closest relatives were apes. On what did he base his argument? He based it on the assumption that the skeletons of contemporary apes were the same as those of fossil apes. And now, of course, we know that they are not the same at all. The apes of many years ago had limb bones that were exceedingly different from those of contemporary apes. So the basis for this widely accepted argument is simply incorrect. People wanted to believe in evolution, human evolution, and this affected the results of their work. But they frequently wanted to believe in a particular theory, one that differed from other people's theories.

Misia Landau, an assistant professor at Boston University, has been working on these issues. At the last annual meeting of physical anthropologists she gave me her just-completed Ph.D. thesis to read. I began reading it on the airplane home and I became fascinated. Landau argues that the early accounts of human evolution may be treated as narratives, as literature, without regard to scientific proof. If one reads

ESTIMATED TIMES OF ORIGIN OF MONKEYS, APES, AND HUMANS		
MILLIONS OF YEARS	BASED ON MOLECULAR DATA	BASED ON ANATOMY AND PALEONTOLOGY
5	ORIGIN OF HUMANS FROM AFRICAN APES	
10	ORIGIN OF ORANGUTANS	
20	ORIGIN OF APES	20 — 30 ORIGIN OF HUMANS
35	ORIGIN OF NEW WORLD MONKEYS	
50	ORIGIN OF MONKEYS	(50 plus) ORIGIN OF NEW WORLD MONKEYS
60	ORIGIN OF PRIMATES (10 million years)	

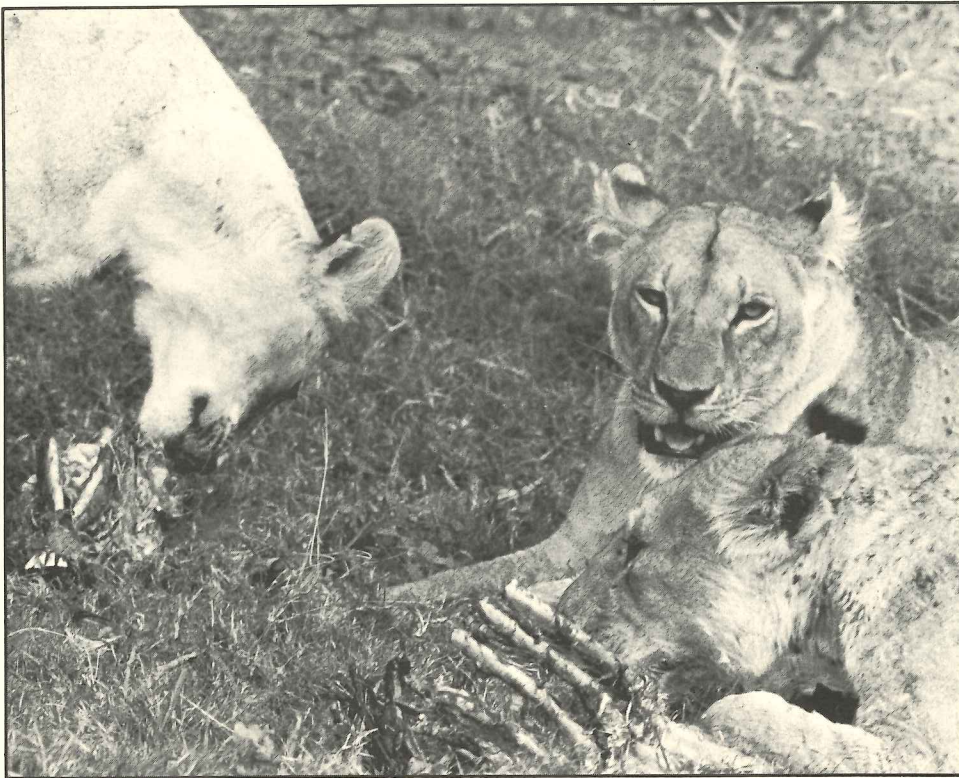
them this way, one finds there is a set of themes that recur in all these stories: coming down from the trees to the ground; becoming bipedal; becoming intelligent; finally, achieving civilization, which comes along with religion and with perfection. And one finds that those basic themes are related to one another; they are held

“... there is a set of themes that recur in all the stories: coming down from the trees to the ground; becoming bipedal; becoming intelligent; finally, achieving civilization, which comes along with religion and with perfection.”

together by plots. This is a literary form, which can be studied as such, and it has little to do with science. This isn't to say science has no bearing on theories of human evolution. As I have pointed out, in terms of immunology and in terms of dating, there has been great scientific progress. But the early accounts were contrived before there were any scientific techniques that would impose definite conclusions. Landau's notion that we can study these accounts as we would study literary narratives is a major contribution.

