

ANTHROQUEST

news of human origins, behavior, and survival

NUMBER 26

THE L.S.B. LEAKEY FOUNDATION NEWS

SUMMER 1983

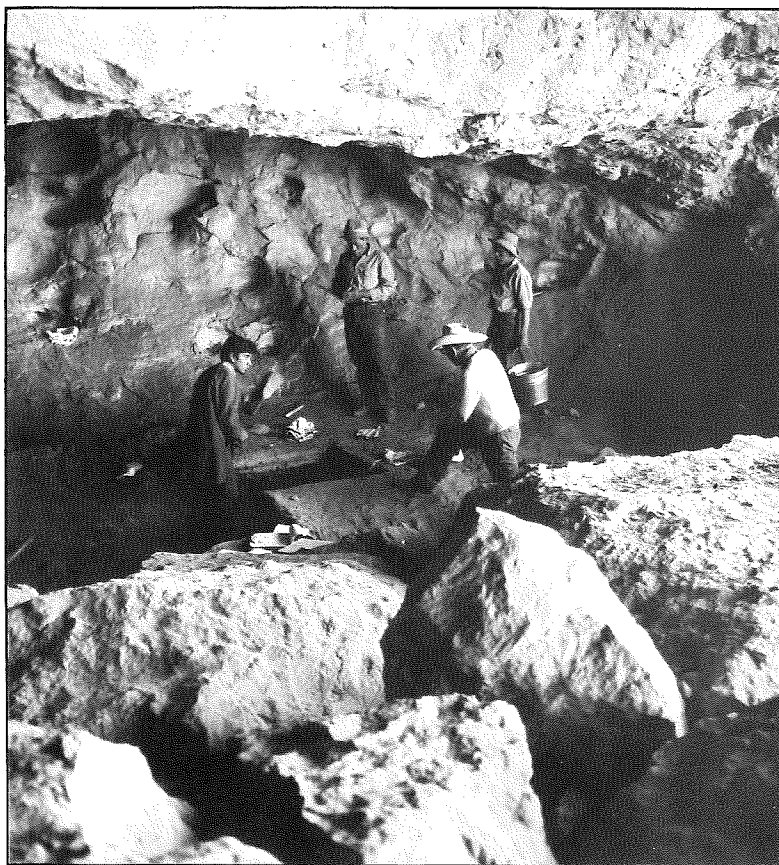
EARLY MAN *OR* EARLY EARLY MAN IN THE NEW WORLD

a controversy

RICHARD S. MACNEISH

Robert S. Peabody Foundation for Archeology, Andover, Massachusetts

Arguments about "how early is early man in the New World" are almost as old as archeology itself is in the New World. At about the same time that John Frere was recognizing the Paleolithic (Acheulian) hand axes in England, Dr. M. W. Dickerson was claiming that a human pelvis from near Natchez, Mississippi, was associated and contemporaneous with mammoth bones that were very old. Both were opposed by "the conservatives" who countered with the argument that these findings could not be old because, on the basis of Bishop Usher's calculations, God did not create the world until 4004 B.C. In the Old World, by the middle of the 19th century, the endeavors of Jacques Boucher de Perthes of France, Pungelly of England and others proved the conservatives were wrong and that indeed there was a Paleolithic of very great antiquity.



Dr. MacNeish (in straw hat) and Inca workmen with 25,000 year old remains in Pikimachay Cave (Flea Cave), Peru.

Not so for the New World, for even though there was a conscious effort made to find a New World Paleolithic (by Putman and Volk of Harvard, the geologist McGee and others), no find was considered acceptable to all anthropologists because of the lack of good archeological contexts, relatively well-dated strata or human remains. In fact, for more than half a century the conservatives seemed to be winning the arguments, in large part due to the efforts of William H. Holmes and Alex Hrdlicka of the U.S. National Museum who shot down, one way or another, every early man claimant. But these conservatives were to lose once again when Jesse Figgins, in 1926, found a fluted projectile point in indisputable association within the ribs of an extinct bison in the Pleistocene deposits near Folsom, New Mexico.

For a while as more and
continued on page 16

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.

OFFICERS OF THE BOARD

Edwin S. Munger, *President*
Lawrence Barker, Jr., *Vice President*
Mrs. John B. Callery, *Secretary*
Coleman Morton, *Treasurer*

BOARD OF TRUSTEES

Gordon P. Getty, *Chairman*
Robert M. Beck, *Vice Chairman*
Mrs. John L. Bradley
Mrs. Elizabeth Brady
Mrs. R. Hugh Caldwell, Jr.
Miss Fleur Cowles
Mrs. Peter Dominick, Jr.
Mrs. Robert Donner
Anne Getty Earhart
Paul T. Guinn
Ed N. Harrison
Hubert R. Hudson
George D. Jagels, Jr.
George Lindsay
The Hon. Robinson McIlvaine
Mrs. Richard W. Muir
Fred Myers
Barbara Newsom
Mrs. Allen O'Brien
Mason Phelps
Dr. John D. Roberts
Mrs. Elmer Schlesinger
Mrs. George M. Seignious II
Jeffrey R. Short, Jr.
Leighton A. Wilkie
Mrs. John Willis
Mrs. Frank M. Woods
Mrs. Robert Wrede

LIFE TRUSTEE

George D. Jagels

SCIENCE AND GRANTS COMMITTEE

Dr. F. Clark Howell, *Chairman*
Dr. Bernard Campbell
Dr. J. Desmond Clark
Harold J. Coolidge
Dr. Irven DeVore
Dr. Ekpo Eyo
Dr. David M. Gates
Dr. Murray Gell-Mann
Dr. Jane Goodall
David A. Hamburg, M.D.
Dr. A. S. Msangi
Dr. Edwin S. Munger
Dr. Richard S. Musangi
Dr. Melvin M. Payne
Phillip V. Tobias, M.D., Ph.D., D.Sc.
Dr. John Van Couvering
Dr. Bernard Vandermeersch
Dr. David Western
Dr. Bogodar Winid
Dr. Richard Wrangham

EMERITUS

Paul MacLean, M.D.
Dr. Sherwood L. Washburn

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

the L.S.B. leakey foundation news

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

AnthroQuest is published by the Foundation as a service to its members. Single copy price, \$1. L.S.B. Leakey Foundation, Foundation Center 1-7, Pasadena, CA 91125. Copyright 1983, L.S.B. Leakey Foundation.

PRESIDENT'S MEMO

At our annual meeting in Berkeley, our Foundation reached the sum of \$1,000,000 in fresh trustees' contributions which become available on a one-to-one basis when matched by our outside contributions.

Lest such a boxcar figure make you hesitate to become a member or Annual Fellow, let me stress that our average grant is \$3,000.

Leakey is fundraising. But it is equally people who use the grants wisely and people who volunteer to make the organization a success. We are extremely pleased to welcome six new trustees who bring a wealth of talent to the Foundation.

Anne Getty Earhart was one of the tireless volunteer workers during a hot, humid summer who made the initial casts for our highly successful Paleoproject for American secondary schools. Subsequently, she spent two years in Paraguay, where her husband headed the Peace Corps. While her husband is doing graduate work at Yale, Anne is living a bicoastal life.

Ambassador "Robby" McIlvaine served with distinction in Dahomey, Guinea, and Kenya. He also brings experience as Director of the African Wildlife Federation. Mrs. McIlvaine drove with her husband from their home in Washington, D.C. for our annual meeting.

Ann Willis was a pioneer in the philanthropic world in establishing the Foundation Center in New York City. Her husband John, a retired officer of Union Carbide, shares her interest in world affairs. Ann was a co-founder of a charitable trust to help villages in Tanzania and serves as Treasurer of World Wildlife-U.S. She hosted the Leakey dinner at the Cosmopolitan Club in New York last January.

George Jagels, Jr. has already proved immensely helpful to the Foundation in the selection of a new word processor and computer for our office records and mailings. Among the vices he occasionally shares with your President is playing Pac-Man and analyzing new patterns.

Philae Dominick and her husband Peter live in Colorado and share their interests in Foundation activities, beginning with the Berkeley meeting. One of Philae's many projects is acting as general contractor for a new office building she is putting up in Denver. But this, she makes clear, is not to interfere with the Dominicks' avidly enjoyed ski vacations.

Last but far from least is Joan Wrede. Her attorney husband Bob joined her for our San Francisco symposium. Joan is a highly effective fundraiser for the International Student Center at UCLA and handled the public relations aspects of Prince Philip's appearance on behalf of the Leakey Foundation. The Wredes are also keen skiers.

While saying hello to six new trustees, we say a regretful retirement goodbye to George Jagels and to Kaye Jamison, two stalwart members of the Executive Committee who have contributed greatly to our success. We also say goodbye to Gayle Gittins who has been elected anthropology graduate of the year at UCLA, where her doctorate is all but completed. Ms. Gittins and Trustee Fran Muir have recently visited Salt Lake City to plan a symposium that Leakey is sponsoring next February.

The 1983-84 season gives promise of much excitement on the lecture front, in research, and in the first Members' Workshop this October. Your involvement and support are invited.

Cordially,

Ned Munger

NEW FELLOWS

The L.S.B. Leakey Foundation is pleased to welcome as new Fellows: Linda Hope, Studio City, California, Brooks Walker, Jr., San Francisco, Ross Lawler, Chico, California, and James Love, San Francisco.

CALENDAR

Dian Fossey Lectures

September 21 — see page 19

September 24 — see page 19

Members' Workshop

October 30 — see page 5

Brain Symposium

January 21-22, 1984 — see page 4

THE CALICO SITE: EARLY HUMANS IN AMERICA

George Carter
Department of Geography
Texas A & M University

In scholarly conflicts opinions are held as if they were Ten Commandments, engraved on stone. When new evidence appears that seems to conflict with the established view, it is necessary to have multiple lines of data all tending to give the same answer before any change is admitted.

In America the view once was that the antiquity of man only amounted to 2000 years. This gave way to 4000 or 5000, and that to 12,000; a figure still defended by some. Meanwhile, the adventurous few are gingerly toying with the 25,000 or even 40,000. New figures now suggest that the real number may be 200,000. This is so revolutionary that it certainly will not be accepted unless several lines of evidence converge on it. This now begins to be the case for the Calico site in the Mojave Desert in California.

It may help to understand these controversies if we look at one that is now more or less settled: the Olduvai Gorge, for example. L.S.B. Leakey thought that the age of the site might be 200,000 years. The first geochemical data came in at 1,750,000 years and was greeted with consternation, derision and utter unbelief. That first date was on lava at the base of the site dated by K/Ar. A cross check was run by fission tracking. This is an entirely separate system for it counts the fission tracks in the minerals. It gave approximately the same data and compelled a drastic revision in all thinking about early humans in Africa. What we have needed in the New World is just this same thing: cross checking dating systems. They must be physical-chemical so that judgment is limited. There must be at least two systems, and they must be unrelated. That is just what we now have for the very important Calico site in the Mojave Desert.

The site has been meticulously excavated. No one disputes that. For a time the broken rock there was challenged as to nature, or man-at-work. Vance Haynes was the major critic who proclaimed that it was just natural rock breakage. Recent studies show that this is not only human breakage of rock, but that the vast majority of the pieces show use wear. This establishes not only the human nature of the breakage, but proves that

this was a habitation site. That leaves the matter of time.

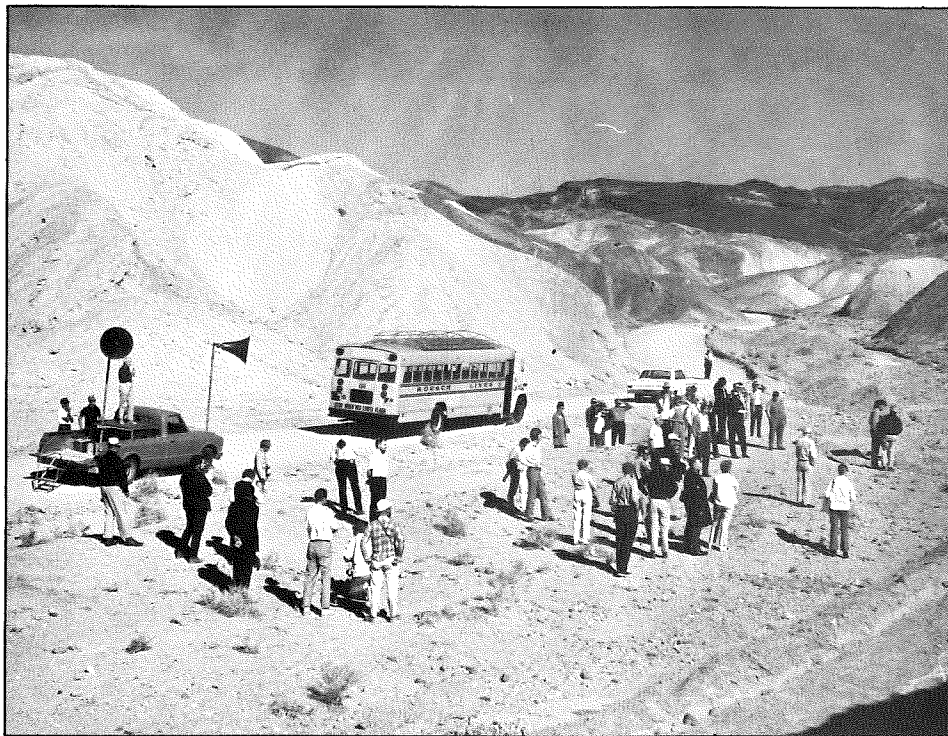
Estimates by geologists and geomorphologists have all agreed that the age of the alluvial fan in which the materials are found is very great. Estimates ran from 200,000 to 1,000,000. Obviously this showed little more than that it was an old feature and that even the minimum age was too great for most views concerning the antiquity of man in America.

