THE L.S.B. LEAKEY FOUNDATION NEWS

NUMBER 21 WINTER 1981

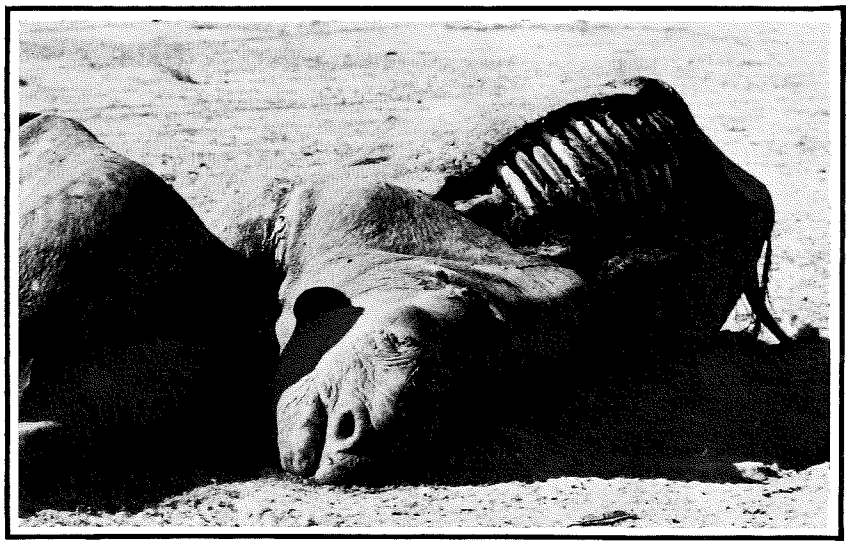
A CHALLENGE FOR CONSERVATION:

HUMAN DIMENSIONS OF THE SAVANNA ECOSYSTEMS

by DAVID WESTERN
NEW YORK ZOOLOGICAL SOCIETY

The Serengeti threatened by a railroad through its heartland, and the Ngorongoro Crater invaded by cattle, are cause enough for an international outcry. Yet enormous swaths of tropical forest burned and hacked down daily scarcely evoke the same anguish, regardless of their global role in maintaining an atmospheric balance and in preserving our watersheds. Why the difference? Is it perhaps that forests, dark and sinister, threaten us, or because their biological role is insufficiently appreciated? Or is it because our natural apathy about distant calamities is overcome in the case of the savannas due to some genetic empathy for our ancient habitat?

Whatever the cause of our differential response, the savannas are under threat from pervasive human changes that no amount of emotional outcry can avert. Occupying vast stretches of land in eastern Africa that dwarf those suitable for arable use, the savannas are being eyed as the logical release valve for a population doubling every seventeen years. Whether the overspill from farmlands occurs randomly or is handled thoughtfully matters greatly, for in the one case the natural savanna community will surely disappear, while in the other I believe some remnants can be salvaged.



Over the last twenty years in Amboseli rhino numbers have declined through poaching from more than 150 to seven in 1977. With recent changes in wildlife policy, the numbers have slowly increased to twelve in 1981. photo: David Western

In the savannas today pastoral herds and wildlife coexist, if less comfortably than formerly, then, at least, still as the centerpieces of the ecosystem. Changes, already well advanced, are underway that will soon transform the ancient subsistence pastoralists into commercial ranchers. In the transition the inevitable economic yardstick of progress will deny any place for wildlife and, unlike in the past, the technology is widely available to ensure its eradication. What prospects exist, then, to bring about an orderly transition and a continued place for wildlife?

I do not believe that national parks and reserves are the entire answer. Most are too small to survive without access to the lands beyond their boundaries, lands which are, ironically, holdings of people hostile toward the wildlife and parks which usurped their former homeland. Whatever their value nationally and internationally, parks, far from benefitting local communities on which they depend, place enormous burden on them. So, without recourse to further expansion and surrounded by the landowners they have alienated, what hope is there for the savanna ecosystems as the small, isolated, biological islands they will inevitably become?

I have long searched for solutions and I believe there is some hope. Unlike most biologists, I do not think that the solution is merely a matter of better ecological design. Most parks were as well designed ecologically as they could have been, given the political circumstances. Rather, I consider the solution can only stem from skillful planning in offering both the social and economic incentives for rural communities to both tolerate and benefit from wildlife. Why, after all, should they, the poorest sector of the population, bear the entire costs of supporting wildlife when economically and esthetically the benefits acrue nationally and internationally to others much wealthier? Is it any wonder that poaching is rampant in and around the parks when

continued on page 14

the L.S.B. Leakey Foundation news

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PRESIDENT'S MEMO

The Leakey Foundation is like a coach of a team. It sits on the side lines and sends in plays and players in hope of advancing the scientific ball. Most players know precisely what they want to do and they only ask the support of the Foundation. Unfortunately, we can only fund approximately one-half of the grant requests received which we find worthy.

But there are also game situations where we have the play we think needs calling but we don't have the players. This memo selects just two of those that arose at our Annual Meeting last September in the Napa Valley.

In Okigwe, Eastern Nigeria, there is the Uturu Acheulian site for which no local archeologist is qualified to be the principal investigator. Dr. Ekpo Eyo, our Trustee in Nigeria, described it to me as follows:

Four years ago, a geomorphologist student of the University of Nigeria, Nsukka, discovered by chance at Uturu, near Okigwe in Eastern Nigeria, huge deposits which contain Acheulian handaxes, flakes, cores and wastes. She recognized the importance of the site from where stones were being quarried for road work and reported this to the National Commission for Museums and Monuments. Since then a few renowned archeologists, including Professors C. Thurstan Shaw and Nicholas David, have visited the site and are convinced of its importance for investigation. It is the most remarkable Acheulian site in the region and there is nothing in East Africa which is comparable in concentration. Uturu is on the fringe of the forest belt, and it looks as if Acheulian man found the stone in this area most suitable for tool manufacture. The site, therefore, most probably represents a workshop. Test excavation by Drs. Anozie and Chikwender of the Department of Archaeology, University of Nigeria, Nsukka, tends to confirm this, but a lot more slides and tests are necessary to determine the full nature of the site. It was considered, because of its importance, to recommend the site for nomination to the UNESCO World Heritage List, but unfortunately it has lost its integrity, some part of it having already been quarried, so may not qualify! Preliminary work of exploratory nature is urgently needed to determine the true nature of the site and to enable the government to protect it from stone seekers. The Leakey Foundation is requested to find a suitable expert to carry out this work under the aegis of the Nigerian National Commission for Museums and Monuments, and in collaboration with the Nigerian Archaeological Association.

Another need identified at the meetings was for a particular conference with great promise of scientific merit. In this instance one may be searching for an institution and/or a galvanic person. Dr. Desmond Clark described the opportunity to me thusly:

The new technique developed for studying the polish and microchipping on the edge of artifacts used for different activities by early man is likely to revolutionize understanding of behavior and function of sets of stone tools. We believe that it would be in the best interest of science for paleoanthropologists to meet and discuss the best ways of training in the use of this outstanding new method. Correct identification of the places on the tools that show usage, the manner of their use, and the nature of the material of which they were made is something that only comes from prolonged exposure and experience in identification. It would be of great value to be able to hold a small workshop and discussion conference which one or more of the specialists (hopefully, Dr. Lawrence Keeley, who developed the technique) would direct. Those participating would have the opportunity to use the microscope for identificational purposes. It is essential that correct identification be made and this will only be done through proper training and experience. Such a workshop might be held back to back with one of the national meetings or alternatively on the occasion of the meeting of Africans in America which is scheduled to take place in Berkeley this coming May.

These two examples of having the "play" without the players precede the question of funding about which this column has a fixation.

You should be reading this memo just before the end of the taxable year. Need I say that, for those in a position to assist the projects adumbrated here or any of the other fine individual grant requests, gifts made this year when the maximum tax applies will save you even more than gifts made in the next fiscal year. It is naturally our hope that when the taxable rate does drop, some of the resulting tax savings will be directed toward the support of charitable organizations such as your Foundation. Happy New Year!

Ned Munger

ALTAMIRA:
THE STUDY OF PALEOLITHIC ART

by Margaret W. Conkey
Department of Anthropology, State University of New York, Binghamton

It was a little more than one hundred years ago, in 1879, that the first Paleolithic cave paintings were discovered at the site of Altamira on the north coast of Cantabrian Spain. Even though almost two hundred painted caves have since been located, the polychrome paintings at Altamira remain among the most significant examples of Paleolithic art. The ceiling there still deserves to be called the "Sistine Chapel" of prehistoric art.

> ". . . the polychrome paintings at Altamira remain among the most significant examples of Paleolithic art."

The story of how the paintings were first discovered by Nineteenth Century eyes is well known: it was the small daughter of a local gentleman who pointed out the colorful bison and other animals to her father, Marcelino Sanz de Sautuola. The little girl obviously had a better perspective on the very low ceiling on which they were painted, for Sautuola had already explored the cave and had even carried out preliminary excavations in its vestibule. Because of his knowledge and interest in the emergent field of prehistory, Sautuola could appreciate what these paintings might be. Of course, the conclusion that they were the works of prehistoric peoples who lived during the Late Ice Age some 15,000 years ago was not easily reached, much less accepted. In 1879, it had only been two decades since the publication of Darwin's *Origin of Species*, and at least two more decades were to pass before accumulating evidence confirming the Ice Age antiquity of the art would be widely accepted by the scholarly world.