It helps us keep the history of evolutionary theory in perspective.

In the studies going on today we have the great advantage of having some facts on which to base our stories. I would like to discuss very briefly some very important recent studies, the studies in Ethiopia that led Donald Johanson and Tim White to name a new species *Australopithecus afarensis*. This is in many ways a uniquely valuable find of a fossil human group because it is the only one involving a large number of humans who were close together when they died, presumably within a relatively short period of time. In this sense, it is the only fossil human population, although we sometimes talk about creatures who lived in the same large area over a long period of time as populations. The Afar fossils are remarkably preserved specimens, dated by potassium-argon at between three and four million years old. Moreover, they are associated with footprints that were found by Mary Leakey and her co-workers in Laetoli, Tanzania, footprints so human that, were it not known they are 3.8 million years old, no one would pay any attention to them. They would say, “Why are you asking us to look at a bunch of human footprints? Go down to the beach and see them for yourself.” The footprints settle the problem of the relationship of the bones to behavior in a definite way. We have dates for the footprints. We also have fossil



Human beings may have acquired their taste for meat and their inclination toward hunting by scavenging the kills of predators. However, some predators don't leave much behind.
photo: S.L. Washburn

teeth. All in all, this is a remarkable set of finds, which enables us to identify a new species.

We don't escape from the problems of narrative because we ask other kinds of questions. Were these people tool users? The earliest stone tools — well-documented ones found by Glynn Isaac of the University of California, Berkeley — are about two million years old. These tools were found next to bones of animals that were butchered by people using stone tools. It is now known that a stone tool used to cut meat from a bone makes a distinctive mark on the bone, different from the mark made by carnivores. So one can say that the animal to which this particular bone, two million years old, belonged, was butchered by a stone-wielding human being. That's two million years ago, but the African footsteps are twice that old. What were those earlier creatures like? The hands, as described by Johanson, are remarkably human. If you believe, and here we come

"It is cutting with a sharp edge on stone that is uniquely human, not the use of stone as such."

to another level of argument, if you believe that the human hand is a product of tool using, that it was success at tool using that led to our hands being different from the hands of the chimpanzee and the gorilla — and I happen to believe that — then this

form of the hand is an argument that these creatures living roughly four million years ago were already tool users and had been tool users for a substantial period of time.

This is a traditional Nineteenth Century kind of argument. Why should they be tool users? There are lots of good data now on tool use among contemporary apes, particularly chimpanzees, and chimps use more objects than all the other mammals combined apart from humans. Chimps use tools in a variety of ways. They throw stones and they bash things with them, but they never take a chip off a stone and cut with it. It is cutting with a sharp edge on stone that is uniquely human, not the use of stone as such.

Returning to the Afar specimens, there are two ways in which they differ from contemporary chimpanzees. One is that they were bipedal, as is shown by those footprints in Tanzania and by the pelvis, and the other is that they had exceedingly small brains. The brains of these early bipedal forms were no bigger than those of the contemporary apes; if contemporary apes don't evolve stone tool use very rapidly, there is no particular reason to assume these early forms should have evolved rapidly. It looks, then, as if our ancestors were evolving at what one might call animal rates four million and three million years ago, and that the rate of human evolution then speeded up at two million and one million years ago. In the interim the brain doubled in size. By one million years ago one is dealing with *Homo erectus* and an entirely different rate of evolution.

In a general way, then, if we look at what has been happening in the study of human evolution, we see that the people who find skeletons today have enormous advantages over the people who were finding skeletons a few years ago. They have an advantage theoretically; they have an advantage in being able to determine dates; they have an advantage in knowing much

"The first and most important reason to study evolution is that it is a humanistic study."

more about associated animals, about pollen analysis, about a wide variety of different things. All in all, they have a much better chance of writing a narrative that not only makes interesting reading but that also makes scientific sense.

Well, so what? Why bother with the study of human evolution? If all this happened long, long ago, why not leave it be? The first and most important reason to study evolution is that it is a humanistic study. If we want to know about man's place in nature and about the courses that resulted in human evolution, we have to study the fossils and the living forms and use modern scientific methods to try to piece out the story. So my first argument is that evolution should be a part of everyone's education, and until it is we are going to have "creationists" popping up here and there.

"... it is important to realize that man is not perfected, as he frequently was considered to be in the early accounts."