The first geochemical data obtained for the site was on calcium carbonate deposited on artifacts near the bottom of the site. The closed system uranium dating indicated a time about 200,000 years ago. The assumption in this system is that the uranium was deposited in the carbonate crust mostly at one time and that time was at the early stage of formation of the calcium carbonate crust. The material was tested to see if the by-products of the breakdown of uranium were present in the proportion expected from the amount of uranium present. When this condition is met, the

system is described as "closed". The date obtained tends to be a minimum date.

Roy Shlemon, an experienced soils — geomorphologist, looked at the ancient soils in the deposit and concurred. The soils indicate very great age. But this is just the kind of dating, based on informed judgment, that is regarded with great suspicion, and so this was not accepted as a confirming date.

Most recently there has been very important work done on the formation of desert varnish. This began with exhaustive investigation of the chemical composition of the dark coating that forms on rocks on old land surfaces in the desert. This work was picked up by Professor Ted Oberlander in the Department of Geography at Berkeley and his student Ron Dorn. They applied electron microscope techniques and found that the desert varnish is a thin skin of clay. In the clay they could see bacteria. It turns out that the bacteria are utilizing the manganese and precipitating it in insoluble form on the rock.



Calico site.



Dr. Louis Leakey.

Review of the literature showed that manganese oxidizing microbes are well known: in pipelines, on rocks in alpine regions, in subsurface ore deposits, in ocean nodules, and in "river varnish."

With this background Ron Dorn was able to grow manganese fixing bacteria in the laboratory and to produce desert varnish under laboratory conditions. This established that the manganese accumulation in desert varnish is due to bacteria under minimal competition from other biota and in a neutral pH environment. From this base they were able to differentiate between desert varnishes, and other varnishes, and to determine that in extreme aridity iron accumulates, while in moderate aridity manganese accumulates. Some of their specimens show alternating layers of iron and manganese, obviously recording climatic changes.

The desert varnish skin accumulates a wide range of chemicals. Some of these tend to accumulate while others tend to leach out. Ratios of the titanium to calcium and potassium can be established. The need then is to calibrate this with some known time sequence. When these ratios were tested against known dated volcanic features (dated by potassium-argon dating) a straight line correlation was obtained: 40,000 K/Ar years equals a cation ration in the desert varnish of 4.0; 100,000 years equals 3.0, and 500,000 years equals 2.0.

When this system was checked in the vicinity of the Calico site, it was found to apply there. And when this dating system was applied to rocks on the surface of the Calico fan they indicated an age of about 100,000 years. Since the alluvial fan at

Calico is extremely eroded, the rocks on its surface must have emerged by erosion — a long process, and then lain on the surface for 100,000 years. The fan must then easily be 200,000 years old, and this tends to confirm the closed system uranium dating of the carbonates within the fan.

Professor Oberlander credits me with focusing his interest on the dating of artifacts by this method. I pointed out to him that arrow points never showed a trace of desert varnish (age up to 2000 years), dart points none (age up to 10,000 years), but from there on back the pre-projectile point materials showed increasingly great desert varnish. I told Oberlander of a site where, on one surface, one material had been quarried over an immense length of time, and where a huge range of desert varnish phenomena could be observed. He visited the site and found it to be just as I had described it. Preliminary work on some of the material suggests ages beyond 100,000 years.

This work is just well underway but it is of explosive importance, for it seemingly will allow the direct dating of ancient artifacts from desert land surfaces. There are tremendous differences from one desert to another. The extreme desert conditions of the Atacama Desert in Chile tend to support iron accumulation rather than manganese. Pictures of rock art and inscriptions from Arabia suggest relatively fast desert varnish formation there. Arabic inscriptions are white, but earlier inscriptions are brown, and the earlier animal figures are as dark as the geological varnish. Obviously local

scales will have to be established, but it is also clear that this can be done.

Resolution of conflicts in evidence will be aided by this new system of dating. At the important Truckhaven quarry site in the Colorado desert a first test of artifacts yielded a date of 100,000 years by desert varnish dating. A skeleton at that site has a protein racemization number that is similar to that of the Yuha man skeleton about 40 miles to the south. The Yuha skeleton by more than one method checks out to 21,000 plus years. The Truckhaven skeleton should date the same, but by C14 dating it seems only to be 5000 years. The rocks of the cairn covering the grave are heavily varnished, suggesting a date surely as great as 20,000 years, and seemingly validating the protein racemization date. The increasing number of dating systems is very promising, for in cases of conflicts of evidence, it is increasingly possible to try a third method to find where the probable error lies.

In the Truckhaven site situation I have suggested a desert varnish test to see what the more probable date is. I am quite certain that it will be much closer to 20,000 than 5,000 years.

The major thing that emerges for America, however, is that for the Calico site, all systems now indicate that this is indeed a very ancient occupation site, with man-made and man-used artifacts in place in an alluvial fan that seems to have a minimal age of about 200,000 years. Difficult as this may be, American archeology is obviously going to have to adjust to this figure, or one fairly close to it, just as the Old World archeologists had to adjust to the startling dates for the Olduvai Gorge. □

BRAIN SYMPOSIUM

A symposium dealing with the human brain and its disorders, sponsored by the Leakey Foundation and the California Institute of Technology, will be held at Caltech's Baxter Auditorium on Saturday and Sunday, January 21-22, 1984.

These Jagels Lectures will be couched in language appropriate for the educated layman — in "Scientific American" terms. Eight distinguished scientists will speak on higher brain function and ways of studying it and on such malfunctions as epilepsy and senility, including the increasingly dangerous epidemic of Alzheimer's Disease.

Members of the Foundation will receive notice of this important symposium through the mail. □

MEMBERS' WORKSHOP

HUMAN BEGINNINGS IN THE NEW WORLD — WHEN? will be the theme discussed at the October 30, 1983, workshop at the Caltech Athenaeum in Pasadena.

The WHEN of human beginnings in the New World (the western hemisphere) is a question on which there is little agreement at present. It will be our privilege to hear the latest data, research and thinking on this controversial subject at this October meeting. For the first time, all members of the Leakey Foundation are invited to attend.

These workshops, or conferences as they were originally called, were first planned to honor L.S.B. Leakey Foundation Fellows and pay tribute to their loyal and generous support. Starting in May, 1975, when more than 150 Fellows from all over the United States joined for a day of lectures at the J. Paul Getty Museum in Malibu, they were popular annual events for several years, always with a panel of distinguished scientists speaking on a variety of subjects. The workshops have been enormously provocative and successful, evoking exceptional enthusiasm in those who attended.

This year for the first time, there will be a common theme on which all the scientists will speak. Much the same format which has been so popular in the past will again be followed, though this meeting opens with a lecture for all who attend. Then the seven or eight scientists will speak to separate groups, members choosing which they wish to hear and having the opportunity to ask questions of the speakers.

Speakers will include anthropologists Lewis R. Binford, University of New Mexico, James M. Adovasio, University of Pittsburg, Gail E. Kennedy, University of California at Los Angeles, C. Vance Haynes, University of Arizona, Nicholas Toth, University of California at Berkeley, chemist Jeffrey L. Bada, Scripps Institute of Oceanography, and archeologist Richard E. Morlan, National Museum of Man at Ottawa, Canada.

At past workshops, it has been difficult to make a choice of which scientists to hear, so interesting all have been. Appended here is a list of suggested reading which can be of value in this regard and also serve to make the lectures of even more interest than they might otherwise be.

Circle October 30 on your calendars as a MUST for it will be a rewarding and

outstanding day. Further information about the program will be mailed to all members of the Foundation.

BIBLIOGRAPHY FOR EARLY MAN IN AMERICA

ARTICLES:

"The Search for the First Americans" by T. Canby. *National Geographic*, Sept. 1979. Pp. 330-363.

"The Discovery of America" by P. Martin. *Science*, 179, 1973. Pp. 969-974.

"Early Man in the New World" by R. MacNeish. *American Scientist*, 63, 1976. Pp. 316-327.

"A Critical Review of Archaeological Evidence Relating to the Antiquity of Human Occupation of the New World" by D. Stanford. *Smithsonian Contributions to Anthropology*, 30, 1982. Pp. 202-218.

BOOKS:

Peopling of the New World, edited by J. Ericson, R. Taylor and R. Berger. Ballena Press Anthropological Papers, No. 23, Los Altos, CA., 1982.

Early Man in America: From a Circum-Pacific Perspective, edited by A. Bryan. Occasional Papers No. 1 of the Dept. of Anthropology, University of Alberta, 1978.

Early Native Americans, edited by D. Browman. Mouton Publishers, The Hague (World Anthropology Series), 1980.

Pre-Llano Cultures of the Americas: Paradoxes and Possibilities, edited by R. Humphrey and D. Stanford. The Anthropological Society of Washington, 1979.

Early Man in the New World, edited by R. Shutier. Sage Publications, Inc., Beverly Hills. Not yet available; projected date of sale, Sept. 1983.

The First American: A Study of North American Archeology, by C. W. Ceram, Harcourt Brace Jovanovich, Inc., New York, 1971. 338 pp.

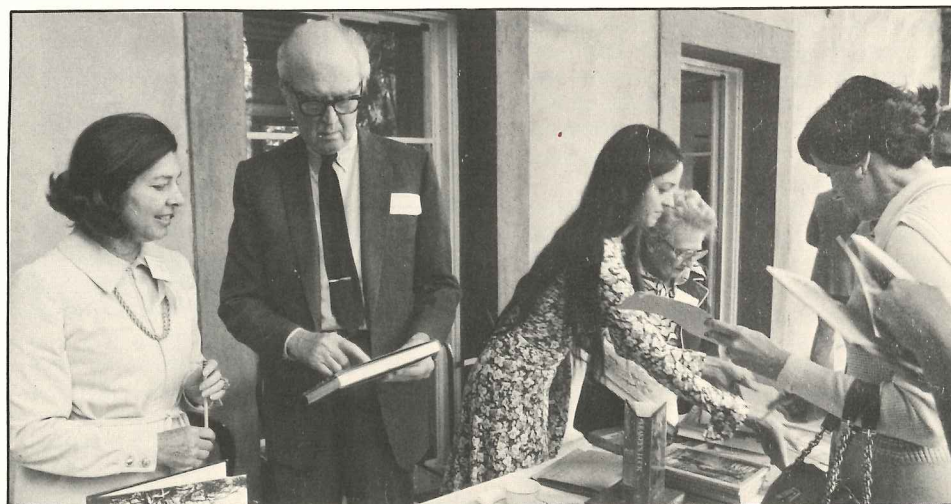
This book does for the archeology of the

North American continent what Ceram's *Gods, Graves and Scholars* did for the history of archeology in Italy, Greece, Egypt and the Near East. Though the book is now over ten years old it still offers a fascinating introduction to the question of who was the first American and when did he get here? An extensive bibliography is included. □

FROM FOLSOM

The Pleistocene sun, shining after these several million years, embraced the birth of *Australopithecus* in Africa, and *Homo neanderthalensis* near Dusseldorf. The night sky sported younger suns then; those stars that watched *Homo erectus* become extinct in Java and Cro-Magnon emerge in France. Cro-Magnon, tearing flesh from bone, hair dribbling blood as he hunkers over meat, is not extinct. The long chains of DNA, helixing toward the axis of that design, bind us to the caves of Cro-Magnon and the Valley of Neanderthal. Java Man resides inside the strands whose sequences overlap with Clovis and Peking. This internal helix has more dimensions than three, where past, present, and future, fit in genetic geometry. Double lines of time in living nuclei enabled Folsom Man to migrate far beyond his memory of volcanic earth and bison, for I am a child of that geography and something in me recognized its home.

B. Sanford Page
Gallina, New Mexico



May, 1977, Workshop at the Caltech Athenaeum, Pasadena. James Stewart and other Leakey Fellows.

IN SEARCH OF MAN

abstracts of talks given at the Leakey Symposium in May of this year

NEW SOUTH AFRICAN DISCOVERIES BEARING ON HOMINID EVOLUTION

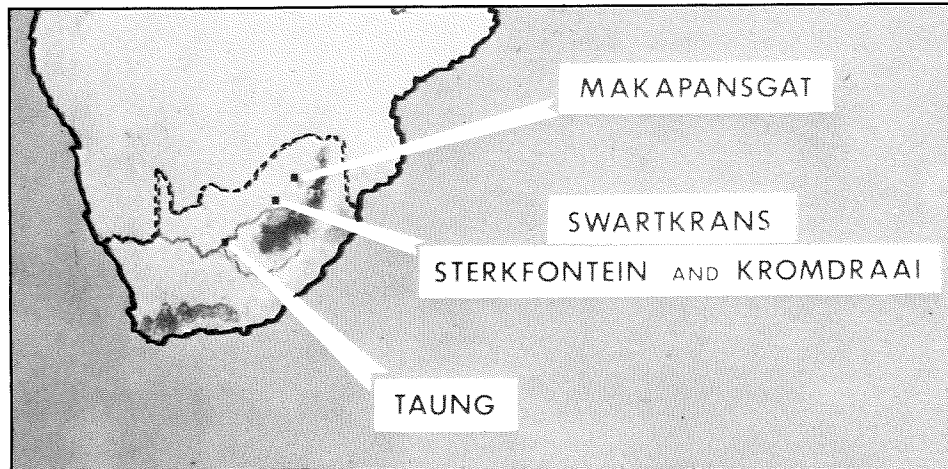
Phillip V. Tobias
Department of Anatomy,
University of the Witwatersrand,
Johannesburg, South Africa

Africa comprises almost a quarter of the earth's habitable land surface. It is the largest land mass to straddle the equator, the tropics and the sub-tropics. Close to three-quarters of its surface lies between the Tropics of Cancer and Capricorn. This immense warm area was the crucible within which there developed one of the great regional faunas of the world; this province of the Animal Kingdom has been known since 1857 as the Ethiopian Faunal Region. The hominids arose, according to the fossil record, within this Ethiopian fauna late in the Miocene or at the beginning of the Pliocene epoch, somewhere between five and seven million years ago.