The story of the study of Paleolithic art since 1879 is less well known than the anecdotes and tales of discovery of such caves as Altamira and Lascaux in Dordogne, France. With both of these magnificent painted sanctuaries now closed to the public because of the rapid deterioration of paintings and wall surfaces, it is timely that a century of research be reviewed. Altamira still ranks among the most magnificent of the painted sites, and its artforms provide excellent examples for the review of Paleolithic art studies.

We can divide the past century of Paleolithic art research into three broad periods. The exact dates bracketing each period are somewhat arbitrary, but convenient, markers: (1) from 1879–1902; (2) from 1902–1960; (3) from 1960–present. From 1879 until 1902 was clearly a period of exploration and intellectual ferment. After twenty-three years of exploration and debate, the eminent French prehistorian, Emile Cartailhac, published his "Confessions of a Skeptic," admitting that he was at last convinced of the Ice Age antiquity of the paintings at Altamira and other newly found sites, such as Font de Gaume in southwestern France.

The factors that contributed to the retreat of skepticism included a continued documentation of more cave painting, often after removing extensive Ice Age deposits from the entries into caves, the geological antiquity of the painted wall surfaces that were sometimes convincingly sealed with ancient layers of calcite, and the recognition of regionally long-extinct species — such as reindeer and wooly mammoth — as the subject matter of much of the art. In addition, there were notable stylistic affinities between some wall art and the decorated portable artforms that were actually derived from archeological layers dating to the Late Paleolithic. These portable art objects included pieces of bone and antler that were carved and incised with both geometric and representational designs. Even today, the authenticity of certain painted caves or portable art is still occasionally questioned, but it is no longer because we doubt that the makers of this art, early members of our own species, *Homo sapiens sapiens,* were capable of such cognitive, cultural, and artistic achievements.

> "Even today, the authenticity of certain painted caves or portable art is still occasionally questioned, but no longer because we doubt that the makers of this art were capable of such cognitive, cultural, and artistic achievements."

> "Exploration, discovery, ordering, and classifying – particularly within the grid of time and space – have long been the primary methods and goals of archeologists and prehistorians."

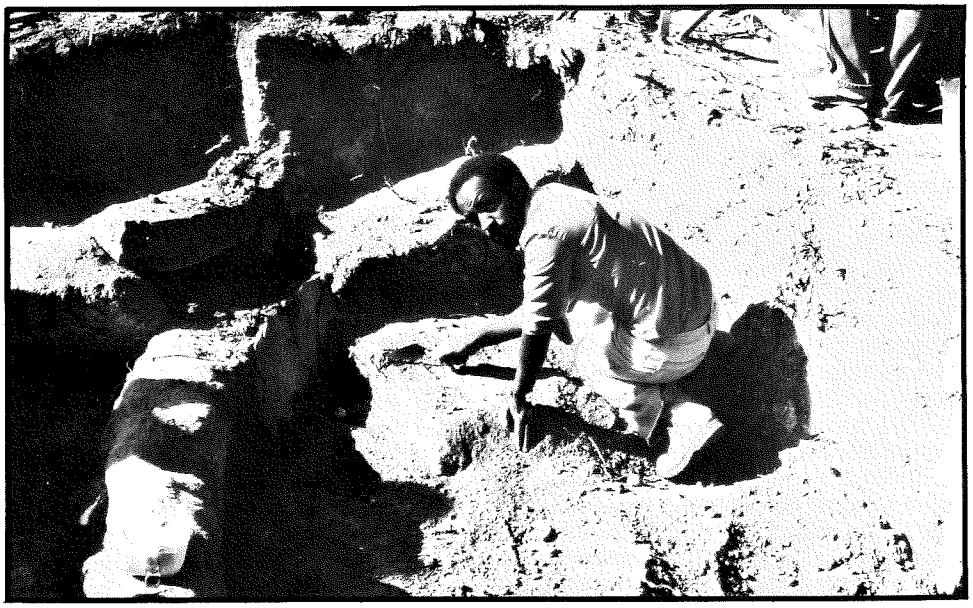
Cartailhac's "confession" formally demarcates the inception of the second and longest period in the study of Paleolithic art. Once most scholars had accepted the art as one of the cultural products of Late Ice Age hunter-gatherers, the usual tasks of a new field of study were vigorously undertaken. Exploration, discovery, ordering, and classifying – particularly within the grid of time and space – have long been the primary methods and goals of archeologists and prehistorians. Caves and rock shelters were carefully explored in the search for new paintings and for the engravings that were much more difficult to find and decipher. In those days before flashlights, flash attachments, and even the widespread use of cameras, most exploration was by torch light, and most docu-

continued on page 16

Two spotted horses with signs and handprints, Pech-Merle, France; late period (20,000 to 12,000 years ago). Courtesy of the Gallery of Prehistoric Paintings, New York.

FIELD REPORTS

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



Berhane Asfaw, University of Utah summer field school, Gooseberry, Utah.

ARCHEOLOGICAL FIELD TRAINING IN UTAH

Berhane Asfaw
Franklin Mosher Baldwin Fellow
from Ethiopia

I attended the University of Utah summer archeological field school in 1981 in central Utah, about 200 miles north of Salt Lake City, at Gooseberry. The program was designed to train students in three important programs: archeological surveying and recording, archeological site mapping, and excavation.

In order to maintain continuity we worked ten successive days and took four days off. The first session was allocated to surveying the area and mapping the whole site, which consists of a considerable number of mounds where there was once a big village inhabited by the Fremont Indians.

The main objective of this year's field school surveying program was to make use of the magnetometer, an instrument that can sense anything that has aligned a magnetic substance, like a firehearth. The magnetometer is a new and not widely used instrument in archeological field research, and every participant got the proper training before using this instrument.

In the second ten day session the class was divided into three work groups; each group was assigned a job and then the groups rotated, so that everyone got a chance to work in every field to gain important field experience. We learned how to make topographic maps of the area, opened new exploratory trenches to test the result of the magnetometer surveying, and ran the magnetometer over areas which were not surveyed.

The third session was strictly devoted to excavation work. We tried to test places identified by magnetometer survey as cultural areas of archeological importance. The last session was used for back filling and excavation.

The thing which impressed me most about this field school was the scientific method of tackling different archeological problems during excavation. First we wrote down everything that was in a feature, measuring it and making drawings and maps. The next step was to formulate different hypotheses. Finally we tested the hypotheses. Thus we never made rushed conclusions.

We were told that whenever we are doing archeological excavation we are destroying. We therefore have the responsibility to fully document the place we are excavating. The methods we used will be very helpful in my future archeological work and when I am in Ethiopia this fall with Professor J. Desmond Clark. After attending this field school, I feel confident about my ability to apply the methods that I have learned to other digs. I obtained valuable additional experience in site organizing; this is a basic in archeological work. I am very grateful to the L.S.B. Leakey Foundation for giving me additional money to attend this valuable summer field school.

KENYAN FLORA

Jeanne Sept
National Museum, Nairobi, Kenya

My Kenyan fieldwork is becoming habit forming. I have become an avid dawn drinker of tea, and have learned to like "ugale," the more-than-hearty cooked corn meal staple here. I can curry lentils in five different ways and bake bread over the coals of a fire better than anything which ever graced my oven in Berkeley.

But of course there is more to fieldwork here than an obsession with food. The modern riverine and other plant food resources I am studying are as popular with modern wildlife as they may have been with early hominids, a fact which makes it a bit hazardous at times for a researcher bent over a tapemeasure, counting grass stems. I've been chased by hippos, stomped at by buffalo, raced past by a herd of elephants, pestered by baboons, watched by crocodiles, pelted with palm nuts by monkeys, buzzed by flies, avoided by snakes, and bitten by mosquitos.

In one park the warden insisted that our work be done under the watchful eyes of two gun-toting park rangers. But after three or four days of watching us slowly counting and collecting plants along a tapemeasure, the poor men had to resort for entertainment to reading bits from the old newspapers we had brought along to press our plants. Meanwhile, even though I've always been a bit sceptical of so-called "armchair archeologists," a routine of bending over tapemeasures and peering upward into dense tree canopies has made me yearn from time to time for the relaxation of a little "campbed botany." But work progresses. I'm about to leave for a seven week bout of paleoecology at Koobi Fora – looking forward to substituting root casts and sediments for ubiquitous grass stems along my tapemeasure.

A TRAMPLING EXPERIMENT

Betty Goerke
College of Marin,
Kentfield, California

Support from the Leakey Foundation made it possible for me to join Professor J. Desmond Clark and a joint American-Indian expedition to the Son River Valley in east central India last year. This area is an archeologically rich one with cultural remains from the Acheulian through the Neolithic periods.

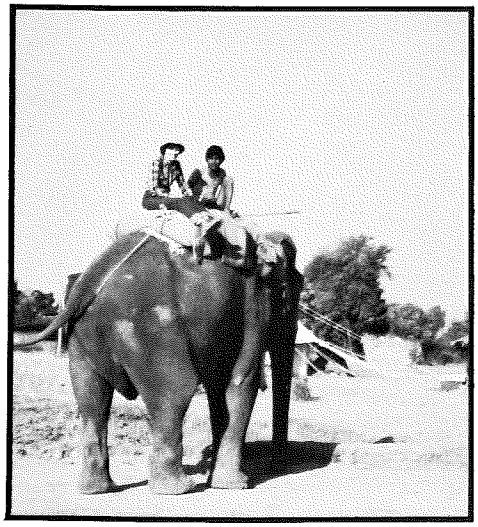
While in India I participated in a number of stone tool experiments. In one of these we tried to find out if trampling by a non-human agency, in this case an elephant, could alter the edge of a flake or blade, and if such edge damage could be distinguished from that caused by human

use. In the second set of experiments we tried to work out the manufacturing sequence of blade tools found on sites excavated by the expedition.