My second argument is that it is important to realize that man is not perfected, as he frequently was considered to be in the early accounts. It is important to consider human anatomy as it is related to human behavior. I will cite a couple of examples of major academic mistakes that come from not considering that our brains evolved over time, rather than being created in special form. Take the notion that the cortex of the brain is equally potential; or that the child starts life with a brain that is a tabula rasa with no particular differentiation in the structure; take the notion of behaviorism. None of these is compatible with the evolution of the brain as we know it. The brain as we know it through evolution clearly evolved in differential ways. The basis for the structure of speech is unique to contemporary human beings, something that cannot be demonstrated in any other primate. The uniqueness of speech is therefore something important for us to realize if we are going to compare human behavior with other

animals' behavior, if we are going to try to understand man from a humanistic point of view.

"... it is easy to learn those things which have been important to a species in its evolution. It may be very difficult to learn things that have not been important ..."

A third argument for the study of evolution has to do with ease of learning. As David Hamburg has suggested, it is easy to learn those things which have been important to a species in its evolution. It may be very difficult to learn things that have not been important to the species in its evolution. A corollary of this notion is the tremendous importance of play. Chimps rarely hit their target when they throw rocks; this is because they don't play at throwing rocks. Human children throw in all kinds of games and all kinds of situations, and then become terribly good at it. My point here is that our school systems do not use this kind of information about human beings. They act as if you could set up a disciplinary scheme without regard to ease of learning, without regard to the fundamental things that human beings like to play with and use, as if culturally determined goals could be substituted entirely for the basic biology of the species. I think this is a profound mistake.

"... our school systems do not use this kind of information about human beings."

In summary, then, I would say there has been enormous progress in the study of human evolution, which makes it incumbent on us as professionals to eliminate the residue of the fossil-free accounts and the kind of thinking that went with them so that we can use the best kind of recent information to construct narratives that have a greater relation to reality.

The other conclusion I would leave you with is that we were not perfected by the process of evolution, that there are problems in human biology, that there are things we can help people with and things we should leave alone. Ultimately, what the study of evolution should impart to teachers, students, and school administrators is a more humanistic understanding of human beings.

A longer version of this paper appeared in the January Bulletin of the Atomic Scientists.

Sherwood Washburn is a member, emeritus, of the L.S.B. Leakey Foundation Science and Grants Committee. □

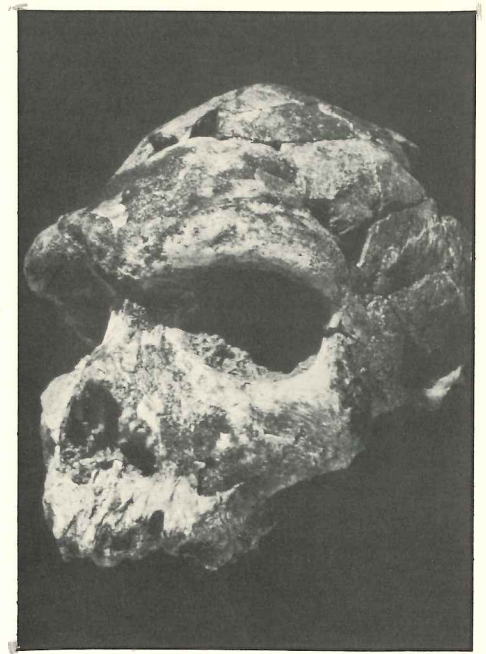
HOMINID DISCOVERIES

continued from page 1

Hadar, agree that the new Middle Awash finds conform to the early hominid pattern of primitive, small-brained, bipedal primates. Previously discovered Hadar fossils (including Lucy) were assigned to the species *Australopithecus afarensis* (the Afar man-ape). The new, earlier fossils are similar to *A. afarensis* in their preserved parts.

The paleoanthropological importance of the Middle Awash Study Area was first made known by the reconnaissance done by the French geologist, Maurice Taieb, in 1969. Then Jon Kalb, who had previously worked with Taieb and Johanson at Hadar, explored parts of the area between 1975 and 1978 with a small team. This was successful in finding a number of vertebrate fossil localities and a Middle Pleistocene hominid cranium at Bodo; work came to an end when Kalb had to leave Ethiopia. In 1981, our own expedition received a permit to recommence work in the Middle Awash and investigations were carried out in the fall with funding from the National Science Foundation and additional support from the National Geographic Society and the L.S.B. Leakey Foundation. The success of the expedition was to no small degree due to the help and advice we received from the Ethiopian government, in particular the Centre for Research and the Preservation of the National Heritage, the Department of Wild Life and the University of Addis Ababa. The research team assembled in Addis Ababa in late September, 1981, and was able to spend nearly two months in the field.