Fossils representing critical phases of awakening humanity have come from the tropical zone of eastern Africa (between latitudes 11°N and 3°S), mainly in the quarter of a century since 1959.

From sub-tropical latitudes (between 24°S and 27½°S) of southern Africa, major fossil hominid discoveries have been coming to light for close on six years. Apart from such Middle and Upper Pleistocene fossils as the hominids of Hopefield, Florisbad, Cave of Hearths, Klasies River Mouth, Border Cave, Springbok Flats, Boskop, Bushman Rock and Otjiseva, five dolomitic limestone cave deposits have furnished a wealth of Plio-Pleistocene early hominid remains assigned to the australopithecines and other early hominid taxa.

New excavations have been carried on at Kromdraai by E. S. Vrba, at Swartkrans by C. K. Brain and at Sterkfontein by P. V. Tobias and A. R. Hughes. These excavations include 17-year excavation programs at Sterkfontein and Swartkrans near Johannesburg. As a result of these three excavations, the available stockpile of early hominid specimens from South Africa has greatly increased. When the late K. P. Oakley and B. G. Campbell published *Part 1: Africa*, of the *Catalogue of Fossil Hominids* in 1967, the number of specimens listed from these five sites



The five most important South African sites of early hominid discoveries.

was 290. When the second edition was issued a decade later, the number of specimens from these five sites had risen to 408 hominid fossils; today, scarcely six years later, the figure has reached 557 hominid specimens from the same five sites. The detailed breakdown is as follows:

	1967	1977	1983
Kromdraai	8	8	13
Makapansgat	25	26	28
Sterkfontein	96	165	251
Swartkrans	160	208	264
Taung	1	1	1
	290	408	557

These figures refer to the number of specimens positively identified as hominid, not to the number of individuals represented. Most of the new fossils have not yet been studied or described in detail, and a series of investigations is at present under way on the basis of anatomical regions.

Among the more important revelations of the last decade, it is now clear that all four Transvaal dolomitic cave sites contain within their deposits a sequence of strata or members, each of which is separated from the subjacent and superjacent layers by time lapses. Some of these lapses are of such duration as to have permitted substantially different faunas, including hominids, to be sampled in successive members. A situation of this kind is of immense value to the student of human evolution; it is beautifully exemplified by the contents of Members 4 and 5 at Sterkfontein and of

Members 1 and 2 of Swartkrans. For example, Sterkfontein 4 only contains one identified hominid, *Australopithecus africanus*, (of which Sterkfontein has provided the world's largest single assemblage), no stone tools, fauna estimated to equate with East African fauna 2.5–3.0 million years old and indications of somewhat moister conditions. Sterkfontein 5, on the other hand, contains *Homo habilis* and, possibly, *A. robustus*, no signs of *A. africanus*, stone tools in fair numbers, fauna of 1.5–2.0 Myr range and signs of drier, open grassland conditions. As much as 0.5–1.0 Myr might have elided between Sterkfontein 4 and 5.

Such a concept of the limestone cave formation is essentially new and was not evidenced when we started the ongoing programs of work in the mid-1960s. This understanding has enhanced the value of the cave deposits; instead of a virtually continuous sequence of deposition, as in most archeological cave fillings, we have in effect two to six different cave deposits in each site sequence (six at Makapansgat, five at Sterkfontein, two or three at Swartkrans and possibly two at Taung). Conditions of preservation within the caves are generally excellent; thus, we have numbers of relatively intact skulls and, too, we have the only goodly sample of *natural* endocranial casts, such as those of Taung, Sterkfontein and Swartkrans. On the other hand, the disadvantage of the cave deposits in southern Africa is the hardness of the calcified cave earth and the necessarily slow rate of progress.

The long vexed and difficult question of the dating of the deposits has given

way to some reasonable progress of late. Since radio-isotopic dating of the South African sites has not proved possible, faunal dating remains the standby, though it has recently been supplemented by paleomagnetic studies, with singular success at one site so far. The pioneering faunal studies were made by Broom, Wells, Ewer and others, at a time when no radio-isotopic datings of fauna were available from East Africa or elsewhere. Newer faunal analyses by Vrba, Cooke, Maglio, Maier, Harris, White, Delson, Pocock and others have been made in the era when radio-isotopically dated, comparable faunae have become known from elsewhere and, especially, East Africa. Makapansgat has emerged — as Wells had long claimed — as the oldest of the five sites, its Member 3 (with most of that site's australopithecines) being dated to circa 3.0 Myr B.P. This faunal dating, provided recently by Vrba, corroborates a date obtained from the same deposit by Partridge, Brock and McFadden, based upon a good sequence of paleomagnetic determinations from Member 1 through the Member 4 of Makapansgat. The pattern of reversed and normal paleomagnetism sets Member 3 at about 3.0 Myr B.P. Thus Makapansgat 3 is approximately contemporaneous with Hadar on Frank Brown's most recent dating of the latter.

Swartkrans 1, containing *Australopithecus robustus crassidens* (or *A. crassidens* on Clark Howell's reading of the evidence) and early *Homo*, probably *H.*

habilis, is of the order of 2.0 to 1.5 Myr B.P. on faunal grounds. Swartkrans 2 has been found recently to contain not only early *Homo* but also *A. robustus*, at least in the earlier component of this member.

Kromdraai B. East, Member 3, is the stratum to which Vrba's new excavation has related all of the 13 hominid specimens from that site. The fauna identified from that member so far are not especially helpful for dating, as all belong to species with long spans. Vrba has suggested, on the evidence of the hominids themselves, that KBE 3 may be slightly older than Swartkrans 1. Further excavation of fauna from the KBE breccias should narrow the possibilities.

The dating of Taung is still uncertain, but its cercopithecoid fauna seems to be of about 2.0 Myr of age. The layer which yielded the baboons is stratigraphically below — that is, earlier than — that which gave up the hominid; and we have at present no means of knowing what time lapse there was between the two parts of the deposit. Because of the circumstances of the discovery and the excavation, Taung is one area where the dating of the fauna (or faunae — since more than one cave deposit is involved) will not automatically provide a dating for the hominid.

Sterkfontein 5, which has long been known to contain stone implements of advanced Oldowan or early Acheulian facies, has at last yielded the identity of the probable toolmaker. In 1976, a par-

tially *in situ* cranium (Stw 53) of *H. habilis* was found by A. R. Hughes in Member 5 deposits. Thus, we have at Sterkfontein a very fine superposition of Member 5, with stone tools, *H. habilis* and, probably, *A. robustus*, overlying a much older layer, Member 4, with no stone tools and only *A. africanus*. The lapse of time elided between these two members may be as great as 0.5–1.0 Myr.

Both at Sterkfontein and Makapansgat, fossil-bearing members underlie and antedate the *A. africanus*-rich members of the respective formations. It is likely that, before long, hominids will be found in these earlier members, probably well over 3.0 Myr in age.

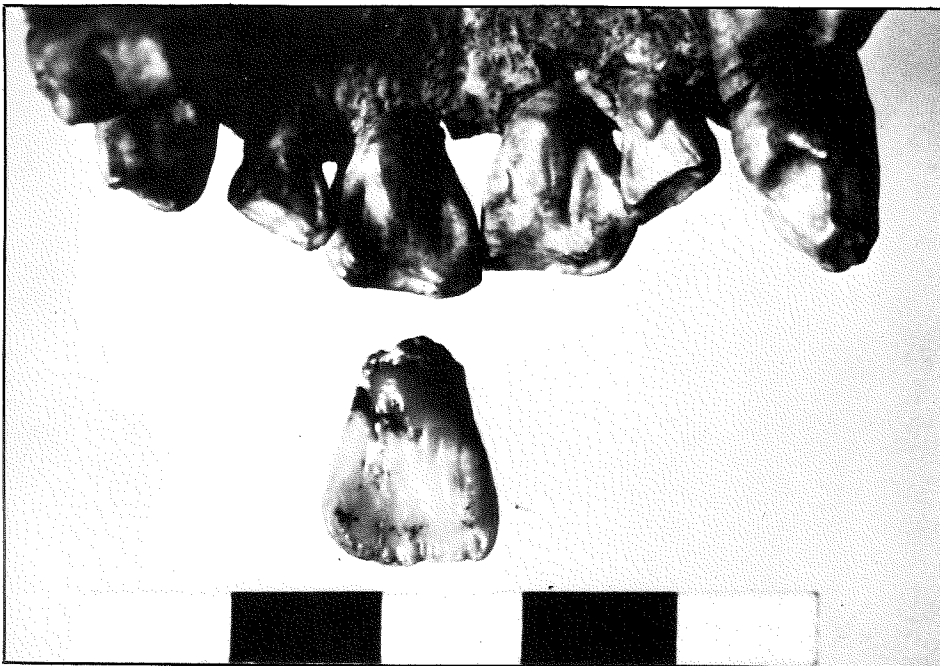
THE ROOTS OF SOCIAL ORGANIZATION

Richard Wrangham
University of Michigan, Ann Arbor

For anyone concerned with human origins there are two reasons for studying the behavior of the great apes. Both are important, but because they have different implications it is vital not to confuse them. The first is the one that seizes us with instant excitement, the discovery of human characteristics in what apes actually do. Varied tool use, complex political alliances, incipient food sharing, laughter, infanticide, aggressive raiding — these and many other ape behaviors help define who we are. They show us which apparently human traits have pre-human histories, and they set us wondering how much of human behavior has its roots in a time before language. They emphasize that we are not so special as we once thought, and they give us fertile ground for imagining the kind of behavior our distant ancestors may have shown. This search for human characteristics has been the major success story from the ape studies of the last twenty-five years.

But as we learn more about apes, the second reason becomes even more compelling than the first. It is to find out how behavior works: how does it develop, why is it different in closely related species, who does it benefit, why is it there? This is a harder problem than merely describing what happens, but by pursuing it we can not only give ourselves a basis for reconstructing the behavior of fossil species, but also make sense of human behavior.

Consider, for example, the aggressive raiding of chimpanzees. Sometimes described as territorial behavior, or sometimes as war, it is actually neither. It involves male parties seeking opportunities to attack and wound members of neighboring communities. It is not restricted to the normal "community range" and hostilities need not be mutual. What is extraordinary about it is its rarity



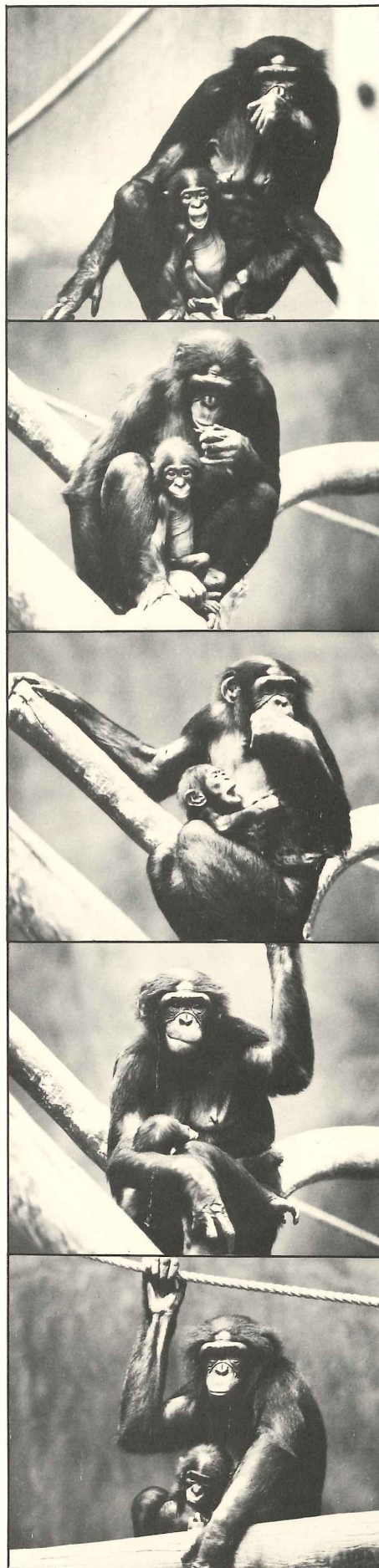
A very broad upper central incisor of *Australopithecus africanus* from Sterkfontein (below) compared with the upper central incisor of a maxilla from Hadar (above). Although Johanson and White have held that broad upper central incisors are one of the diagnostic criteria of their proposed species *A. afarensis*, this feature clearly does not distinguish between the Hadar hominid and *A. africanus*. The author has found that the other supposed diagnostic hallmarks of *A. afarensis* do not, in fact, differentiate the Hadar fossils from *A. africanus* of the Transvaal and he has proposed therefore that the Hadar fossils belonged to the same species as the Transvaal fossils which, by priority, should be called *Australopithecus africanus*. The East African specimens of Hadar may represent simply a different geographical subspecies of *A. africanus*.

in the animal kingdom. No other animal is known to seek opportunities to launch gang attacks with the intention of physically damaging members of an adjacent social group. Why does this behavior occur in chimpanzees and people, who are so closely related, and not elsewhere?