Aiding us in the trampling experiment was a 4300 kg. male elephant who was led over a scatter of debris created experimentally in the replication of stone tools. Although the elephant walked over the debris for only a few minutes, he caused both edge damage and transverse fractures. Most of the edge damage was found at corners and randomly on straight edges and would probably have been interpreted correctly by an archeologist as debris. On the other hand there were a few pieces with less random edge alteration which resembled the tool type known as utilized flakes. These could have been intrepreted by the unsuspecting archeologist as *bona fide* tools. In general, however, the non-patterned edge damage would suggest an unplanned non-purposeful activity such as trampling. The clean breaks caused by the elephant's walking produced fractures, however, which are indistinguishable from those associated with manufacturing problems of human stone tool production.

Experiments of this kind remind us how easily an edge can be damaged through such natural activities as walking. If the elephant had walked for a longer period of time or if there had been more elephants, it is likely that more patterned damage would have occurred.

Other experimental work in the field included demonstrating the possible steps toward the manufacture of stone tools recovered by other members of the team at terminal Paleolithic and Mesolithic sites. The small blade cores that were found on the site had been heat treated. Replication experiments and the comparative study of my debris with that of some of the prehistoric debris showed that at least one method of removing the blades and cores was by direct free hand percussion. The range of possible blade removal also included indirect percussion and hand held pressure. Although this work is in the preliminary stage, it is still useful in making important intersite comparisons and in learning about changes through time.



Betty Goerke's elephant trampling experiment, India.

1980 trampling experiment, southern France. Paola Villa, (left).

ANOTHER TRAMPLING EXPERIMENT

Paola Villa
Dept. of Anthropology,
University of Wyoming, Laramie

During the summer of 1980, I conducted an experiment designed to study processes of formation of the archeological record. The hypothesis to be tested was that trampling, as done by prehistoric inhabitants of a site, can cause vertical dispersal of artifacts in the soil and can create false stratigraphic associations. The experiment is part of a study of the stratigraphy and patterns of site use of a neolithic cave in southern France, spanning the transition from hunting and gathering to farming.

The experiment was designed to replicate conditions prevailing at the cave. Materials similar in size, shape and kind to cave materials (pottery sherds, bones, stone tools, shells) were laid out on terraces built in front of the cave to hold the excavated backdirt. Thus the sediments used in the experiment were the same silty sands of the cave. The precise location of each object was recorded with three spatial coordinates. Trampling was done in a casual manner by excavators walking in and out of the cave to work. As is traditional in French digs, all of them wore only light sandals or went barefoot.

The main results of the experiment are:

(1) In sandy deposits, trampling can cause mixing of materials belonging to two separate levels without leaving visible traces of disturbance. Horizontally associated materials in an archeological layer may derive from the mixing of two distinct episodes of site use.

(2) Significant downward displacement (7-8 cm.) can be achieved even with a limited amount of trampling. This suggests that in caves whose rates of sedimentation are low, some archeological items may be considerably younger than the matrix in which they have been found.

(3) The effects of trampling are felt in a zone 10-15 cm. deep at most. Other agencies must be responsible for larger scale vertical displacement.

The results of this experiment – which strongly suggest caution in the interpretation of living floors and stratified sites – were presented in April, 1981, to the meeting of the Society for American Archeology in San Diego. A joint paper with Jean Courtin will be published in *Bulletin de la Societé Préhistorique Française.*

STONE AGE ARCHEOLOGY IN THE NYAKYUSA BASIN, TANZANIA

Thomas Wynn
University of Colorado,
Colorado Springs
Franklin Mosher Baldwin Fellow

Most of Africa remains an archeological blank. The prehistory of only a few areas, South Africa and parts of Kenya for example, is known in any detail. Even this knowledge is meager when compared to

the detailed cultural histories of, say, the American Southwest. For most of Africa the prehistory of entire regions must be reconstructed from a few, occasionally only single, sites. As a consequence African Stone Age archeology is still very much in an exploratory phase. We need to find out what happened in as many places as possible before we can begin to discuss the more difficult questions of how and why.

During the summer of 1980, I directed an archeological survey in the Nyakyusa Basin of southwestern Tanzania. The area seemed promising for two reasons. First, a brief reconnaissance in 1976 had suggested a fairly intensive Stone Age occupation during the Late Stone Age and perhaps the Middle Stone Age. Second, the basin is geographically isolated and presented an opportunity to investigate a tendency toward Late Stone Age regionalization that had been recognized elsewhere in Africa.

The Nyakyusa Basin lies within the Rift Valley system at the northern end of Lake Nyasa (Lake Malawi). It is enclosed by the Livingstone escarpment to the east, the Ndali hills to the west, the Rungwe volcanics to the north and the lake to the south. The basin extends roughly forty miles from northwest to southeast and thirty miles east to west. There are two major types of terrain: low-lying alluvial flats bordering the lake and rugged volcanic highlands.

The actual survey consisted of walking transects across the selected areas. When artifacts were discovered we located the position on a map and, if the artifacts were numerous, took a random surface sample. We also followed leads supplied by local farmers. We excavated test trenches in three of the most promising sites and at the end of the field period excavated more extensively at one site at the Kala Waterfall.

The distribution of sites was at first puzzling. As it turned out, the key lay in the volcanic history of the basin. In the Masukulu Forest Reserve, for example, we found a dense concentration of artifacts on the surface of a sunken road. We sank a test trench off to the side of the road and found artifacts on top of the underlying rocky surface at a depth of 60 cm. The rocky surface turned out to be a basalt and the upper soft deposits a volcanic ash.

When we finally obtained a detailed geologic map of the basin, we found that the basalt belonged to a series of basalts that erupted during the early Pleistocene from a source near Tukuyu. The ash belonged to a series of pumice tuffs associated with a much later eruption of the Rungwe Mt. volcano. All of the sites we had located in the western part of the basin were found in similar context – above the Tukuyu basalt and below the Rungwe tuffs.

Unfortunately it is unlikely that the volcanics could supply a very precise date for the artifacts. The Tukuyu basalt is probably much older than the occupation

Thomas Wynn and friends.

and the tuff too recent for potassium-argon dating. Due to the extreme acidity of the soil no material datable by radiocarbon has been preserved.

The artifacts associated with the old land surface all appear to belong to one industry. The best assemblage we obtained was excavated at the Kala Waterfall site where we recovered over 14,000 artifacts from three trenches. Over 95% are made of quartz. Trimmed tools account for less than one percent. The assemblage also exhibits a wide range of manufacturing techniques, including some typical of both the Late Stone Age and the Middle Stone Age. All in all, it closely resembles early Late Stone Age assemblages from eastern Zambia which have been dated between 25,000 and 21,000 B.P. Unless datable material is recovered at some future point we must assume that the Kala artifacts are at least roughly similar in age.

The nature of the artifacts suggests that, at least during the early part of the Late Stone Age, the Nyakyusa Basin was not culturally distinct but was occupied by people using tools similar to those used in other parts of central Africa during that time period. Despite the unique environmental circumstances of the basin in terms of rainfall and available resources, the material culture appears not to have been unique. This does not rule out the possibility that later Late Stone Age industries in the basin were, in fact, unique. This brings me to the survey's most interesting finding or, perhaps I should say, lack of finding.

We found no evidence in the basin of the predominantly microlithic industries so typical of the Late Stone Age in central and eastern Africa. In fact, we found no clear evidence of prehistoric occupation between the early Late Stone Age and the later Iron Age. It is as if the basin had been abandoned for several thousand years. Several hypothetical explanations jump to mind. Perhaps successive eruptions of the Rungwe volcano drove human population from the surrounding area. More realistically, perhaps the formation of the Rungwe cone so altered the local climate that Stone Age occupation became impractical. Alternatively, the vagaries of deposition and erosion in a volcanic area may have hidden all evidence of this time period. At this point we simply do not know; we can only speculate.

EARLY HOMINID DIET

Henry T. Bunn
Dept. of Anthropology,
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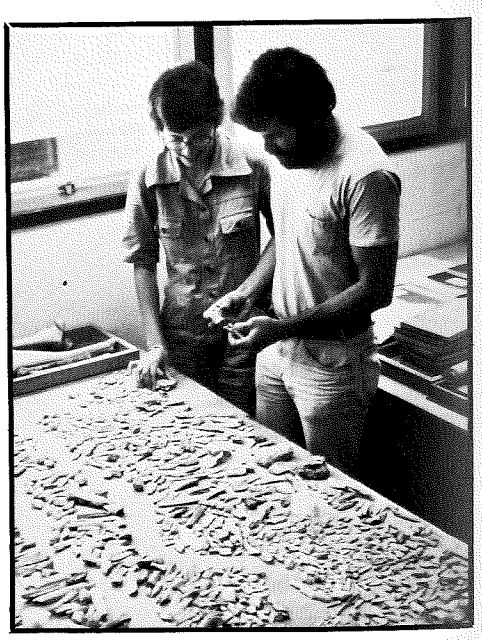
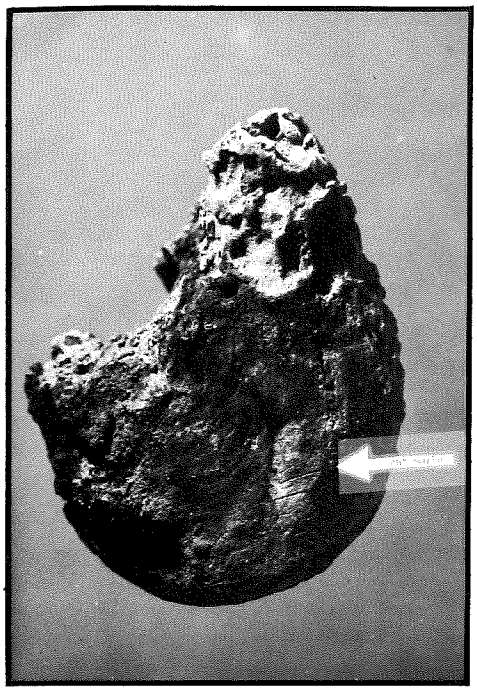
At Olduvai Gorge, Tanzania, and Koobi Fora, Kenya, Plio-Pleistocene sedimentary deposits formed within ancient lake basins contain abundant archeological, paleontological, and geological evidence. They afford an excellent opportunity for highly detailed interdisciplinary studies of the ancient environments in which some of the earliest known traces of hominid behavior are preserved. The fossilized bones of animals that lived in these areas constitute a major class of evidence on the environmental contexts in which hominids lived, and on some subsistence activities of the hominids.