The great importance of the Middle Awash region lies in the very long sedimentary record with interbedded volcanics that is preserved there — a record that is probably unique in the great extent of time that it covers: from the later Miocene through the whole of the Pliocene, Pleistocene and Holocene, spanning in all some six million years. These sediments lie in the northern part of the Ethiopian section of the Great Rift Valley known as the Afar Depression. It is shaped like a huge, inverted triangle where three major trends of rifting meet and comprise an enormous area of lowland that rarely exceeds several hundred meters in altitude and in the north descends to -100 m. below sea level. The Afar section of the Rift is bounded by fault scarps. To the west and south the escarpments of the Ethiopian and southeast plateaus rise steeply in a series of steps to altitudes of several thousand meters above sea level. To the east, the plateau surface is lower, the bedrock comprising uplifted Miocene and Pliocene flood basalts of the Afar floor. Waters bringing sediments from the plateau to the west became ponded in this structural sink and rapid accumulations of thick fluvial, deltaic and lacustrine sediments took place that date



Bodo hominid cranium. photo: Tim White

from the Miocene to recent times. The oldest sediments are exposed close to the margins of the present basin where the seasonally dry tributary streams or *doras* deposit water and sediments onto the gently-sloping, low-lying, grass- and bush-covered plain through the center of which meanders the Awash River. The exposures of the older sediments occur in typical bandlands topography adjacent to the margins of the Rift and especially on the eastern side of the Awash. The terrain is rough and without roads or tracks but negotiable by four-wheel-drive vehicles. We were fortunate in having good air photo coverage that made it possible for us to identify and map the exposures and pinpoint the localities where we found rich assemblages of fossils and artifacts.

This low-lying area receives only moderate annual rainfall, while mean annual temperatures exceed 25°C; in short, it was very hot and, at first, not a little humid.

The indigenous inhabitants are the Afar, nomadic pastoralists who occupy the country west of the Awash but cross to the east when the flood waters recede to graze their cattle, sheep and camels there. From time to time this brings them into conflict with raiding parties of Esa Somalis from further east and is one reason why every Afar male carries a gun and cartridge belt. We had with us four of these Afar whose responsibility it was to keep watch out for the Esa, who were not, however, in evidence.

This is superb game country and has been a reserve for several years now. We were fortunate in being able to see numbers of oryx and gazelle together with warthog, waterbuck, kudu, cheetah and ostrich. It is also probably the last part of the world where the wild ass survives — a magnificent animal that lives in small herds. Since they are inquisitive creatures,



J. W. K. Harris and giant core at Bodo site.

photo: Desmond Clark

they gave us a number of opportunities of observing them.

All supplies had to be brought in from Addis Ababa to the base camp at Bodo, roughly in the center of the Study Area on the east side of the river. From here we carried out a systematic survey of the sediments exposed in the tributary drainage basins to the north and south.

The sediments, in particular those of the Pliocene and earlier Pleistocene, have been affected by tectonic movements and faulting that sometimes render correlation difficult without detailed geological mapping. Responsible for this mapping was Dr. Martin Williams of Macquarie University, New South Wales, and for the sedimentology Dr. Geteneh Assefa, head of the geology department at the Addis Ababa University. Working with them was Dr. Bob Walter of the Geophysical Laboratory at the University of Toronto who is providing the chronological framework by means of radiometric dating methods, paleomagnetic reversal stratigraphy and identification of interbedded, volcanic marker beds, some of which can be radiometrically dated and will provide the basis for cross-correlation

of sediments over the long distances that have to be covered.

The archeological team consisted of Drs. J.W.K. (Jack) Harris, Hiro Kurashina and myself, together with Berhane Asfaw, Rob Blumenschine and Carole Sussman. The objectives were to survey the exposures east of the Awash for *in situ* assemblages of artifacts and fauna and to investigate the reported occurrences of butchered animal remains with the Acheulean bifaces.

The survey has shown that there is a more or less continuous record of hominid occupation with artifacts from at least 1.5 million years ago up to the end of the Acheulean Industrial Complex. Five sites in the Bodo area and one at Dawaitoli have produced Oldowan artifacts, in some cases associated with faunal remains.