At present we can only guess because we know too little about chimpanzees. Though aggressive raiding is known from Jane Goodall's studies at Gombe and apparently occurs among the Mahale chimpanzees studied by Toshisada Nishida, it may not happen everywhere; more studies are needed before we can define the conditions which set it off. This means that we cannot yet say whether four to five million years ago our ancestors gathered to stalk and attack conspecifics. Here as for other behaviors our ability to reconstruct the past is limited by our understanding of the present.

Already, however, ape behavior is beginning to make sense to us, based on comparisons of the living great apes. A survey of orangutans, gorillas, and chimpanzees reveals vulnerability to attacks by conspecifics as a common problem. The most frequent type of mating among orangutans, for instance, is one forced on the unwilling, struggling female by a young male. Gorilla mothers can lose their offspring to sudden attacks by strange males. And lone chimpanzees are vulnerable to raiding parties. In each case the best defence is to form a bond. Oestrous orangutans who travel with dominant adult males are protected from sexual assaults. A gorilla mother with an infant stays particularly close to the infant's father, who can provide effective protection if he successfully intimidates other males. And male chimpanzees gather into large groups whenever they can. The roots of ape social organization seem to lie in the vulnerability of solitude. Lone or poorly protected individuals are prey to the competitive strategies of others.

Why, then, don't apes travel in permanent large groups, where individuals could rely on each other for protection against outsiders? Gorillas, of course, do. Each breeding female faithfully follows her chosen male, forsaking him only when another male shows evidence of being a more powerful protector. But orangutans and chimpanzees, it seems, can't normally afford the economic costs of group travel. Rehabilitant orangs, for example, are friendly and sociable as long as they are given sufficient food by people, yet as soon as they are forced to find their own supplies, they forage on their own and the bonds break up. Similarly chimpanzees travel in large parties when food is abundant, but in seasons of scarcity they behave more like orangs, wandering alone for much of the time. If social bonds emerge from vulnerability, the ultimate



Pygmy chimpanzees.

cause of vulnerability is a dispersed food supply, forcing animals to feed alone.

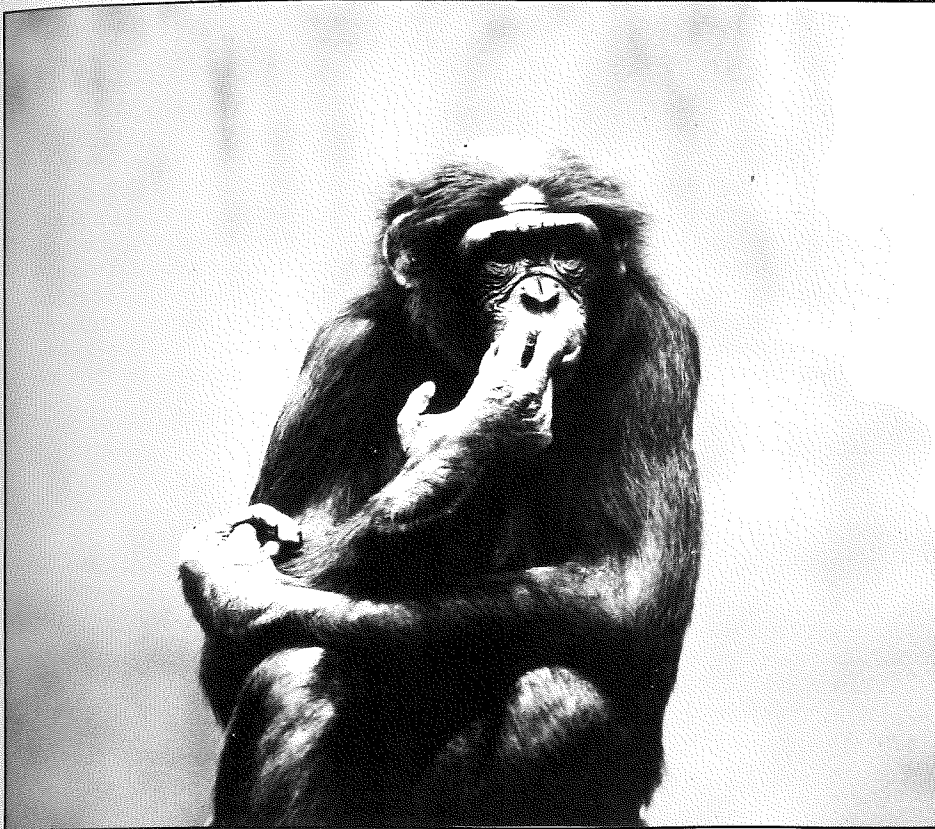
What does this mean for the reconstruction of hominid behavior? First and foremost, we need to know what our ancestors ate and how it was distributed. Only then can we reasonably infer what kind of groups they lived in, how vulnerable they were to attacks by neighbors, and hence what kind of bonds they formed. This is one of the major challenges for the study of human origins, and it is not an easy one. Not only must we find out what our ancestors were capable of eating, we must also consider what they were able to eat, given the presence of competitors.

This is shown by the fourth great ape, the bonobo or pygmy chimpanzee. The bonobo is so similar to the chimpanzee in size and morphology that it was not recognized as a separate species for several years after its discovery. Like the chimpanzee it inhabits the forests of the Zaire Basin, but each species lives in its own part — chimpanzees to the north of the winding River Zaire, bonobos to the south. Living in such similar habitats, do these species have similar behavior?

In some ways they do, but in several remarkable traits they differ. Most importantly, the studies of Noel and Alison Badrian, Randall Sussman, Takayoshi Kano and Suehisa Kuroda show that bonobos live in groups twice as big as those of chimpanzees, even when population density is the same. Why don't bonobos forage alone when food is scarce, as chimpanzees do? The answer looks simple and surprising. When the trees and vines lose their abundant fruits, bonobos turn to eating fruits and parts of ground-living plants. These foods, chiefly species of *Marantaceae* and *Zingiberaceae*, occur in patches big enough to support large groups. South of the River Zaire, they allow bonobos to be more sociable than chimpanzees. But on the north bank, they are eaten not only by chimpanzees but also by a species not found in the range of bonobos — the gorilla. Apparently because these are the main foods of lowland gorillas, the chimpanzee is forced to turn to other foods, found in smaller patches, and hence to live in smaller groups than bonobos. In a similar way, we need to know about the food competitors of our ancestors before we can establish their foraging patterns.

Further study of apes in different areas is urgently needed to test ideas such as this. It is a dreadful irony that just as we stand on the threshold of understanding the variation within and between ape societies, the habitats of wild apes are threatened with eradication. If we are to capitalize on the pioneering ape studies of the 1960s and 1970s, we must establish a series of new study sites to explore the way ape behavior varies in different habitats. But time is short. Today's apes are tomorrow's ghosts.

photos: Russell Mittermeier



Tomorrow's ghost.

photo: Russell Mittermeier

HUMAN NATURE

Sherwood L. Washburn
Professor of Anthropology Emeritus
University of California, Berkeley

Sometimes the behavior of other animals, the fossils, and the stone tools may seem remote. Even our closest living relatives have been separated from us by many millions of years. The human fossil record stretches back four million years, and the earliest stone tools are at least two million years old. It is these events, so long ago and far away, which have forged our biology, our human nature.

Rhinelanders tell us that some understanding of human nature is essential for the analysis of history, politics, ethics, values, and art. Far from being remote, the events of our evolution give us insights into the understanding of our behavior. For better or worse, we are the living fossils; our nature is a summary of the evolutionary events of the last few million years.

We assume we understand our nature, yet philosophers have argued that human beings are inherently good, but are debased by evil customs, or that humans are evil and must be held in check by customs. Such discussions have continued almost without regard to evolution or biology. I think that the study of these

subjects may alert us to some of the dimensions of human existence. I do not claim that evolutionary studies will give final answers to the question of human nature, only that such investigations will alert us to new problems and help us to see unsuspected facts and biases.

It is because of our nature that I can talk and you can sit and listen. If we were chimpanzees, I could not talk and you would not be sitting still. In fact, if the room were filled with some hundreds of chimpanzees, many of them in heat, there would be more chaos than any of us have ever witnessed.

The mere facts of talking and calmly sitting show an important part of our human nature, shared with no other animals.

I want to suggest that the fossil record and the study of primitive behavior show that human beings are creative, social, and skillful. All humans share these basic abilities which are products of the evolution of the species. The development of skills requires a large amount of repetition and this is guaranteed by play and the pleasure of doing. Human beings make great efforts to learn to walk, to talk, to be social. This general human nature, the biology of our species, is modified by the learning in different cultures. The human brain makes it possible to learn to speak, and the basic biology makes it easy to learn any language. And, in addition to learning the first language, humans can easily learn a

second language *if* they see why learning a second language is useful.

The amount that motivated humans will learn is most usefully shown by looking at the ways of life of peoples who had no schools. People learned religions, often more complicated than ours; they learned intricate social systems; they learned necessary skills; they knew the local plants and animals. The desire of children to do what adults do is very strong.

Our educational system is based on an entirely different view of human nature, from the one just outlined. The movement of back-to-basics assumed that the people being educated do not want to learn, and that the primary key to the schools' problems is more discipline. Surrounded by examples of people learning more than one language without difficulty, American schools succeed in discouraging most pupils from learning languages. School subjects are made hard to keep up the standards, yet we know that human beings thrive on encouragement and success.

One way of changing the education system is by encouraging peer teaching, a method which has been tried and which works. In college I have tried letting seniors teach freshmen. Those doing the teaching soon learn that they have to master the subject far more thoroughly to teach than just to pass a course.

Another change easily made is the use of the case system. Cases can be developed from the issues before the country — those involving science, history, the arts. This would give far greater scope for teacher and pupil to discuss, write, and discover why they are learning.

The problems in our schools do not stem from lazy pupils and dull teachers. They are rooted in the educational system itself, a system based on a faulty view of human nature. Humans will work hard if they understand why they are learning and are given social reward for success. With its roots in the comparison of cultures, in archeology and the fossils, in the behavior of the nonhuman primates, anthropology is in a good position to see how primates learn and to suggest major modifications in the schools. □

THANKS

The Leakey Foundation is heavily dependent on volunteers to manage its many programs. In this issue we particularly wish to thank Applied Management Systems Inc., Box 1504, South Pasadena, CA 91030, 213-682-2452, for its thorough analysis of the Foundation's computer needs and recommendations. These were made *pro bono publico*. Do you know a local attorney, who would be willing to volunteer for occasional small tasks for the Foundation? □

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

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

GRANT SPOTLIGHT

The L.S.B. Leakey Foundation supports research related to human origins, behavior and survival. Priority is given to studies in the areas of human paleontology, archeology and environmental studies of the Miocene, Pliocene and Pleistocene; into the behavior of the Great Apes and other Old World Primate species; and into the ecology and adaptation of living hunter-gatherers. Eligibility is limited to applicants who are doctoral candidates or engaged in postdoctoral research. Potential applicants are encouraged to submit a Petition for Grant Application. On invitation of the Science and Grants Committee, those with projects falling within the range of priorities of the Foundation will be asked to submit a formal application. Deadlines for submission of the formal application are: March 15, June 1, Sept. 1 and Dec. 1.

For further information and application forms contact the Leakey Foundation, Foundation Center 1-7, Pasadena, CA 91125.

Naama Goren \$2,000 needed

THE ACHEULIAN INDUSTRY OF BEREKHAT-RAM AND ITS GEOCHRONOLOGICAL POSITION

Earlier field and laboratory research on the Acheulian site of Berekhat-Ram has indicated the importance of continuing work at this locality and surveying for other prehistoric sites in the area. This work will lead to a better understanding of the paleoenvironmental and cultural relationships between various Acheulian cultures in the northern Golan Heights. Dr. Goren is an Israeli.

David P. Watts \$5,000 needed

ECOLOGY OF THE MOUNTAIN GORILLA SOCIAL SYSTEM

Mr. Watts will collect data concerning the habitat use pattern, feeding ecology and intergroup relations of mountain gorillas in the Karisoke Study Centre, Rwanda. Information on the distribution and abundance of gorilla plant resources will be used in combination with demographic data to test hypotheses on the evolution of polygyny.

Lynne Alison Schepartz \$1,500 needed

THE EVOLUTIONARY DEVELOPMENT OF EAST AFRICAN REGIONAL MORPHOLOGICAL DIFFERENCES

The goal of this research is to test the hypothesis that regional differences in human skeletal morphology increase substantially through the later Pleistocene and Holocene times in East Africa and that these increasing differences are related to the appearance of different adaptive subsistence patterns in populations.