One of the fundamental aspects of early hominid behavior which we would like to know more about is diet. Preservation factors limit the kinds of evidence we have to the most durable materials, so that, along with the scatters of stone artifacts identifying the sites, we find quantities of fossilized bone fragments. What we do not find preserved is much plant material, except for some pollen grains. However, if the two most widely used modern analogues for early hominid behavior, modern chimps and modern hunter-gatherers, are valid, then plant foods certainly constituted the bulk of early hominid diet.



Henry Bunn showing a fossil bone assemblage to colleague at the Louis Leakey Memorial Institute in Nairobi.



Cut marks on fossil bone.

The issue of meat eating by early hominids has been a controversial subject for decades. Raymond Dart was perhaps the most outspoken advocate of the view that early hominids were violent, bloodthirsty meat eaters. Others have presented similar ideas in more restrained fashion, and reports on the two main Plio-Pleistocene archeological localities in East Africa, on Olduvai Gorge by Mary Leakey and on Koobi Fora by Glynn Isaac, have interpreted the animal bones found with stone artifacts as food debris left by hominids at camp or butchery sites. Growing taphonomic awareness among paleoanthropologists has led to considerable skepticism of this evidence. With a wide range of opinion, there has been a clear need to return to the bone assemblages to look for evidence of hominid involvement.

For the past several years I have been studying fifteen bone assemblages from archeological sites at Koobi Fora and Olduvai Gorge under the supervision of Glynn Isaac. I have combined this work with comparable analysis of two modern large carnivore den assemblages – a bone accumulation from a modern hunter-gatherer camp in Botswana and a series of butchery and fracture experiments. The range of data is very useful because by identifying criteria which are distinctive of each sort of modern assemblage we have a sound basis for interpreting the Plio-Pleistocene bone assemblages.

The Olduvai and Koobi Fora bones from both artifact-bearing accumulations and dispersed surface scatters were first studied by paleontologists to gain insight on biostratigraphy and paleoecology. To achieve these broad objectives, attention was directed mainly toward highly diagnostic cranial parts, especially complete tooth rows and horn cores.

Recently, some of these same bone assemblages and additional freshly excavated assemblages have been studied from an archeological perspective. This work has refined and expanded taxonomic and skeletal part lists at the major sites and thus has augmented prior paleontological research. Moreover, additional topics have been studied, including:

(1) estimates of minimum numbers of individuals for each taxon and age class;

(2) frequencies of different skeletal parts;

(3) frequencies of various types of modifications, including hominid-induced butchery marks, carnivore and rodent-induced gnaw marks, and weathering or post-depositional alterations. The locations of butchery marks may reveal patterns in the butchery procedures of early hominids.

One of the most exciting results of this project has been documenting the occurrence of hominid-induced butchery marks on some of the animal bones at Koobi Fora and Olduvai sites that are between 2 and 1.5 million years old. These so-called cut marks were produced by hominids using sharp-edged pieces of stone to skin and cut up animal carcasses and to remove meat and connective tissues from the bones. The marks are very fine linear grooves averaging only 1/4 mm. in width, but under a strong directional light they can be readily seen and identified with the naked eye. Other types of linear grooves are also present on some of the bones, including gnaw marks produced by rodent and carnivore teeth, but these gnaw marks are wider and relatively more shallow than cut marks.

Thanks to the well-timed support of the Leakey Foundation, I was recently able to return to Kenya to firmly document this evidence. Completing this task required the use of special techniques and newly-acquired equipment at the Kenya National Museum, and it yielded close-up photographs of the bones for publication and a large set of high resolution silicone molds of the cut and gnaw marks for additional microscopic analysis.

There is now direct evidence linking hominids to some of the bone assemblages, but there is also evidence of other animals' activity and involvement with the bones. Given this complexity, it seems clear that the formation of these early archeological sites involved a complex interplay of several key factors, including hominid butchering and marrow processing activities, carnivore scavenging and other animal activities, and various depositional and post-depositional processes. The presence of cut marks on significant numbers of bones documents the involvement of early hominids nearly two million years ago in cutting up animal carcasses and breaking open bones. This direct evidence on early hominid diet enables us to dismiss models of human evolution which do not incorporate meat eating as a significant component of early hominid behavior.

LOCOMOTOR BEHAVIOR IN BUSHBABIES

Robin Huw Crompton
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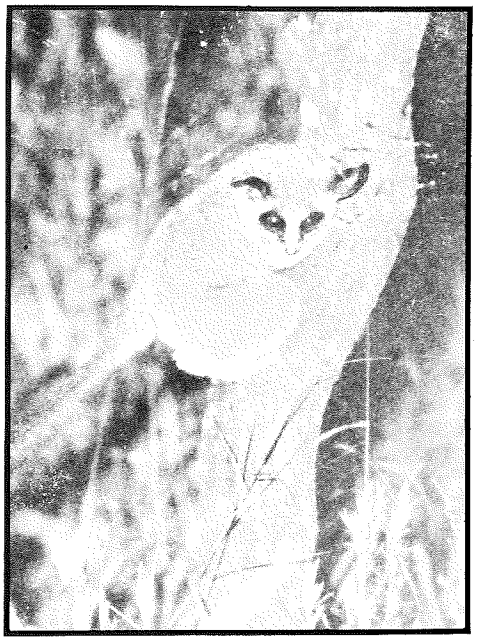
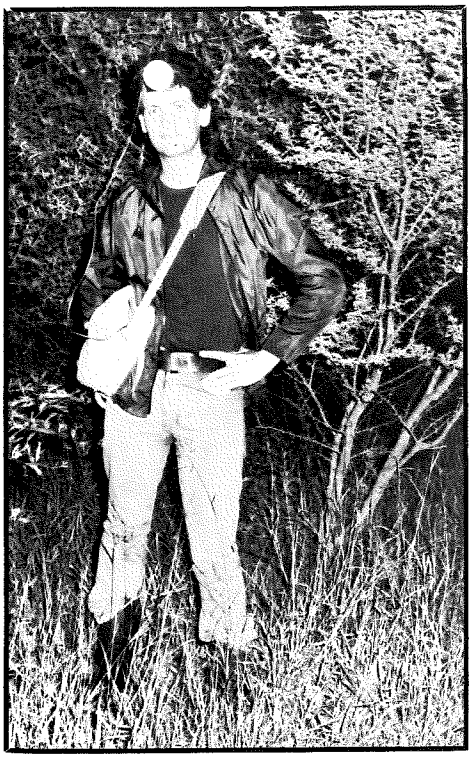
The first of the primates lived in the Cretaceous period at the time of the last dinosaurs. However, they are represented only by a few, scattered teeth. By the Paleocene, the primates had already diverged into a successful but specialized lineage not closely related to living species, and another more or less unknown lineage, ancestral to extant primates. The succeeding Eocene period saw the extinction of the specialized Paleocene forms and the diversification of the remaining lineage into several major groups of prosimian primates. The groups most likely to have given rise to the monkeys, apes and ourselves are known from teeth, skulls and limb-bones and appear to have been small-bodied, nocturnal, insectivorous forms with elongated hind-limbs.

To understand the natural history of ancestral primate radiation, we can look at living forms of similar dental, cranial and limb morphology and see how they behave, and in particular look at the relationship between morphological and behavioral differences between closely related pairs of species, a kind of "natural experiment" which reveals adaptive shifts in morphology and behavior.

The group most similar to the Eocene forms in skeletal morphology is the bushbabies or galagos. Behaviorally and morphologically, they are a "lowest common denominator" for extant primates. With the help of an L.S.B. Leakey Foundation grant, I spent eleven months studying locomotor behavior and habitat use of



Bushbaby, Northern Transvaal, South Africa.



Robin Huw Crompton.

Galago senegaleusis and *Galago crassicaudatus* in the thornbush and thorn woodland of the Northern Transvaal of South Africa. The study locations are subject to considerable seasonal change in climate; climates in the Eocene northern continents, where most of our fossil evidence has been found, are known to have been quite strongly seasonal.

I made nine separate studies, embracing contrasts between the species, between seasons, between adults and infants and between different sites for one species, and collected over 17,800 observations on fourteen variables, including movement type, support orientation and diameter, height, distance travelled, tree type, feeding and other associated activity.