The Acheulean Tradition is very well represented and widespread on the east side of the Awash and one Early Acheulean locality with fauna has been found on the west side. A number of occurrences were discovered where artifacts and fauna are eroding from Middle Pleistocene sands and silts. Most of these are associated with fluvial channel deposits. Stream beds can

now be seen as the favored activity areas for groups of Acheulean hunter-gatherers. We carried out test excavations at four such localities. Two main kinds of assemblages occur: those with handaxes and cleavers — sometimes many, sometimes only three or four — made from large basalt flakes; and others where the artifacts comprise numerous flakes, some retouched as scrapers, but apparently no bifaces. These occurrences represent discrete assemblages of tools and flaking waste that appear to reflect the activities of a single, relatively brief and transitory occupation by hominids. There are, therefore, excellent possibilities for being able to determine how and on what some of these tools may have been used.

One test excavation showed fresh flakes, a core, and artificially fractured bone in a discrete, high density patch in silty sands close to the locality at Bodo where the cranial fragment of *Homo erectus* was found earlier by Tim White. The animals represented consisted of large, medium and small bovids, a small mammal, a canid, crocodile and catfish. This site appears to be a largely undisturbed activity area in a stream bed and to have suffered only minimal resorting before burial. Other assemblages of bones and artifacts in stream sediments are the result of the components having been washed together in the channel.

It is evident that the Acheulean handaxes and cleavers were not made at the places they were used. They received some of the final trimming there but the large primary flakes from which they were made were struck elsewhere, adjacent to the lavas of the rift scarp a few kilometers away, and were then carried to the activity areas. Sometimes huge spheroid cores of lava half a meter in diameter and weighing about 300 kg. were used and three such occurrences were found. These are some of the largest cores known to have been used by prehistoric man and great opportunity exists here for experimental studies in artifact replication and usage, as well as for identifying the source areas of the raw materials. The latter could give an indication of the distances some of these hominid groups may have travelled and of the direction of the movements.

There is no certain evidence that fire was used by early hominids before the time of *Homo erectus* in the cooler, temperate regions of the northern hemisphere. Recently, however, circumstantial evidence at Koobi Fora, Chesowanja, Gadeb and Ethiopia, dating to 1.0–1.5 million years ago, has reopened the question of the antiquity of early hominid control of fire in Africa. The Middle Awash is likely to make a major contribution to this problem since numerous concentrations of burned clay occur in Pliocene and Pleistocene sands, silts and clays. Sometimes stone artifacts and fauna occur in close proximity in the Pleistocene sediments. Experiment and ethnographic observation indicate that the burned clay areas most

probably result from burning tree stumps already under attack by termites. Systematic study may show whether some of these stumps might have been lighted by hominids as a source of fire while they occupied one of their ephemeral camping places.

Unsurpassed opportunities exist in the Middle Awash Study Area for research into early hominids' use of space, their preferred habitats and the way these appear to have changed with time, their dietary habits and preferences, their subsistence strategies and their possibly early and regular use of fire. Research here will go a long way towards helping to answer such questions as what constitutes a hominid kill or butchery site; what were the circumstances under which meat began to form an increasingly significant part of the diet, how much of this came from scavenging, how much from hunting, and to what extent did hunting, particularly big game hunting, become a hominid adaptation during the Middle Pleistocene. The numerous Middle Awash sites, distributed over large expanses of sediments, contain abundant, well-preserved fauna in association with stone artifacts and hominid remains. The Middle Pleistocene occurrences constitute the largest site complex of this nature in Africa and, therefore,

offer a unique opportunity for the resolution of these issues.

Two major discoveries of fossilized vertebrate tracks — those of medium sized ungulates — were made in 1981. The first footprint locality was discovered in Late Miocene (five to six million year old) rocks on the west side of the Awash. The second was an outcrop of a volcanic ash horizon, the Cindery Tuff, at Gamedah on the east side. This ash horizon is the most important marker bed of our Pliocene succession, provisionally dated by the Toronto laboratories at ca. 4.0 (±0.1) million years.

An example of the diversity of fossil vertebrates found in 1981 comes from the newly-discovered limonite stained sands of the Maka area where three days of survey identified the following Pliocene taxa: hominids, monkeys, bovids, equids, elephantids, deinotheres, hippopotamids, carnivores, giraffids, rodents, suids, rhinos, birds, turtles, crocodiles (including eggs) and snakes.