Nadine Ruth Peacock \$2,950 needed

OVULATORY PROFILES OF INFERTILE WOMEN IN THE ITURI FOREST, ZAIRE

Analysis of demographic data collected on Efe Pygmies and Lese agriculturalists in the Ituri Forest of Zaire has confirmed the existence of widespread infertility among women of both groups. Gonorrhoea is suspected as a causative agent, but until now it has not been feasible to clinically investigate this and other possibilities. However, a technique has been developed for isolating gonadal steroids from saliva, permitting the construction of an "ovulatory profile" for each subject. This grant will support a trip to the Ituri to collect saliva samples from thirty Efe and thirty Lese women. Anthropometric and life history data will also be collected during this visit.

Christiane Denys \$3,500 needed

PALEOECOLOGY OF LAETOLI-OLDUVAI RODENT ASSEMBLAGES

The aim of this project is to establish complete microvertebrate assemblages from levels of the Laetoli and Olduvai sites that remain undocumented. This will permit tabulation of frequencies of skeletal elements and determination of associations at each locality. Detailed paleoecological and taphonomic studies are planned.

Wayne R. McGuire \$2,000 needed

MALE PARENTAL CARE IN THE MOUNTAIN GORILLA

This research will describe the pattern of silverback male-immature interactions during rest periods and travel-feed periods in order to determine preferences of certain immatures and to specify how male parental care becomes divisible or depreciable in certain social settings. Three groups of mountain gorillas (*Gorilla gorilla beringei*) will be compared. This is the only great ape to exhibit male parental care and investigation of this aspect of social life will further our understanding of the role of male parental care in human evolution.

Kim Hill and Hillard Kaplan \$3,660 needed

MANU RIVER HUNTER-GATHERERS

This grant will fund initial exploratory research on groups of hunter-gatherers in Manu National Park, Peru. The foragers of the area have yet to come in contact with western civilization, making this an ideal situation for studying relatively unaltered hunting and gathering. The research has four main goals: 1) to determine the cultural, linguistic and demographic affiliation of this newly discovered people; 2) to verify that they are truly hunter-gatherers; 3) to determine the size and number of closely related groups; and 4) to assess the possibilities for future in-depth research.

Francis Van Noten \$3,000 needed

THE KAPTHURIAN PROJECT, BARINGO, KENYA

Excavation will continue on a site near the top of a formation containing a rich fossil-bearing horizon which has yielded remains of *Homo erectus*.

R. E. Taylor \$2,486 needed

HEMS RADIOCARBON DETERMINATION OF PLEISTOCENE BONE FROM STRATIFIED SITES

Dr. Taylor will visit institutions in South Africa which house collections of bone samples which will be used in a NSF funded project to refine the C14 dates. The goal is a better understanding of the temporal relationships among Late Pleistocene hominids.

H. S. Green \$1,500 needed

THE EARLIEST HUMAN SETTLEMENT OF WALES

This funding will provide continued excavation of Pontnewydd Cave, Wales. Past seasons have yielded an Acheulian industry dating to circa 250,000 years ago. A human tooth and fragment of maxilla with teeth comparable to Neanderthal fossils have also been found with a Paleolithic industry. Excavation will also be done at nearby Cefn Cave.

T. Harrison \$2,622 needed

NEW FOSSIL PRIMATES FROM THE MIOCENE OF KENYA

Dr. Harrison's research will focus on the taxonomic and phylogenetic relationships of the fossil primates from Maboko Island in an investigation of the origins and early evolutionary development of the *Cercopithecoidea* and *Hominoidea*. Specimens collected by Dr. M. Pickford and housed at the National Museum of Kenya will provide the data base. New primate specimens will be described in detail and their taxonomic affinities and phylogenetic relationships critically assessed in light of the existing primate fossil data.

J. J. Jaeger \$5,000 needed

EARLY MAN IN NORTHWEST AFRICA AND MIDDLE EAST

This grant will fund a reinvestigation of the classical Ternifine locality in Algeria and the dating of microvertebrates of the Erq El Ahmar Formation in the Jordan Valley. Excavations will be made to determine more precisely the location of fossiliferous layers, to collect samples for sedimentological, geochemical and dating purposes and to screen for microvertebrates.

Robert Blumenschine \$4,500 needed

ECOLOGICAL OPPORTUNITIES AND CONSTRAINTS ON SCAVENGING BY PREHISTORIC HOMINIDS

This study will quantify the ecological opportunities and constraints on scavenging from larger herbivore carcasses in order to construct an optimization model of scavenging by prehistoric hominids. The model will engender predictions on the profitability and regularity of scavenging in East African savanna habitats and on carcasses of different sizes.

Elizabeth Ann Williamson \$2,880 needed

COMPARATIVE ECOLOGY OF WESTERN LOWLAND GORILLA AND CHIMPANZEE IN GABON

The aims of this project are to conduct a comparative study of the behavioral ecology of the western lowland gorilla and the chimpanzee in Gabon, to investigate how each species influences the behavior and ecology of the other in sympatric populations and to focus attention on the feeding ecology and basic social organization of these apes. There has been very little research in this area and this project will make it possible to assess key differences as well as similarities which can be used in constructing models of human evolution.

P. Y. Sondaar \$2,500 needed

THE PLEISTOCENE MAN OF CORBEDDU CAVE

Deer bones showing traces of human modification have been found in Corbeddu Cave, Sardinia, Italy. It is not yet certain whether the cave was used as a workshop or whether the finds reflect ceremonial activities. This grant is for a preliminary study.

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:

BALDWIN GRANTS AWARDED

Amal Abubakr Mohamed,

a Sudanese doctoral candidate, will receive a Baldwin grant of \$2,200 in order to reexamine Paleolithic materials from the Nubian section of the Nile Valley which are part of the data salvaged in the construction of the Aswan Dam. Ms. Mohamed hopes to do a detailed study of intersite variability in order to demonstrate that part of it reflects temporal changes while other aspects reflect functional differences.

Kodzo Gavua,

a graduate student from Ghana, has been granted \$1,500 to study collections at the Institute of West African Studies, Birmingham University, and to carry on four months of field work in Ghana. Mr. Gavua's interest is in the agriculture and agricultural village foundations of his country.

James A. Ssemakula,

a Ugandan, has been awarded a \$5,000 Baldwin grant to enter a doctoral program in the Department of Ecology and Evolution at State University of New York, Stonybrook. He has worked with Dr. David Western as a research associate at the New York Zoological Society.

FIELD REPORTS

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

LIZARDS AND SNAKES OF OLDUVAI GORGE, KENYA

Peter A. Meylan
Florida State Museum
University of Florida

The squamate fauna of Olduvai Gorge, Beds I and II, is large and diverse. My examination of all the fossilized squamate remains from there indicates that at least seventeen genera are present. Five are lizards, representing four different families; the remainder include four different families of snakes. There is no evidence to suggest that the habitat from which these specimens came was other than savanna of medium altitude. However, more complete identification of the Olduvai squamates will be necessary before their full potential as paleoecological indicators can be realized.

The lizard families represented in the Olduvai material include monitor lizards (*Varanidae*), true chameleons (*Chamaeleonidae*), spiny lizards (*Agamidae*) and skinks (*Scincidae*). The monitor lizard, *Varanus*, is represented by only three vertebrae. It has not yet been possible to assign this material to species. There are two species of chameleons in the fauna. The larger is represented by a single dentary and can be assigned to the *C. dilepis* species group. The smaller, a member of *C. bitaeniatus*, is common throughout Bed I. The agamid lizards are represented by two species; the larger and more abundant is identical to modern *Agama cyanogaster*, a large arboreal savanna dweller which occurs in the vicinity of Olduvai Gorge today. Four different skinks are present in the fauna. Three are members of the genus *Mabuya*; the fourth appears to be *Riopa*, a genus whose members have reduced limbs and tend to use undulatory locomotion similar to that of snakes. *Mabuya* is the common genus of skinks found throughout Africa. It is interesting that there are no gekkonid or lacertid lizards in the fauna.

The twelve genera of snakes from Olduvai are members of the *Boidae*, *Colubridae*, *Viperidae* and *Elapidae*. The *Boidae* are represented by a single species, *Python sebae*, the African python. The colubrids include at least eight genera. Three racers are tentatively identified as *Psammophis sibilans*, *P. subtaeniatus* and *P. tritaeniatus*. Constricting colubrids include *Boaedon*, *Rhamphiophis* and

Scaphiophis. The egg-laying snake, *Dasy-peltis*, occurs throughout Bed I and the highly aquatic colubrid genus *Grayia* is also present but rare.

Poisonous snakes are represented by two viperids and an elapid. The larger viper is known only from Olduvai Gorge and has been described as *Bitis olduvaiensis* by Rage (1973). The elapid is a spitting cobra, *Naja nigricollis*.

The paleoenvironment indicated by the squamates from Olduvai is one of open, dry savanna. Trees were undoubtedly present, as indicated by the abundance of the arboreal lizard, *Agama cyanogaster* as well as the snakes *Psammophis sibilans*, which climbs to bask, and *Dasy-peltis*, which climbs to raid bird nests. Six taxa (*Python*, *Dasy-peltis*, *Duberria*, *Grayia*, *Psammophis sibilans* and *Naja nigricollis*) favor well-watered environments and their presence in the fauna indicates a permanent water source close at hand. All of the species identified thus far are known to occur up to altitudes of 1200 m or more. Two prefer higher altitudes: *Psammophylax tritaeniatus* usually occurs above 100 m and *Duberria lutrix* is rare below 1500 m. *Scaphiophis*, *Rhamphiophis* and *Riopa* are associated with sandy soils in which they can burrow.

Thus the Olduvai squamate fauna suggests a gradient of wet-to-dry habitats. Some species are lake and lake-margin inhabitants, while others prefer well-drained uplands. Complete examination of the material should reveal if the gradient was spatial, temporal or both.

This project is being conducted under the auspices of the National Museum of Kenya, Richard Leakey, Director. It is supported by the Leakey Foundation and the Florida State Museum.

FOSSIL MONKEY SKELETONS FROM NORTHERN KENYA

Mark G. Birchette
The Johns Hopkins University
School of Medicine, Baltimore

The L.S.B. Leakey Foundation has helped to support my research on the evolution of nonhuman primate skeletal adaptations and enabled me to spend two months in Kenya examining original

specimens of fossil old world monkeys. While popular interest has been focused on the impressive discoveries of hominids from famous East African fossil sites in Kenya, Ethiopia and Tanzania, the other primate fauna recovered from these areas also deserves our enthusiastic attention. The study of monkey postcrania (i.e., those parts of the skeleton excluding the skull) helps us to refine our ideas about processes influencing primate body "architecture" and allows us to develop widely applicable theories that relate changes in skeletal design to locomotor behavior.

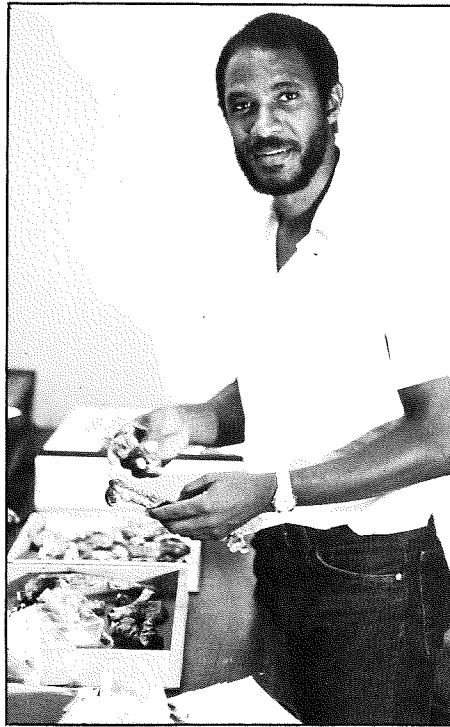
I spent eight weeks in Nairobi as a Research Associate of the Kenya National Museum, continuing work on a project I began in 1981 to describe new monkey postcranial specimens from Koobi Fora, east of Lake Turkana, and to assess the functional implications of their morphology in terms of the locomotor and postural behavior of the represented species. My "fieldwork" was conducted entirely in the Paleontology laboratory of the L.S.B. Leakey Institute of the KNM. Much of my time was spent sorting and examining hundreds of fossil monkey limbs, first noting the various anatomical traits of material that was clearly identifiable to species and genus because of its clear association with diagnostic skulls and teeth. I took a series of measurements on each specimen to establish the necessary data base for more thorough quantitative studies currently in progress. Although this aspect of research is, to be honest, more often tedious than stimulating, in one respect it is relatively straightforward and satisfying to the extent that it lays the necessary foundation for the construction of larger theoretical issues. A more exciting — and more challenging — aspect of my work was to examine the vast collection of monkey postcrania that previously was identifiable only as "monkey" (in the absence of associated cranial material) and to try to put these specimens into more precise taxonomic groups solely on the basis of limb morphology.

Anyone who has worked extensively with old world monkey skeletons knows that even among modern forms it can be extremely difficult to categorize specimens using isolated limb elements; this is true because, in certain respects, cercopithecoid skeletons show considerable morphological variability that is not restricted along taxonomic lines. The problems of taxonomic assignment are of course compounded when dealing with fossils, since the material is frequently fragmentary and/or distorted, the ranges of variability for a given feature are difficult to establish, and the amount of taxonomic information seemingly varies with the particular skeletal element under consideration. Although many of the fossil limb bones I examined were too incomplete to place in a species group, I was able in several instances to make

provisional identifications at the generic level based on my preliminary work. Once I have completed the quantitative analysis to determine if additional, more subtle morphological features are diagnostic of certain taxa, then I will use this information to increase the percentage of identifiable limb elements. Equally important, I could exclude certain fossil postcranial specimens from specific groups depending on the presence or absence of particular morphological traits. The advantages of clearly delimiting which animals were represented in the faunal assemblage of a fossil site are obvious, and my work on the postcranial evidence will assist in the accurate determination of primate faunal composition.