I found that the difference in body size between the 200 gram *Galago senegaleusis* and the 1,500 gram *Galago crassicaudatus* leads to major differences in diet, habitat use, and locomotion. Although both species live on a diet of insects and *Acacia* gum, the smaller species is more insectivorous, and makes more use of the ground and the first couple of meters above it. Supports available within this zone include a high proportion of tree-trunks, on which saps may be found oozing at wounds. The high frequency of vertical supports and the large discontinuities that characterize this zone contrast with the low-angled, continuous supports available in the canopy, where *G. crassicaudatus* lives. As a consequence, clinging postures and saltation — leaping and hopping — characterize the locomotion of *G. senegaleusis*, while standing postures, walking and climbing characterize that of the large species.

Seasonal changes in behavior are much more marked in the small species; in summer, it is often to be found in the peripheral canopy, foraging for insects in the small, low-angled terminal branch zone. In winter, cold, dry weather reduces the availability of arthropods, and a greater proportion of gum is consumed. Since gum licks are found on the main branches and tree-trunks, *G. senegaleusis* moves more often at a lower level; supports used are now larger and more steeply angled. In very dry, cool weather the gum sources dry up and *G. senegaleusis* comes down even further, foraging for insects that may yet be found in the moist leaf litter on the ground. As would be expected, the use of vertical, large-diameter supports is greatest.

The saltatory locomotion of *G. senegaleusis* is most obviously advantageous at this season. However, the frequency does not change from season to season; it has become a species-specific behavior pattern. Leaping allows rapid exploration of a wide area when insects are in short supply. It is the only efficient way to move in a highly discontinuous arboreal zone, and helps reduce the high risk of predation near the ground.

The behavior of the large species does not change markedly; it is dependent on gum throughout the year, and remains in the low, central canopy region, moving slowly from gum-lick to gum-lick along the major radial branches of trees. For a large bodied form such as *G. crassicaudatus* an insect forms a small part of its energy requirements but costs more to hunt and catch — it is not a good strategy for a large animal to hunt single insects. However, large body size brings large stomach size and the ability to ingest bulky foods. It is also in itself a protection against predators. Small body size brings relatively high metabolic energy requirements which cannot be satisfied by a diet of plant food, but an individual insect forms a large proportion of total energy requirements — a high investment of effort in hunting insects is appropriate and mandatory for *G. senegaleusis*.

Thus differences in locomotor behavior can be seen as consequences of alternate strategies in surviving predation and seasonal food shortage. Leaping locomotion, for *G. senegaleusis*, is an adaptation that allows access to the ground and tree trunk zone. Although quantitative information on other primate species with similar morphology is limited, it seems to be a common pattern of behavior. We may hypothesize, therefore, that this was an important behavioral pattern for Eocene primates with similar limb morphology.

The next stage in the project is to demonstrate quantitive differences in morphology of the limbs between the two *Galago* species corresponding to the behavioral differences I have recorded and to accumulate similar behavioral and morphological data on the other small prosimian leaping forms, before moving on to an analysis of the quantitative morphology of the Eocene fossils.

THE CHIMPANZEES OF GOMBE

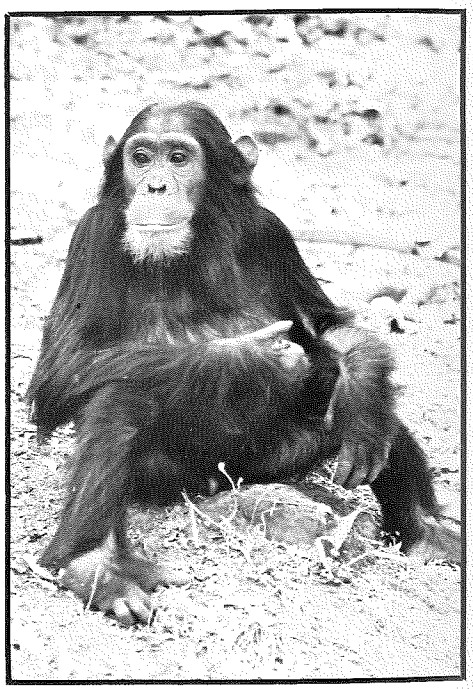
Jane Goodall
Director, Gombe Stream Research Centre,
Kakombe Valley, Tanzania

In January, 1980, the males of the Kasakela community numbered six adults, eight adolescents and juveniles below the age of fifteen, and nine infants under four years. There were seventeen adult females, nine adolescents and juveniles, and four infants less than three years of age. During the year, Nope gave birth to a female, Hepziba. There were, of course, many more adult females in the community than males. The ratio of almost three to one was the highest in twenty years of research. But at the other end of the age scale, infant males outnumbered females.

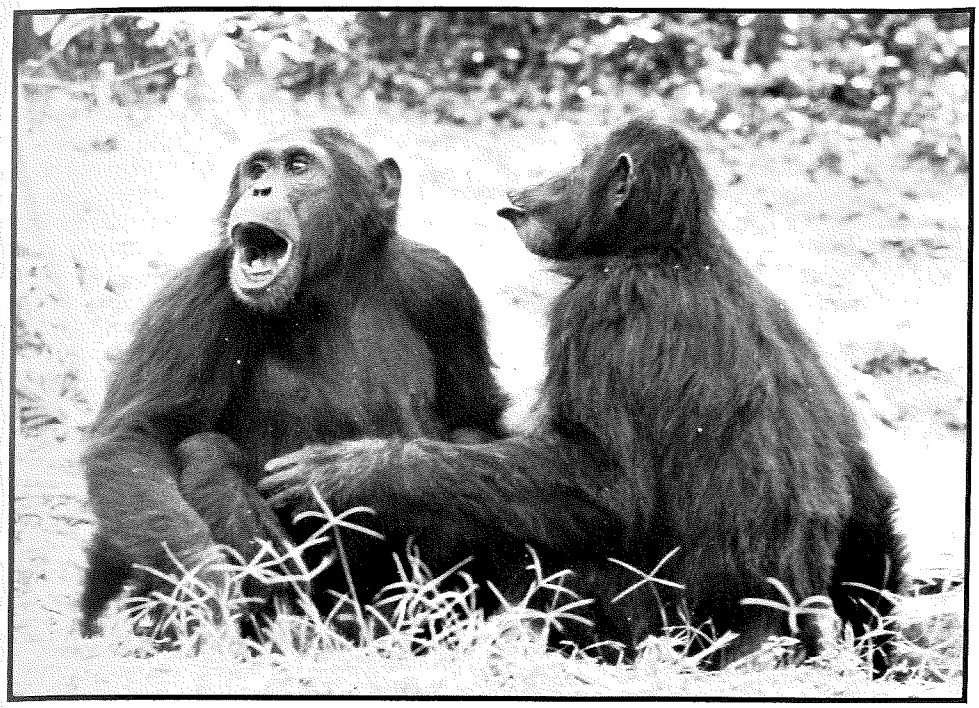
One newcomer to the community, who appeared with his mother during 1979, was eight year old Jagali, named for George Jagels, a long time friend of Gombe. He became very independent during 1980 and was often seen, without his mother Joanne, traveling with groups of adult males.

During 1980, Figan was able to re-establish himself as alpha male, a position which had been nearly usurped by Goblin. Goblin had lost status after an attack on him led by Figan. During the year, Goblin, in some ways, reverted to the peripheral position of an adolescent, quite often sitting apart when the older males were grooming, spending more time on his own. He did not, however, opt out of the struggle for high rank, challenging males, other than Figan, when there were not more than two together.

There were three outbreaks of colds and coughs in the community during 1980. Very serious injuries were sustained by



Seven year-old Wilkie, named for Gombe benefactor, Leighton Wilkie.



Melissa reaches to touch her son, Goblin. photos: Jane Goodall

Passion, her infant son, Pax, and Freud, Fifi's adolescent son. It was suspected that Passion and Pax were victims of intercommunity aggression during an encounter with males of the Kalande community to the south. Freud received his injury from Goblin, whom he tried to keep from mating with his mother, Fifi. Freud apparently broke a bone in his ankle and was lame for over two months. All three injured eventually recovered.

The Gombe field assistants, under the direction of Hilali Matama, recorded considerable chimpanzee predatory behavior during the year. Members of the community were seen to eat eighteen colobus monkeys. Both males and females joined the hunts; sometimes females hunted on their own. The staff observed six baboon hunts, in two of which the chimpanzees were successful in catching infant baboons. Four bushbuck fawns were consumed, one of which was snatched from baboons. The chimpanzees also searched for piglets on seven recorded occasions, after seeing or smelling adult pigs; only once did they find piglets and catch one. One unsuccessful hunt for blue monkeys was observed. A number of chimpanzees consumed fledgling birds.

The behavior of eight different families was followed in particular in 1980. These were the mothers Fifi, Passion, Melissa, Winkle, Patti, Athena, Little Bee and Pallas and their offspring. Passion and her daughter Pom are the infamous pair who were responsible for killing and eating a number of Kasakela infants during 1975 and 1976. They made a number of attempts in 1977 and 1978 but were thwarted and no such behavior was seen during 1979. But in September, 1980, they attacked Patti, held her down, and tried to seize Tappit, her infant son. In the confusion that ensued, Patti broke free. Subsequently, other mothers appeared to be very wary of Passion and Pom. Both females are, however, efficient and attentive mothers themselves.