The original "Bodo Man" cranium recovered in 1976 is currently being cleaned and restored. This specimen represents an intermediate between fossils typically called *Homo erectus* and anatomically modern humans. Its absolute age is not yet determined but is estimated to lie in the neighborhood of 200–300,000 years. Our

study of this specimen has identified an interesting series of cut marks on the forehead (frontal bone) and cheek bone (zygomatic). We have used a scanning electron microscope to examine these marks and our findings are clearcut; this hominid was intentionally defleshed (scalped) by other hominid(s) after its death. The marks on the bone bear the unmistakable signature left by the cutting edge of a stone tool.

The Middle Awash Study Area has the potential to contribute data crucial for solving a wide variety of archeological, paleontological and geological problems. There is no other known study area of this size in the world that offers such high possibility for ongoing research. The time depth is great, the fossils are abundant and the rocks are well exposed. The future of paleoanthropological research in the Middle Awash Valley of Ethiopia holds great promise for many years of productive work. An international research team will return there in September, 1982, as our search for more clues to human origins continues.

Dr. Clark, a member of the Leakey Foundation Science and Grants Committee, led the 1981 expedition and will return to Ethiopia this fall. □

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CALENDAR

SEMINAR

September 21, 1982 — Beckman Auditorium, California Institute of Technology, Pasadena, California

L.S.B. Leakey Foundation/World Wildlife Fund—U.S. co-sponsored seminar, "Primates and the Tropical Forest"

RUSSELL MITTERMEIER

September 23, 1982 — Chapman College, Orange, California

MARY LEAKEY

September 25, 1982 — Allen O'Brien Memorial Lecture, Washington, D.C. (by invitation)

October 3, 1982 — Allen O'Brien Memorial Lecture, Natural History Museum, Los Angeles, California

HUGO VAN LAWICK

November 7, 1982 — Emory University, Atlanta, Georgia

November 14, 1982 — University of Long Island, Greenvale, New York

November 18, 1982 — GLAZA (Greater Los Angeles Zoo Association), Los Angeles, California

November 20, 1982 — Seattle Zoological Society, Seattle, Washington

ROGER PAYNE

February 3, 1983 — University of Colorado, Boulder, Colorado

JANE GOODALL

April 22, 1983 — Northern Kentucky University, Highland Heights, Kentucky

April 23, 1983 — Cincinnati Zoo, Ohio

April 25, 1983 — Sweet Briar College, Virginia

May 2, 1983 — Central Washington University, Ellensburg, Washington

May 5, 1983 — Cleveland Museum of Natural History, Ohio

May 6, 1983 — Ohio Wesleyan University, Delaware, Ohio

May 9, 1983 — University of California, San Diego, California

EVENTS

SEPTEMBER 21 SEMINAR

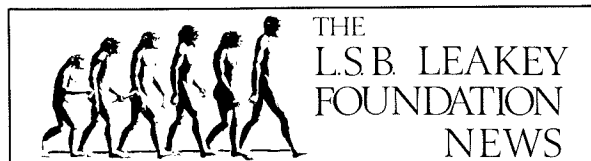
The L.S.B. Leakey Foundation and the World Wildlife Fund—U.S. are co-sponsoring a seminar, "Primates and the Tropical Forest," on September 21 at the Beckman Auditorium at Caltech in Pasadena. The speakers are H.R.H. The Prince Philip, Duke of Edinburgh, John Fleagle, Tom Lovejoy, Russell Mittermeier, Mark Plotkin, Alison Richard and Shirley Strum. The session will begin at 1:30 p.m. and

continue for the afternoon. The tickets are \$35. Those wishing to purchase sponsor tickets for \$135 will receive preferential seating and will be invited to attend a lunch for the scientists at the Caltech Athenaeum before the seminar.

Wild populations of most of the world's 175 living species of nonhuman primates are disappearing rapidly, especially in the tropical forest belt which is the home of more than 90% of the Order Primates. The purpose of this seminar is to highlight the plight of these unique animals, and to emphasize both their intrinsic scientific interest and their economic importance to their closest living relative, the human primate.

BRITISH ROYAL VIEWING

H. M. Queen Elizabeth the Queen Mother has accepted the invitation of Fleur Cowles to be the guest of honor at a private viewing of the Nigerian Art Exhibition at the Royal Academy in London on November 24. Miss Cowles, who heads the English branch of the L.S.B. Leakey Foundation, arranged the event as a Foundation fund raiser. The magnificent exhibition, covering 2,000 years of Nigerian art, has been seen in Los Angeles and New York. Miss Cowles announces that it will tour Europe, including Moscow and Leningrad, after the London engagement. The curator, Dr. Ekpo Eyo, is a member of the Foundation's Science and Grants Committee.



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