During the past year my studies have focused primarily on the hindlimb of Plio-Pleistocene monkeys from Northern Kenya, including the bones of a new genus of colobine monkey, *Rhinocolobus turkanaensis*, recently named by Dr. Meave Leakey. This large monkey will doubtless prove very interesting when I have finished my analysis of its postcranial skeleton; my preliminary results indicate that although its shoulder and elbow regions show compelling evidence of locomotor adaptations for life in the trees, there are some peculiar anatomical traits of its knee, ankle and foot that do not parallel the morphology of any known relatives, modern or fossil. For example, the proximal tibia of *Rhinocolobus* is characterized by an extraordinarily prominent posterior intercondylar tubercle, a condition not seen in other cercopithecids. In addition, there is an obvious, well-defined contact facet on the distal end of the tibial shaft for articulation with the fibula, a trait which certainly is uncharacteristic of African colobines and may well be unusual for old world monkeys as a group. These features and particular details of its tarsal (foot) bones, suggest that there was a requirement for increased stability between the major joints of the hindlimb, with a possible concomitant sacrifice of limb mobility. Whether these morphological peculiarities are related to the presumed large body size of *Rhinocolobus* is uncertain and is one question I will attempt to answer in the near future.

Another interesting case is that of a monkey named *Cercopithecoides williamsi*. This cercopithecoid has been known from skulls and teeth for close to thirty-five years, but only recently has clearly-associated postcranial material been recovered. *Cercopithecoides* is remarkable because although it is clearly a colobine (i.e., "leaf-eating") monkey on the basis of cranial and dental morphology (and one therefore might have reasonably assumed it was geared primarily to life in the trees), its postcranial skeleton shows unequivocal evidence of a highly terrestrial locomotor adaptation. The hindlimb of *C. williamsi* corroborates



Dr. Mark Birchette working in the National Museum of Kenya; April, 1983.

what I determined when I studied the forelimb: in terms of skeletal design, this extinct monkey was very similar in its locomotor behavior to ground-living baboons.

In addition to the work I did at the Kenya National Museum, I visited The British Museum of Natural History and the Anthropological Institute of the University of Zurich, as well as the Smithsonian Institution and the American Museum of Natural History, to collect data on the skeletal morphology of modern cercopithecids. I'm looking forward to finishing the quantitative studies on the fossil and modern samples, and am optimistic that my research will push us a little closer to our common goal of a better understanding of what primates are, where they come from, and why humans are special.

SPHEROIDS: AFRICAN EARLY AND MIDDLE STONE AGE TECHNOLOGY AND VARIABILITY

Pamela R. Willoughby
University of California, Los Angeles
Franklin Mosher Baldwin Fellow

My study is an attempt to re-examine the role of spheroids and other battered artifacts in the African Early and Middle Stone Age. These artifacts comprise a class that varies significantly over time and space. It thus offers a useful alternative for the analysis of variability among

the earlier stone tool industries. Such a study required me to visit a number of countries in order to collect information from widely dispersed sites. Most of the collections remain in the countries where they were found or are on loan to researchers abroad.

I examined collections at the following institutions: (1) the Institut de Paléontologie Humaine, Paris (2) the Department of Archeology, Hebrew University of Jerusalem, Israel, (3) the National Museums of Kenya, Nairobi, (4) the National Museum of Tanzania, Dar es Salaam, (5) the Livingstone Museum, Livingstone, Zambia, (6) the Queen Victoria Museum, Harare, Zimbabwe, (7) the Archeological Research Unit and the Department of Archeology, University of the Witwatersrand, Johannesburg, South Africa, and (8) the Transvaal Museum, Pretoria, South Africa. In the course of my visit, I was able to see what kind of research is being done locally in the various countries. The staff members of all these institutions were very receptive to my work, and I would like to thank them for their generous help. I would especially like to thank Madame Colette Roubet, Sous-Directeur of the Institut de Paléontologie Humaine in Paris. She arranged for me to meet Doyen Lionel Balout and Madame Henriette Alimen, who together developed much of the foundation for Stone Age research in North Africa.

I would also like to thank those people who provided me with housing. In Jerusalem I stayed with an American couple, Steve and Arlene Rosen, who are both Near Eastern archeologists. In Kenya I stayed with my fellow UCLA graduate student, Mr. Henry Mutoro, also of the University of Nairobi, and his family. Through him I was introduced to Dr. Fidel Masao, the Director of the National Museum of Tanzania, and I stayed with him and his family in Dar es Salaam.

I was able to see some of the archeological sites where the collections I am studying were found, as well as other major prehistoric and historic centers.

The collections I went to examine come from some of the best known early sites in Africa. They include those from Olduvai Gorge and Isimila in Tanzania, Olorgesailie in Kenya, Ain Hanech in Algeria, 'Ubeidiya in Israel, Kabwe (Broken Hill) in Zambia, and Sterkfontein and the Cave of Hearths in South Africa. Most of the assemblages fall into the category of Developed Oldowan or Acheulian, except Kabwe which belongs to the Middle Stone Age. In other words, they belong to the second phase of the Early Stone Age, somewhere within the time range of around 1,400,000 to 150,000 years ago. Their context ranges from good (*in situ*) at Olduvai through probably reworked (most of the Acheulian material) to questionable. The most unusual has to be Ain Hanech, or as



Pamela Willoughby measuring spheroids from Ain Hanech, Algeria, at the Institut de Paléontologie Humaine, Paris. photo: Madame Colette Roubet

it is known in French, the *Source du Serpent*, or spring of the snake. Situated below a Medieval Islamic cemetery, it is composed of two horizons of gray fossiliferous clay with one meter of sterile clay in between. It was recognized as a paleontological site in the late 1940s by Dr. Camille Arambourg. Most but not all of the approximately five hundred limestone artifacts recovered from the same levels as the bones are flaked spheroids or *boules polyédriques*. The site is assigned to the Early Pleistocene on the basis of the faunal remains.

Ain Hanech is an extreme example of a recurring pattern in the African Early Stone Age. Spheroids and battered stones are a familiar site in archeological collections of this period. They commonly represent a third of the flaked pieces found. But, inexplicably, they are totally absent in other assemblages, notably those from Koobi Fora, Lake Turkana, in northern Kenya. This represents an interesting discontinuity in its own right.

Why study spheroids? They were described as exhibiting *un grand monotonie de formes* (Romendo, 1963), a phrase that surely needs no translation. Why bother looking at them at all, let alone as a dissertation project?

Quite a lot of recent Stone Age research has been centered on determining the relative importance of cultural tradition to function in the makeup of artifact assemblages. In order to study the former, one looks at the distribution of artifact types and their percentage occurrence over time and space. In order to study the latter, one relies on technological features that illustrate how artifacts were made, and possibly how they were used. Both approaches have recognized merits and together they form the methodology for all Stone Age studies. But they obviously produce different, if complementary, pictures of what was

going on in the past.

Cultural tradition is represented in assemblages as the product of manufacturing decisions. Artifacts and collections of artifacts — assemblages — from excavated contexts look similar, according to this approach, because the people who made them learned how to produce them in the same way. If similar patterns extend over space and time, the assemblages are called industries, and are assumed to represent the distribution of a more or less integrated social group.

Spheroids *per se* represent the extreme end of a continuum of angular to spherical core artifacts. At Olduvai Gorge, they first appear in any numbers in the Developed Oldowan of Bed II. There they replace the modified battered nodules and blocks of the preceding Oldowan. Other battered artifacts include choppers, pieces flaked in one direction on at least one face. They often show bruising on surfaces away from the cutting edge. Diagnostic of the Oldowan, these artifacts also decrease markedly in the Developed Oldowan.

The class of battered objects segregates the Developed Oldowan from the contemporary Early Acheulian as clearly as any other diagnostic criteria, such as the frequency of bifaces. Spheroids and their allied forms are common in the Developed Oldowan (up to 35% of flaked pieces), and, while present in the Early Acheulian, their numbers are greatly reduced (10-11%). This class is demonstrably different in frequency in the various assemblages of Beds I and II and Olduvai, and it reinforces Dr. Mary Leakey's division of these into three industries (Leakey 1971).

But it is in the functional realm that such mundane objects as spheroids come into their own. They clearly represent a functional entity, one joined by common purpose, reflected in the battered and

smashed condition of the pieces. They may or may not have been produced through intentional modification. It is possible that a wide range of activities were being carried out with these objects. Among the roles previous archeologists have suggested are pounders, *bolas* stones or other missiles, club heads, hammerstones, or simply cores from which flakes were struck to make tools. Perhaps their context may reveal useful information. Are members of this group located preferentially near specific features of the environment, such as springs or raw material sources? What is their relationship to other general artifact classes? These are some of the questions still to be addressed in this study.

Preliminary statistical analysis of the archeological collections reveals that spheroids and battered stones do represent a distinctive class in terms of shape (yes, they tend to be spherical!). But there is a wide range of variation in the absolute size of pieces, with no obvious preference. Most pieces are quite angular, their surfaces are anything but smooth. The smoothness or roundness of the edges is increased by battering the crests in between the flake scars. This presumably happened during use. The perfectly smooth spherical 'stone balls' found in the Upper Acheulian and later Middle Stone Age sites, as well as on office desks all over southern Africa, are exceptionally smooth. This is either due to the natural spheroidal shape or weathering of the rock, as in dolerite and ironstone, or to intentional pecking of the entire quartz piece to produce a sphere.

There is clear selection of specific raw materials for this class in several sites, notably 'Ubeidiya. Presumably this is the same case at Ain Hanech where all the artifacts were made of limestone and almost all the artifacts are spheroids. This stands in direct contrast to most other artifact classes. It becomes clear that the physical or mechanical properties of the various raw materials chosen for battered stones control much of the final range in their form. These attributes include hardness, flaking properties, size and shape of the pieces, and their overall availability near archeological sites. Such selection could have been carried on by hominids as they moved around their environment. This selection was either *active* — certain rocks and minerals were chosen consciously for the physical features they exhibit, or it could have been *passive*. In the latter case, the material chosen produced spheroids and battered artifacts because of its geological nature, regardless of any decision made beyond simply the desire to flake the piece.

The second stage of this research project, currently underway, seeks to test a series of questions about raw material form and function in order to better understand hominid behavior and land use in the Early and Middle Stone Age.

TUBEROUS PLANTS IN THE EVOLUTION OF HUMAN DIET

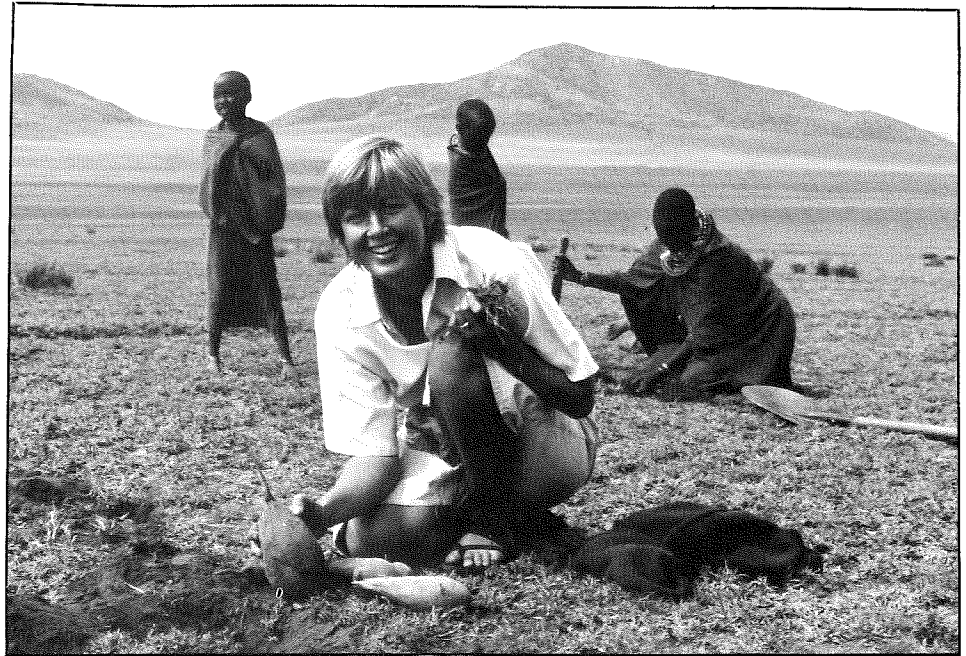
Anne Vincent
University of California, Berkeley
Franklin Mosher Baldwin Fellow

Most archeologists assume that meat has been a regular part of the human diet from the early Pleistocene on. However, the obvious other component of the diet, vegetable foods, has been largely ignored. This is probably because the remains of plants are notoriously difficult to find, especially for the earlier periods, although there are some tantalizing hints from both the Olduvai and Sterkfontein areas in the form of fossil rhizomes on the DK living floor and bone tools which show wear comparable to modern bone pieces used in digging up bulbs. Some recent approaches to prehistory, including my own, have attempted to overcome this problem by studying the modern environments that are analogous to the ones we know early hominids to have inhabited. These are being studied to assess the feasibility and constraints of procuring plant foods, and to plot their locations in the environment.