Now, in 1981, there is an unprecedented number of infants growing up in the chimp community. Several mothers have three offspring, the eldest of which is adult or nearly adult. Fifi is the most recent of these mothers – she gave birth to a daughter, Fanni, in April. We have been interested in observing how (a) Fifi's high social rank and her protective maternal attitude have encouraged her eldest son, Freud, in his early attempts to dominate the females in his community; (b) his infant brother (male sibling) Frodo had imitated Freud, watched him, helped him in his displays at females or baboons; (c) Freud's increasing ability to intimidate other females has assisted Fifi to raise her own rank.

Passion's son, Prof, is the same age as Freud. He, too, has a high ranking and protective mother, though a far less social one. Prof also has had the benefit of protection by his elder sister, Pom, who is still an integral member of the family group, along with her own infant son. Yet Prof has shown none of the precocity of Freud. The latter has been displaying at females for over three years; Prof has barely started. Prof's younger brother, Pax, does not gaze at and imitate his elder brother in the way that Frodo does. These differences in personality are not only interesting in themselves, but further analysis of the factors involved should prove of value to those studying human behavior.

So far (with one possible exception) no physically mature male of a total of seven has been seen to mate, or try to mate, with his mother. Moreover, sisters have typically resisted, and resisted vigorously, the sexual advances of their male siblings, particularly during their first few periods of estrus. Gremlin, the eldest daughter of Melissa, has proved the exception. Last year she attained menarche and showed her first estrus swellings. The first time her elder brother, Goblin, was observed to show sexual interest in her she responded instantly by approaching, crouching in the correct female mating position, and cooperating fully during an apparently normal mating. It will be interesting to see how this seemingly unusual sexual relationship develops during 1982.

For the past two to three years, very few of the Kasakela females have been cycling, as they were all suckling young. During that time a number of "stranger" females, usually in estrus, have been observed traveling with Kasakela males. Two of these were older females with young; if these were real transfers from neighboring communities, then it is the first time that the movement of mothers between communities has been recorded at Gombe.

Another matter of special interest is the physical and social development of the two orphans, one female, Skosha, and one male, Beethoven. They are now eleven years old – Skosha's age is known precisely, Beethoven's is an estimate since he was first seen as a young juvenile traveling with his presumed older sister. Both orphans are at least two years behind others of the same age in their physical development; both show unusual social behavior. They will be observed carefully during 1982. □

'TIS THE SEASON

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Tickets for a lecture or lecture series might also be a welcome present.

The Foundation sends best wishes for the holidays to all members, and expresses hope and faith that 1982 will be a happy and productive year. We take this opportunity to reiterate our thanks for your generous support.

GRANT SPOTLIGHT

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

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

Karen Lee Davis *$2,100 needed*

EXPERIMENTAL FRACTURING OF BOVID LONG BONES: A TAPHONOMIC PERSPECTIVE

Plan for research: African bovid bones will be fractured experimentally to study breakage patterns and to link particular patterns with the processes that produced them. The results of the experiments will be used to construct a model to predict how a bone of known size will break when subjected to specific stresses. The utility of this model will be tested by applying it to the archeological assemblage from Die Kelders, an Upper Pleistocene-Holocene cave site on the Cape coast of South Africa.

Studies have shown that patterns of bone breakage will depend on the agent involved as well as on structural characteristics of the bone. However, criteria indicative of specific processes have not been established. Progress has been hampered by lack of a standard method to describe and classify fractures. Previous experimental studies have dealt only with bones of limited size range and primarily with domesticated animal bones. Ms. Davis' proposed research will deal directly with these problems.

Roy R. Larick *$3,950 needed*

THERMAL ALTERATION IN PERIGORD CHERTS

While heat treatment of Upper Paleolithic chert artifacts is known to have occurred in the Perigord of southwestern France, positive identification of heat treated artifacts is difficult in this region. The problem is caused by a heavy, white, porcelain-like patina that frequently coats artifacts recovered from both rock shelter and open-air deposits. This patina is common on the artifact types that, on morphological grounds, are most likely to have been heat treated prehistorically.

Roy Larick, a Ph.D. candidate in the anthropology department at the State University of New York at Binghamton, proposes a set of experiments to examine the relationship between thermal alteration and patination of cherts. His analysis of the results will use electron spin resonance techniques developed for geochemical applications. The comparative data produced can be used to evaluate heavily patinated archeological specimens in the future. The proposed research is a necessary step in the continuing investigation of Perigord cherts and their use during the entire Paleolithic sequence.

Nancy S. Minugh *$3,000 needed*

PATTERNS OF SKULL GROWTH AND DEVELOPMENT IN UPPER PLEISTOCENE HOMINIDS

Several lines of evidence, particularly the fact that Neanderthal and anatomically modern human infants closely resemble each other while adults of these groups differ considerably, indicate that skull growth in *Homo sapiens neanderthalensis* differed from that of *Homo sapiens sapiens*. Moreover, metric trends in Upper Pleistocene hominid dental evolution indicate that craniofacial growth, which is intimately related to dental development, should have undergone concomitant changes through that time period. Thus, a knowledge of growth differences may materially increase our understanding of the morphological differences between Neanderthal and anatomically modern human skulls. Ms. Minugh's project will attempt to identify the growth patterns underlying the morphological changes in the skull from infancy to adulthood in Upper Pleistocene hominids from Europe, North Africa, and the Middle East – those areas from which fossils identified as Neanderthals have been recovered.

Dr. Erik Trinkaus *$2,835 needed*

MOLDING OF THE SHANIDAR NEANDERTHALS IN THE IRAQ MUSEUM

The Shanidar Neanderthals represent one of the most important samples of Upper Pleistocene fossil human remains, yet many of the original Shanidar fossils have never been molded. Any serious damage to them would represent a significant loss to science. In addition, the absence of high quality casts has limited their study by human paleontologists, since travel by foreigners to Iraq is difficult. Funds are requested by Dr. Trinkaus of Harvard University to enable Mr. Mario Chech to return to the Iraq Museum, Baghdad, where most of the Shanidar Neanderthals are housed, to complete the molding.

In 1980, Mr. Chech, the casting technician from the Vertebrate Paleontology Laboratory of the University of Paris, accompanied Dr. Trinkaus to the Iraq Museum and molded about half of the Shanidar fossils. Permission was obtained at that time for Mr. Chech to return. This project will provide a permanent record of the Shanidar Neanderthals and make their general study and integration into views of human evolution possible.

Leo Berenstain *$2,952 needed*

SOCIAL STRUCTURE OF FORAGING IN LONG-TAILED MACAQUES

In a two year study in the rain forest of the Kutai Reserve, Indonesian Borneo, Mr. Berenstain will investigate the relationships between social and foraging behavior of long-tailed macaques (*Macaca fascicularis*). The study tests several general hypotheses: (1) foraging subgroups occur most often when food is relatively scarce and are composed of matrilineal kin-groups with attached adult males; (2) individuals' dominance ranks influence their foraging success in ways that vary predictably with food density and troop dispersion; (3) competition at food patches is greater in a large troop, causing its members to forage in autonomous subgroups more often than do members of a small troop. Data for testing these hypotheses will be obtained from focal animal sampling performed by teams of observers during a variety of observational procedures, including all-day follows of individual monkeys.

Greer M. Murphy, Jr. *$1,529 needed*

MORPHOLOGICAL HEMISPHERIC ASYMMETRIES IN HUMAN AND RHESUS MONKEY CEREBRAL CORTEX AND THALAMUS

Mr. Murphy plans to examine a sample of 176 normal human brains and thirty rhesus monkey brains on a histological level for morphological hemispheric asymmetries. Eight regions of the cerebral cortex and thalamus, chosen because of their association with behavioral lateralization, will be studied. Neural regions related to language skills will be given special attention. Photomicrographs will be made of the areas of interest and their dimensions in

the two hemispheres determined with an electronic digitizer. The digitizer is interfaced with a minicomputer so that data can be transferred from the photomicrographs directly to the computer storage disk.

The scientific significance of this work is that for the first time a search for the anatomical basis for hemispheric specialization will be made on a histological level in a sample of statistically meaningful proportions drawn from two primate species. It is important that we determine whether hemispheric asymmetries that have been observed in human brains are unique to man or if they are general primate characteristics.

Dr. Biruté Galdikas *$6,000 needed*

ORANGUTAN RESEARCH PROJECT

Dr. Biruté Galdikas, Director of the Orangutan Research Project in Indonesia (northern Borneo), has been awarded $6,000 in emergency funding to cover contingencies which include extensive repairs to the camp generator and the camp jeep. The vehicle, on its last legs, is slated for replacement in 1982. Additional monies are needed to cover costs of repairs and additions to the guest house where the Indonesian students and the research assistants attached to the project are housed. Other unscheduled costs include an emergency eye operation for the cook and replacement of video recorder equipment.

Dr. Robert M. West *$2,400 needed*

VERTEBRATE PALEONTOLOGY AND GEOLOGY, NEOGENE SIWALIK GROUP, WESTERN NEPAL

The Siwalik Group is a thick wedge of clastic sediment which has poured southward off the rising Himalayas for much of the Cenozoic. Diverse fossil mammals have been collected in the Siwaliks of northern India and Pakistan including three hominoid taxa – *Ramapithecus, Sivapithecus* and *Gigantopithecus*.

The Siwalik Group also extends the length of the country of Nepal. During the winter 1980–81 field season, the team of Dr. West, Curator of Geology at the Milwaukee Public Museum, and Dr. Jens Munthe added to the Lower Siwaliks fauna from Nepal and found the first record of hominoids there. A single tooth of *Ramapithecus punjabicus* was collected in Tinau Khola. Magnetostratigraphic study of the rock there indicated that this *Ramapithecus* is probably the oldest reported hominoid from South Asia. Its occurrence in Nepal extends the known range of the genus and helps fill the geographic gap between the ramapithecines from southwestern China (Yunnan) and those from northern India.