My research in northern Tanzania, which is also being partly funded by The Foundation for Research into the Origins of Man and the Boise Fund, Oxford, is focused on one major class of wild vegetable food, edible underground storage organs (USOs), that is, tubers, rhizomes, bulbs and corms. As a food source they would be of particular value because, unlike fruits, nuts and leaves, they can be found and eaten all year round and, also unlike these other plant foods, there are relatively few competitors for them.

There are three categories in my fieldwork: (1) vegetation surveys to determine the frequency and abundance of all USOs in various savanna habitats, (2) experimental harvesting and digging schemes of a sample of these USOs, and (3) ethnographic observation of USO procurement and utilization. I have now spent five months in the field and have begun vegetation surveys in all of my study areas, Lake Manyara National Park, Lake Eyasi, and the Maasai Steppe. These areas will be visited at different times of the year to determine the differing visibility of USOs and their changing nutritional and toxicity levels. Sample areas of concentrations of USOs are also being studied to assess tuber growth and regeneration rate.

Some of the experimental work has involved digging. With a simple digging stick I was able to dig up between eight and twenty pounds of tubers per plant of *Ipomoea longituba* Hall f. (*Convolvulaceae*), known locally as *ngoswaki*, with the area covered by this species



Anne Vincent in Tanzania with three Maasai girls.

approaching several acres. These tubers can be peeled by hand and eaten raw. Less easily accessible due to their depth of burial are the tubers of *Vigna esculenta* (*Papilionoidea*). Women of the Hadza group of hunter-gatherers near Lake Eyasi can collect up to six pounds in an hour from one plant. These can also be peeled easily by hand, and the Hadza eat them both raw and cooked. About 20 different specimens of USOs have already been submitted for nutritional analysis, with the results still pending; but my predictions are for high carbohydrate and moisture levels, low to medium protein levels and high calorie values.

While I originally thought that only hunter-gatherers would be able to provide me with information on edible USOs, I find that pastoralists and agriculturalists also have a keen appreciation of their local wild flora. The Maasai in the Olduvai Gorge area have named for me seven types of plant with edible USOs, one being the *ngoswaki* already mentioned. Another is called *alakole* and is a new species of *Trachycalymma* (*Asclepiadaceae*) which is at present being named at Kew Gardens.

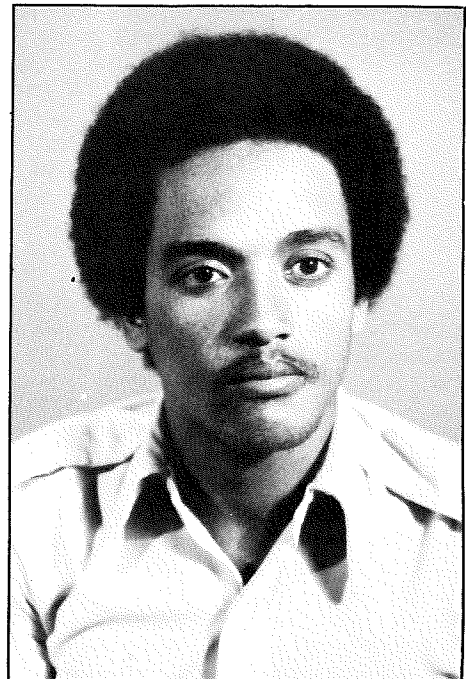
Of the variety of East African environments, savannas contain a superabundance of plant species with USOs varying from 10% to 20% of the species list (compared with a value of 3% for "normal" environments). It is precisely these types of environment that early hominids are postulated to have moved to in the Pliocene and lived in during the Pleistocene. Several intriguing questions arise. Could the sudden discovery of this tremendous food source have motivated the initial move from forests to savannas? Could the digging stick, still in use today, be the oldest functioning technology? Could the exploitation of this stable and

predictable food source have provided the springboard for other human development during the Plio-Pleistocene?

AN ETHIOPIAN IN OHIO

Giday W. Gabriel
Addis Ababa, Ethiopia
Franklin Mosher Baldwin Fellow

I was born 28 years ago and brought up in a village in Tigray, northern Ethiopia. I went to a mission school that was run by the American Lutheran Church



Giday W. Gabriel.

for my elementary education and continued my high school studies in Debre Zeit, central Ethiopia, again in a mission boarding school that was supported by a group of Lutheran churches. I did my undergraduate and graduate studies at Addis Ababa University where I received my B.Sc. and M.Sc. in geology in 1978 and 1980 respectively. I have been teaching since 1978 in the geology department of the university before coming to the U.S.

I arrived in the U.S. on the night of December 30, 1982, and since then I have started to experience the American way of life and the cold winter of Cleveland which is quite a new environment — different from the hot African tropics. I am very grateful for this great opportunity and the financial award granted to me by the L.S.B. Leakey Foundation to study at Case Western Reserve University in Cleveland, Ohio. I will be able to upgrade my knowledge so that I can contribute my part to the understanding and development of African resources and studies in the field of archeology. □



14,150 year old bone (next to scraper) under rock fill at Pikimachay Cave, Peru; 1970 excavation.

continued from page 1

more early finds came in during the 1940s and 1950s, it looked like the conservatives were finally defeated. But no, they were just regrouping, for in the 1960s they re-emerged under the leadership of Vance Haynes and a new scenario was to be written by P. C. Martin in the 1970s. Basically they saw early man, already a highly skilled hunter, entering the New World in a single migration about 12,000 years ago. Then after the MacKenzie River corridor became free from glacial ice, they moved rapidly southward, with an expanding population which caused the Pleistocene megafauna to become extinct, and so all the New World was populated by 7000 B.C.

This model allowed for no earlier remains in the New World, and its various adherents provided various arguments to back up their hypothesis. These, according to Hadleigh West and others, included the so-called fact that no Middle Paleolithic (pre 35,000 years old) remains had been found in Siberia that could be ancestral to anything before 12 to 15,000 years ago; that ice sheets blocked man's migrating south before about 12,000 years ago and more importantly, according to Griffin and Haynes, the evidence adduced to support an earlier entry is not only "not completely convincing," but unacceptable. In fact, Haynes states, "I have yet to see unequivocal evidence of pre-Clovis. Each site has some kind of uncertainty connected with

it." Both he and Stanford have discussed the uncertainty of the various sites, but in my opinion without adequate detail.

While the earlier arguments about the Siberian Paleolithic and the access routes are debatable, the whole conservative position rests on the premise that there are no acceptable pre-Clovis remains in the New World. It follows that if there is acceptable evidence of *any* pre-Clovis, then their whole argument falls. In the following pages, I believe I can show that not only is there one site with indisputable evidence of pre-Clovis (12,000 B.P.) human remains, but that there are many (at least 20) that are as acceptable in terms of good artifacts, association with extinct animals, culture contexts and dates as any of the Clovis finds. Further, I believe I can show that most of the arguments of Haynes, West, Lynch, Stanford, *et. al.*, for not accepting much of these data are, in fact, invalid, wrong or incorrect. Now let us look at some of the evidence which one cannot wish away and which destroys the whole fabric of the present conservatives' position.

First and foremost is the evidence from Pikimachay Cave near Ayacucho, Peru. No one, not even Martin who visited the cave (nor Haynes nor Stanford), holds that the upper 300 or so artifactual remains in zone h and h1, found in non-random clusters with bones

(often worked) of a variety of extinct animals that C14 date at $14,150 \pm 150$, are not valid. Obviously, when accepting this date, the whole argument about man not earlier than 12,000 B.P. in the New World falls apart.

The case is even stronger for the lower level remains that go back to as much as 25,000 years ago. These remains are just as valid as the upper ones which are sealed under a rock fall which happened when the cave was not occupied for 2,000 years (at 9000-7000 B.C., not 5,000 years ago as Lynch writes in 1982). Haynes once used the false argument that these dates were not in chronological order. This is incorrect, for zone j is dated by two radiocarbon labs as 19,600 and 20,200; zone i is 16,100 and zone i1 is 14,750; zone h dates at 14,100 years ago.

The second argument is that the artifacts are roof fall, not real artifacts. Actually some of the artifacts are of quartzite that does not occur in the roof (Lynch, who has never seen the artifacts, writes in 1983-1982 to the contrary). The conservatives, however, accept this hearsay over the evidence of flint knappers such as Crabtree, C. Phagan and Ruth Ann Knudson who not only state that these Paccaicasa tools are artifacts, but they also note that some of them show evidence of repeated use-wear. It has also been stated that the bones (and these

include animals other than sloth, but there are no sloth feces as Lynch states) and the stones (rock fall, not artifacts) are associated by chance. However, as I have pointed out, there are about 22 non-random clusters of artifacts and bones in six stratified zones. It is highly improbable that this is due to chance (in fact, according to X^2 , this could only occur by chance once in a million). I do not see any Clovis site with any better association than these from Ayacucho, and this is equally true of the nearby excavated cave of Los Toldos in Argentina which has levels similar to the Ayacucho complex.

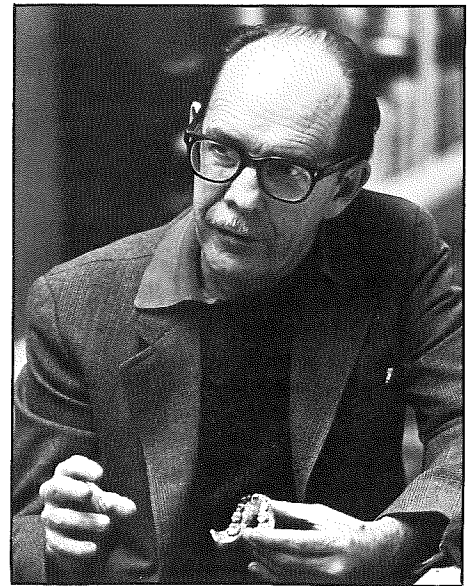
Here Cardich excavated a well-stratified site with many of the upper layers carbon dated in the Archaic Period, while in level 11 there were fluted fishtail points, often dated in southern Argentina at about 9,000 to 11,000 years ago, but here dated at 8,750 B.P. Below this was a thick layer containing only unifaces and in its topmost layers were a few bones which dated at 12,600 years ago. This means the artifacts of lower level 12 dated unequivocally before $10,650 \pm 600$ B.C. Whether this level 12 has projectile points or not and no matter how fast man ran the length of the continent, he had to come across Bering Strait well before 12,000 years ago in order to drop these tools at this date.

It might be added that there are other sites with even earlier chipped stone materials in South America such as the Piaui Caves of Brazil with dates of $11,950 \pm 300$ B.C., $15,050 \pm 600$ B.C. and $16,650 \pm 600$ B.C. (but without mention of extinct animals found with these flake tools). In Chile at Monte Verde there are artifacts associated with mastodon bones with dates of about 12,000 B.C. There are the El Jobo materials from at least three sites in Venezuela, all with dates of from 12,000 to 16,000 years ago from tools definitely associated with extinct fauna. In fact, one example from Taima-Taima has a point imbedded in a mastodon pelvis. Unfortunately, reports on these sites are of preliminary nature, so they are not quite of the caliber of Pikimachay and Los Toldos, but they cannot be ignored or the evidence called equivocal just because of this.

Somewhat better are Cynthia Irwin-Williams' finds at Valsequillo in Mexico. She found unifaces in the bones of extinct animals that have about nine associated dates ranging from 21,850 to more than 40,000 years ago. These artifacts are located stratigraphically in unit I under bifacial early tools dated at 9150 B.C. in unit C. This evidence is unequivocal for here we have a long sequence of definite artifacts in association with bones from extinct animals in good well-dated stratigraphy that is in agreement with geological estimates. The data from the 18 localities in nearby Tlapacoya is just as good, with all the features of the

former. For instance, a log associated with a fine obsidian blade was dated at 24,000 years ago and the date was confirmed by an obsidian rind calculation on this blade of about 19,000 years ago. These dates were consistent, also, with geological estimates and associated extinct fauna. Further, a hearth with a date of $23,150 \pm 500$ B.P. was associated with artifacts and extinct animal bones stratigraphically under layers with bifacial points and dates in the 10,000-year range. The evidence is just as excellent from the other localities, and I do not understand what kinds of uncertainties Haynes or anybody else sees connected with it. About the only legitimate criticism that can be made of these data is that the final reports have not been published.

Just to show I have no pro-Latin prejudice, let me mention the evidence from Wilson Butte Cave in Idaho. Here, also, there is clear-cut stratigraphy. Under Archaic remains dated at 4890 B.C. were five artifacts associated with bones of extinct animals that were dated at 14,500 which in turn were over bones (some of which may be worked) dated 15,000 years B.P. Criticism has been made that the bone dates came from three different squares, but this hardly negates the association with extinct animals or its stratigraphic position. In fact, if these are average dates of a number of different bones of different ages, then this date of 14,500 may be considered a possible minimum date for the tools which may date closer to an underlying zone with a bone date of 15,000 years ago. These are superior data as are the possible related materials from Meadowcroft Rockshelter in Pennsylvania. Here again there was beautiful stratigraphy that was very carefully excavated. The upper layers are on Woodland and Archaic materials whose dates are consistent with those of related materials from sites from surrounding areas. Below these are a whole series of artifacts from zone IIa that have been dated as follows: $10,850 \pm 870$ B.C., $11,290 \pm 1010$ B.C., $11,320 \pm 340$ B.C., $12,975 \pm 620$ B.C., $13,170 \pm 165$ B.C., $14,225 \pm 975$ B.C., $17,150 \pm 810$ B.C. and $17,650 \pm 2400$ B.C. Further, under these remains were two possible hearths that date at $19,430 \pm 800$ B.C. and $28,760 \pm 1140$ B.C., but whether or not these were associated with human activity is difficult to say. However, there is no doubt about the upper man-made materials being dated at between 12,000 and 17,000 years ago, even though there are no associated extinct animal remains. In fact, the only criticism that has been made (mainly by Haynes) is that "the charcoal used in dating appears to have been contaminated by dead carbon carried in the ground water." It might be added that there is not one iota of chemical or physical analysis to back up this opinion. Further, Stuckenrath did considerable analysis to make sure the



Dr. Richard S. MacNeish.

carbon he dated was not contaminated. Also, none of the later Archaic or Woodland dates shows any evidence of this reputed contamination. This contamination criticism is just not based on any valid evidence, and until the critics bring in some real evidence, one just has to accept the Meadowcroft dates.

Similar criticisms of the dates of sites on Santa Rosa Island in California have been made, and perhaps criticism here is valid for some localities, but not for the Woolly Mammoth site reported and dated by Reiner Berger, who is an atomic physicist specializing in radiocarbon determinations. Here, four or five chopper-like tools with definite evidence of use wear were excavated in association with mammoth bones and a hearth. Three samples of carbon from the hearth, studied for radiocarbon determinations, revealed them to have no radiocarbon activity and, in Berger's professional opinion, this is because the carbon is older (more than 40,000 years). In other words, the carbon was made before the period that can be measured by the radiocarbon method, and it is his opinion that this could not be due to contamination. Do we take the equivocal opinion on Carbon 14 dating of archeologists playing atomic physicists or do we take the unequivocal conclusions of physicists who are experts on radiocarbon determination and who have done basic analysis on such matters?

Similar cries of contamination on Carbon 14 dates not dating the human remains have been made for two other sites — Bluefish Cave in the Yukon, Canada, and the Manus Site in the state of Washington. Again the burden of proof for these dates being equivocal is on the critics of the excavation. Although we have only preliminary reports, Bluefish Cave appears to have in its upper levels microblades and burins dating to roughly



Lookout down the Ayacucho Valley, Peru, from Pikimachay Cave (Flea Cave) with workers digging in foreground.

10,000 to 12,000 years ago which overlie chert flakes (tools) associated with horse, proboscidian, giant bison and other animals with dates of about 15,000 years ago. The date, tools and association are indisputable as are the remains at Manus where there was a cobble tool with a butchered mastodon that had a bone point imbedded in its rib. There can be no doubt of this association or of the organics (food) in the mastodon stomach that was twice dated to more than 12,000 years ago.

I could go on and on with more cases of early man dated before 12,000 or being pre-Clovis. The Shriver Site in Missouri, the Little Canyon Creek Site in Wyoming, the Levi Site in Texas, the Lamp Spring Site in Colorado as well as the nearby Selby and Dutton Sites have clear unequivocal stratigraphic evidence of tools or human workmanship below those with Clovis or Clovis-related remains that date before 12,000 years ago. Also, we could mention the Old Crow bones of the Yukon in Canada, the El Cedral and Santa Lucia findings in Mexico that date very early, the possible early dated remains at El Bosque in Nicaragua, and remains at Rio Uruguay in

southern Brazil, but we don't need any of these to destroy the conservative model. Any one of the 14 examples mentioned in the previous paragraphs is evidence of man in the New World well before (3,000 to over 40,000 years earlier than) the 12,000 date line. Further, every season sees more and more incoming evidence of early early man. Therefore, it is high time to quit snipping at the validity of these early finds and to stop ignoring the real evidence and to start explaining what we do have with more realistic models. Complaining that these early early remains are not as numerous as Clovis remains is not a criticism of the validity of the early remains. Indeed, this fact should be a spur to do more research and to attempt to find more early sites rather than a reason for ignoring the evidence as Hadleigh West does. It is certainly not time to rest on our laurels and to assume there is nothing more to find or that nothing earlier can be found.

It surely is the time to re-assess what we do have securely on this early early level and to make some new models explaining the peopling of the New World.

Some of us have made attempts in this

direction, taking into account and trying to explain these earliest New World remains. Vance Haynes has suggested a three period scheme to explain these early remains — with the first period being greater than 30,000 years old, the second period being between 30,000 to 12,000 years old and the third period, in which he sees real evidence in terms of specialized point types such as Clovis, Folsom, etc., being from 12,000 to 7,000 years ago. Mayer-Oakes and Ben Rouse have devised a similar early sequence. Muller-Beck has another hypothesis to explain these early remains and envisions two invasions — an early one coming out of the Mousterian-like bifacial and flake tool industry between 28,000 and 26,000 years ago and a later one about 11,000 years ago bringing in Aurignacian industries with their specialized cores, blades and burins. This, from the standpoint of better defining the stages, is an improvement over the relatively sterile Haynes approach. It, also, bears similarity to Alan Bryan's model that would have an Old World Paleolithic core, flake and bone generalized horizon over 25,000 years old as a base for the development (about 10,000 years ago) of three later traditions — Fluted Point, Stemmed Point and an (Archaic) Notch Point. Lorenzo, based on Mexican materials, has still another model with three developed stages somewhat following the earlier terminology of Menguin in Argentina that are as follows: Archeolithic 25,000 to 12,000 B.C., Cenolithic 12,000 to 9,000 B.C., and proto-Neolithic 9,000 to 2,000 B.C. I, also, have attempted to explain these meager early man remains with a four developmental stage model:

1. Chopper-Chopper stage — more than 40,000 B.P.
2. Unifacial and bone tool stage — 40,000 to 20,000 B.P.
3. Leaf bifacial point, burin, blade stage — 20,000 to 13,000 B.P.
4. Specialized bifacial point — 13,000 to 9,000 B.P.

All the above are hypothetical schemes attempting to explain our early finds. All are hypotheses to be tested by new data we uncover, but more importantly, they are hypotheses that should determine the directions that future investigations should take.

It is not time to arrogantly think that we have accomplished all the basic research on early man. Nor is it the time for negative evidence or non-constructive criticism to be considered as profitable as newly acquired positive evidence (West, 1981). As in the earlier periods, the conservatives have once again lost another round, and it is time to move on. The best is yet to come in the field of early man, but only if we go look for it and test new and more profitable, deductively derived hypotheses about how and why early early man entered the New World. □

FOSSEY LECTURES

Dr. Dian Fossey, regarded by most as the world's leading authority on the mountain gorilla, will present an illustrated program on September 24 at the Los Angeles County Museum of Natural History. Entitled "Mountain Gorilla: Gentle Giant of the Forest," the lecture will be cosponsored by the museum and the Leakey Foundation. Dr. Fossey, whose work has been partially funded by the Foundation, is the author of a new book, *GORILLAS IN THE MIST* (see BOOKS), which tells of her work at the Karisoke Research Centre in Rwanda. The research station has served as base for visiting scientists whose collaborative efforts have contributed much of what we now know of the imperiled gorilla species.

The lecture at 7:30 p.m. will be followed by a reception and book-signing session. Reservations for the evening can be made by sending a check (\$10) and a self-addressed stamped envelope to the

Museum Alliance, 900 Exposition Blvd., Los Angeles, CA 90007.

Dr. Fossey has been chosen to deliver the 1983 Allen O'Brien Memorial Lecture. It will be held on Wednesday, September 21 at 8 p.m. at the California Academy of Sciences in San Francisco.

Invitations will be mailed to all members and pertinent information regarding tickets and registration will be included. Other inquiries should be directed to the Foundation office. □

÷

Jeffrey R. Short, Jr., a member of the Board of Directors of the Leakey Foundation, was awarded the Frances K. Hutchinson Medal by the Garden Club of America. Testimony of Mr. Short's versatility, it was presented at the annual meeting in Houston, Texas, in April.

÷

IN BRIEF

A new and stunning sketch depicting Louis Leakey and "Zinj" has been donated to the Foundation. Artist Linda McManus is making available for purchase a small limited number of signed black and white photographic prints, size 13" x 16", for \$25 each (including mailing and a donation to the Foundation). Orders may be placed by sending a check to the Foundation headquarters.

The Ninth Congress of the Pan African Association for Prehistory and Related Studies will be held December 11-17, 1983, in Jos, Nigeria. Membership in the Association is open to scholars and institutions interested or engaged in the study of and research in African history and related subjects anywhere in the world. The General Congress normally meets every four years. This meeting will feature papers, symposia and discussions on various aspects of African prehistory. For further information contact: Director General, National Museum, P.M.B. 12556, Onikan, Lagos, Nigeria. □

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



MEMBERS RECEIVE:

*Invitations to special MEMBERS ONLY EVENTS.

*CHOICES OF PREMIUMS for many categories of membership and a 10% DISCOUNT on books and tapes.

*Advance announcements of all symposia & lecture programs & *AnthroQuest*, the Leakey News.

SEND A GIFT MEMBERSHIP TO:

ZIP _____

PLEASE DESIGNATE MY GIFT TO SUPPORT:

Research Project Title or Scientist.

NEW MEMBER () RENEWAL ()

PREMIUM CHOSEN: book () tote () send no premium ()

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

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

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

Authorized signature _____ expiration date _____

NAME _____

ADDRESS _____ PHONE _____

CITY _____ STATE _____ ZIP _____

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

N26

BOOKS

HEN'S TEETH AND HORSE'S TOES by Stephen Jay Gould, Norton, New York, 1983. \$15.50.

The widely acclaimed and sometimes controversial paleontologist, Stephen Jay Gould, holds forth here on evolutionary biology — what he has termed “the story of us all.” Always attacking a subject from an unusual angle, he both amuses and informs in these 30 essays and, perhaps, even raises a touch of ire. A fascinating *tour de force* by one of science's stars.

GORILLAS IN THE MIST by Dian Fossey, Houghton Mifflin, New York, 1983. 230 pp. \$19.95.

Dr. Fossey, after spending years alone in Rwanda studying the endangered mountain gorilla, here traces her observations of three generations of the great apes. The daily lives of these animals are also documented in 80 pages of photos.

Only 240 mountain gorillas now survive on earth, living only in the remote rain forests of the Virunga Mountains, shared by Zaire, Uganda, and Rwanda. Sent by Louis Leakey in 1967 to study these magnificent animals, Dr. Fossey launched the now renowned Karisoke Research Centre. There she developed her unique approach to primate study, earning the gorillas' confidence by imitating their behavior — body language, vocalization, feeding habits.

The book includes an invaluable bibliography on the species.

THE NEW EVOLUTIONARY TIME-TABLE by Steven M. Stanley, Basic Books, New York, 1982. 222 pp. \$16.75.

A convincing presentation of the “punctuated equilibrium” view of evolution. First postulated in 1972 by paleontologists Nils Eldridge and Stephen Jay Gould, this theory refutes Darwin's belief that evolution is a slow, constant, gradual process. Not so, says the view held here — new species evolve by rapid separation from existing species and then survive for millions of years. There are, therefore, no missing links in the fossil record, simply because these fossils do not exist.

THE HUMAN CYCLE by Colin M. Turnbull, Simon and Schuster, New York, 1983. \$14.95.

This provocative book addresses the art of living as demonstrated by cultures throughout the world. The author, a distinguished anthropologist, reviews life from infancy to old age, vividly portraying the response of various peoples to the attitudes and practices of the western world. A profound book, posing unsettling questions.

RACHAEL CARSON by Carol B. Gartner, Frederick Ungar, New York, 1983. \$11.95.

The author calls Rachael Carson a scientist who wrote like a poet and anyone who has read her books can testify to the aptness of this accolade. But Rachael Carson deserves and receives the added tribute of being one of the first to alert the world to the devastating impact of new chemicals unleashed on the world during the last 40 years. This biography includes a complete and valuable bibliography.

LAW, BIOLOGY AND CULTURE: THE EVOLUTION OF LAW edited by Margaret Gruter and Paul Bohannon, Ross-Erikson, Santa Barbara, 1983. Paperback, 226 pp. \$10.95.

For years we have looked at law and legal behavior without understanding its roots in biology and culture. This book examines the possibility of biological precursors for individual legal behavior and human social organization; in human anatomy, especially the human brain; in behavior of non-human primates; in body chemistry such as endorphins; early human history and in cultural modes of expressing dominance and social control. Contributors include Jane Goodall and Paul D. MacLean.

THE CREATIVE EXPLOSION: AN INQUIRY INTO THE ORIGINS OF ART AND RELIGION, by John E. Pfeiffer, Harper and Row, New York, 1982. 262 pp. \$29.95.

Why did people suddenly begin drawing on the walls of caves in Spain and France during the Upper Paleolithic period? How are these paintings related to Cro-Magnon social organization and community life? John Pfeiffer, a noted scientific journalist-author, suggests that cave art was designed to reduce conflict among prehistoric hunter-gatherers and may have functioned in the transmission of knowledge from one group or generation to another. □



FOUNDATION CENTER 1-7, PASADENA, CA 91125

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

ADDRESS CORRECTION REQUESTED

TIME VALUE — PLEASE EXPEDITE