Dr. West now proposes to continue to develop Nepal paleontologically, extending the stratigraphic range of fossil vertebrate localities into the Middle and Upper Siwaliks. He feels that a significant new area for research into Mio-Pliocene Asian faunas is now available.

Dr. Jane Goodall *$6,000 needed*

FIELD STUDIES OF FREE RANGING CHIMPANZEES AND BABOONS AT GOMBE, TANZANIA

Dr. Goodall, Scientific Director of the Gombe Stream Research Centre and Visiting Professor in Zoology at the University of Dar es Salaam, requests funds for the continuation of the long term study of chimpanzees and baboons at the Gombe National Park. 1982 will be the beginning of the twenty-first year of continuous daily observation of the chimps of the Kasakela community and the sixteenth year of continued observation of the baboons.

Please see her remarks on chimpanzees in "Field Reports." Observation of four different baboon troops will continue through 1982. The largest of these (Camp Troop) shows signs of dividing. This process is being watched carefully; if the troop does split, this will be the third time such an occurrence has been recorded at Gombe.

Stanley H. Ambrose *$2,998 needed*

EARLY HOLOCENE ENVIRONMENTS AND ADAPTATIONS, CENTRAL RIFT VALLEY, KENYA

Stanley Ambrose is a Ph.D. candidate in the Department of Anthropology at the University of California, Berkeley. He proposes additional field and lab work on the Early Holocene regional settlement system of the central Rift Valley to complete coverage of this system. He plans to test predictive models of hunter-gatherer subsistence and settlement patterns in changing environments for the Eburran (Kenya Capsian) Industry, a microlithic Later Stone Age industry. The location of the projected study area provides an ideal situation in which to test the utility of the technique of stable carbon isotope analysis of archeological faunas for the determination of prehistoric environments and detection of climate change. If the technique proves successful, it will have universal applications as a tool for paleoecological reconstructions in tropical and subtropical environments.

Dr. Dian J. Fossey *$10,000 needed*

RESEARCH ANALYSIS OF LONG-TERM MOUNTAIN GORILLA FIELD DATA

Dr. Fossey is now processing the important and unique data accumulated during her thirteen years' work with the Karisoke mountain gorillas.

Her affiliation with Cornell University offers the opportunity to utilize the computer facilities and trained statisticians for data analysis. She has begun the training of one student in drawing data from the field observations. Initially the following topics are to be analyzed quantitatively for scientific papers: infanticide, inter-group interactions, sexual behavior, grooming and related maintenance behavior.

When a sufficient amount of the above data is drawn, they will be submitted to a key puncher for programming. Access to Cornell's library will provide ample reference material to accompany the statistical presentation of scientific papers.

Timothy G. Bromage *$4,266 needed*

HOMINID CRANIOFACIAL REMODELING AND GROWTH: A SCANNING ELECTRON MICROSCOPE STUDY

Paleoanthropology is a multidisciplinary science which receives extraordinary public interest because of its biological interpretations of fossil hominids living several million years ago. It is usually necessary for anthropologists to infer and speculate on these interpretations because the actual biological processes cease with the organism's death. New developments resulting from scanning electron microscope (SEM) research on bone growth mechanisms, however, have brought us within one step of actually observing certain biological processes of our early hominid ancestors.

The objective of the study proposed here is to gather data on the craniofacial bone remodeling among juveniles of the early hominid genus *Australopithecus* from several East and South African localities. Making high resolution replicas and examining them with the SEM requires only 8% as much time and 14% of the cost as similar studies using a histological technique and does not damage rare fossils. □

PROFILE · STONES & BONES

Stones and Bones, the pilot project involving the study of paleoanthropology at the senior high school level, was initiated in 1977 by a far seeing combination of groups, each with a well defined area of expertise. The plan was conceived by the L.S.B. Leakey Foundation's President, Dr. Edwin S. Munger, and Mrs. Max K. Jamison, Trustee, and encouraged from the outset by Drs. Clark Howell, Paul MacLean, David Hamburg, Bernard Campbell and Irven DeVore. Assistance was sought from Dr. Seymour Sitkoff, Instructional Planning Specialist, Science, Los Angeles Unified School District, who became director of the project and from the Los Angeles Museum of Natural History, for the casting of all fossil specimens necessary to the tactile implementation of the courses being devised.

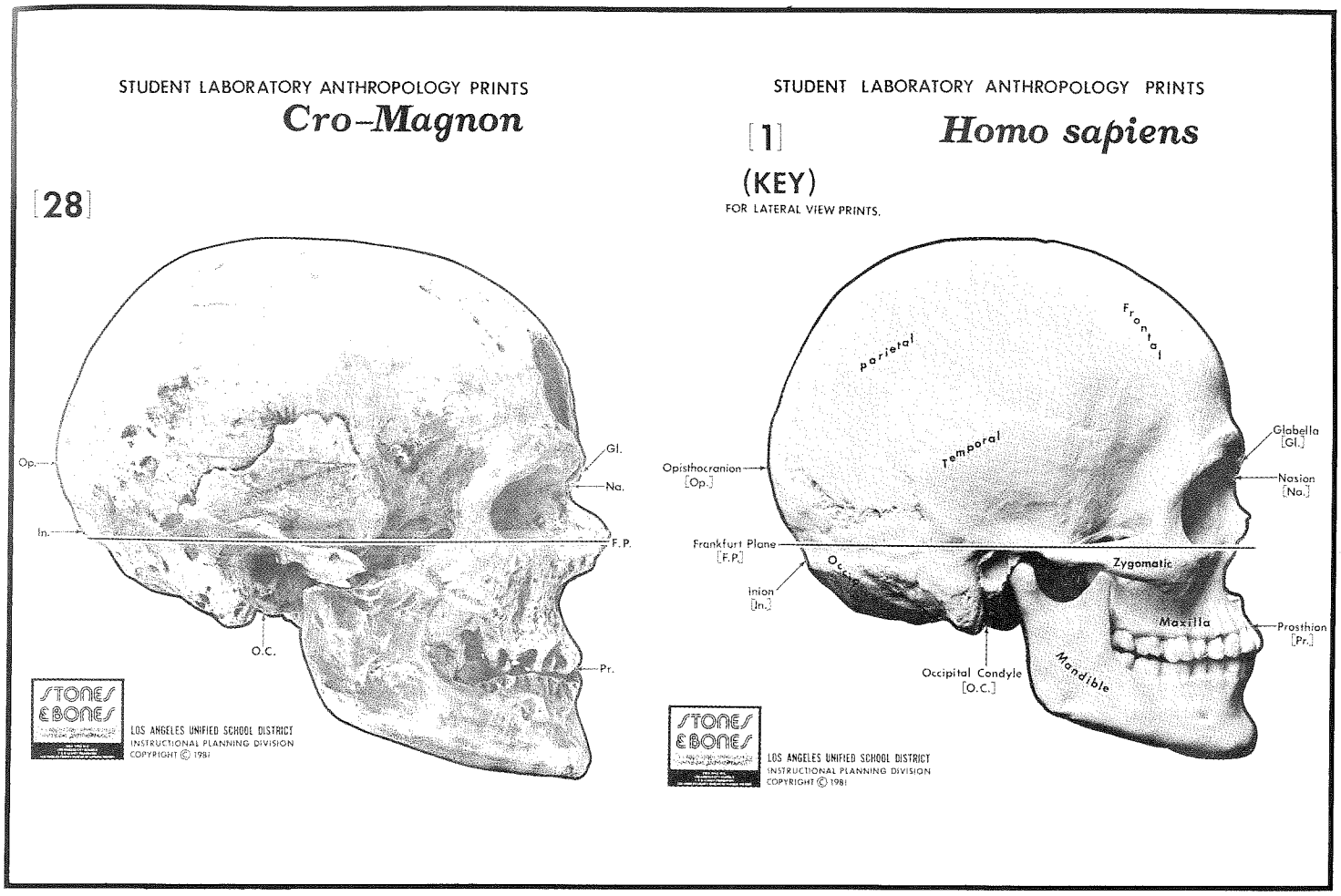
With the experienced guidance of Dr. Sitkoff, the three pilot years that followed saw the development of printed and multimedia instructional materials designed for senior high school student ability from the non-academic to the academic. These materials, including fossil replicas, are scientifically accurate. The Leakey Foundation, the Natural History Museum and members of the professional staff from the universities of California, Berkeley, and Los Angeles, have all provided technical assistance in their production.

During the academic year 1980–1981, Stones and Bones had its state-wide dissemination. Three courses of study are now being offered for adoption by interested school districts in California.

The biology unit reinforces many basic concepts presently being taught in the general biology curriculum. It presents a four to six week overview of physical anthropology and provides students with a series of eleven laboratory explorations that focus on topics which include primate distribution, behavior, locomotion and morphology, early hominids and interpretation of the archeological record. Cast fossil specimens are used extensively. Also included in the unit instructional material are a syllabus and visual aids illustrating the progress of the class.

The modern (general) science unit is specially designed to motivate non-college oriented students. Each of the twenty-one laboratory explorations offers opportunities to investigate topics which include the geologic time table, measuring of radioactivity, primate behavior and fossil hominids. Each has a glossary and vocabulary drill. A series of booklets on these topics is illustrated and written in a narrative style, a simplified format with easy readability. During the four to six week course, students have the opportunity to simulate excavation of specimens through the use of tools provided in the fossil dig classroom kit.

The semester course in physical anthropology provides students with the chance to study the story of humankind in depth. Their investigation pursues such subjects as phylogeny through time, continental drift, primate classification, morphology, behavior and locomotion, *Australopithecus,*



Some of the visual aids used in the project.

Homo erectus, Neanderthal, and Cro-Magnon. Supplementary instruction materials for both student and teachers include study prints, charts, film strips and a set of fossil casts and photographs.

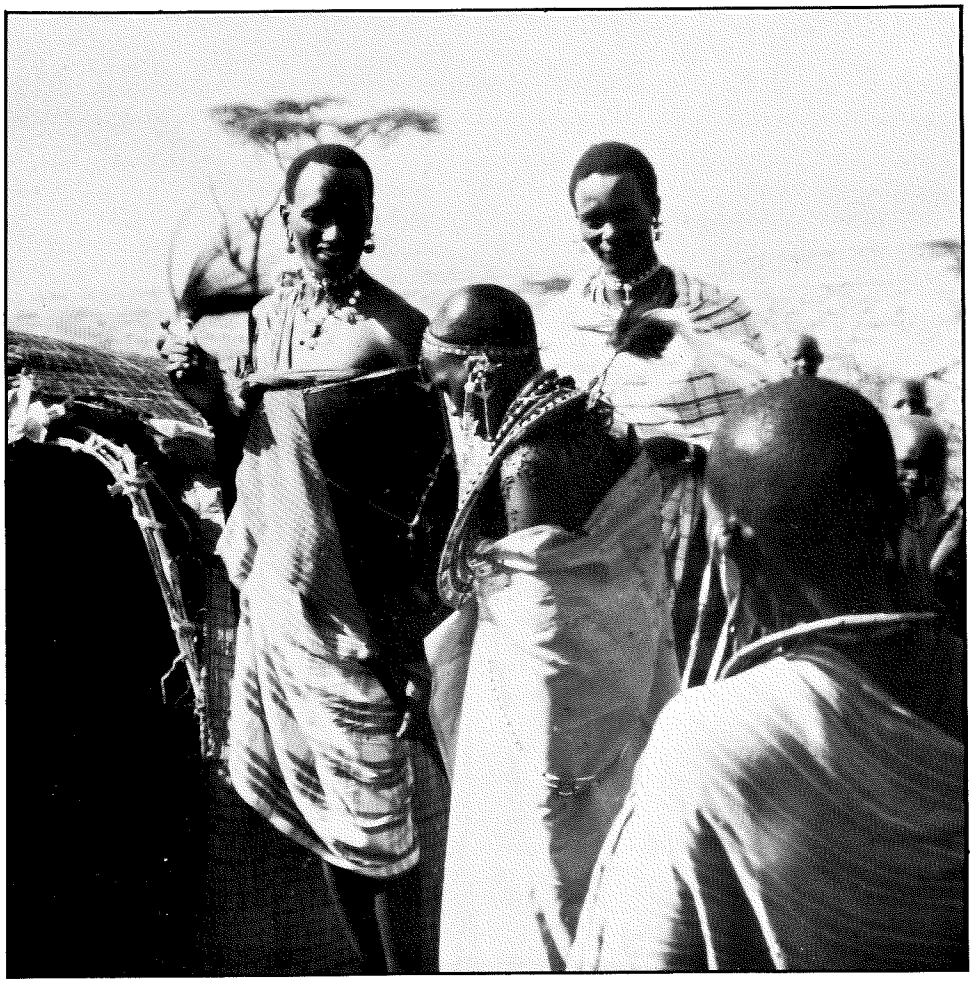
The fossil specimens (twenty-two in all plus various types of tools) continue to be cast at the Los Angeles Unified School District's Science Center in Van Nuys, California. The mold and casting procedures which were developed at the Natural History Museum at the beginning of the project are still being used under the supervision of four student assistants from California State University, Northridge, who work approximately eighty hours per week to pour and finish casts as well as repair and make molds. Although this process is time consuming, to date their production capability has been sufficient to accommodate the requirements of the project. Should the demand for these casts accelerate because of the successful dissemination of the courses throughout California, other means of production will have to be sought that will enable the same high standard of quality to be retained at a reasonable unit price, thus satisfying one of the objectives of the project.

This year thirteen school districts other than Los Angeles have adopted the program. Seven are receiving grants from ESEA, Title 4C (Elementary and Secondary Act, Title 4C, which funds pilot and innovative projects) while six districts are using their own funds for this purpose. Over the past three years, sixteen to twenty senior high schools in Los Angeles and thirty selected teachers have participated in the pilot stages. 2,200 students benefited each year from this opportunity to research their "roots" while being additionally exposed to an interdisciplinary emphasis on oral and written language, and mathematical and social science skills. Post-test evaluation showed a considerable improvement in these skills, indicating a high level of interest and motivation. In addition, there was a significant drop in absenteeism while the units were being taught.

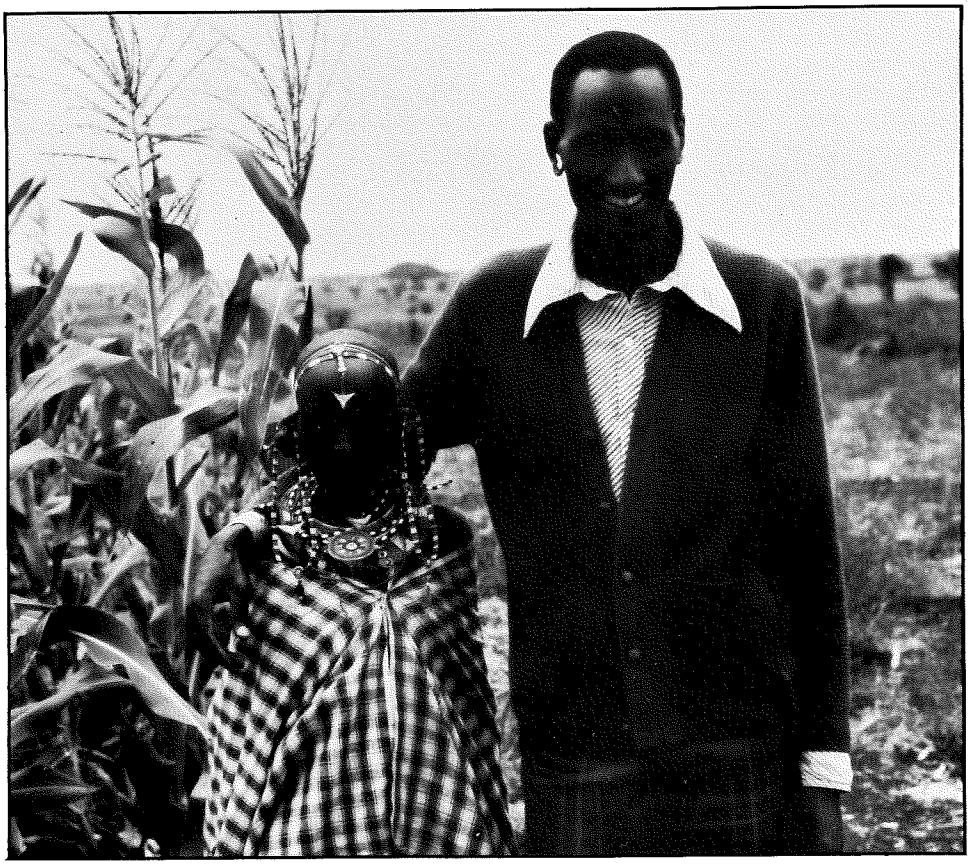
Considerable interest in the paleoanthropology project throughout the United States and abroad has been indicated from correspondence with colleges, universities, secondary schools, museums and individuals. The National Museum of Natural History, Smithsonian Institution, is using the materials in their Outreach Program and as study and review guides for their volunteer museum teachers in association with their regular text, *Humankind Emerging*. In addition, the fossil casts are being used as touchable objects during regular tours in their Ice Age Mammals Hall. A letter from their Education Specialist indicates, "It is wonderful that Los Angeles students have such excellent materials from which to learn about physical anthropology, primatology and fossil hominids. I feel sure that when the project is nationally distributed, there will be a great deal of interest from other secondary schools. A university professor has even indicated an interest in using some of your materials at the introductory level."

But the future of the project is very much up in the air!

Funding for national dissemination is in doubt as the source, ESEA, Title 4C, will receive a sixty percent cut in their budget on July 1, 1982. In the face of proven student interest and achievement and strong teacher commitment and enthusiasm, this is extremely unfortunate. Stones and Bones has been cited as "exemplary" by the California State Board of Education through a very competitive process. The project directors are proud of the team that has enabled it to attain this status. The curriculum is unique, well designed and well implemented. It affords students opportunities and benefits not usually available in regular secondary classroom programming. Stones and Bones has made an outstanding contribution to secondary science education and it is hoped that it will be able to continue to do so. □



Top to bottom – the Maasai lifestyle is changing rapidly. Over a five-year span the warrior spokesman changes from a traditional subsistence pastoralist to a farmer, though still with substantial cattle holdings. photos: David Western



continued from page 1

killing serves the dual purpose of making a much needed profit and eliminating an unwanted competitor?

There is no easy solution. I have had, nevertheless, the opportunity during the past thirteen years in the Amboseli ecosystem in southern Kenya to show that an integrated approach can be devised and is practical. Here both Maasai and wildlife gravitated to the same restricted grazing and watering sites each dry season and, during the rains, used similar migratory pathways. The seeming coexistance of pastoralists and wildlife was already in the process of change by the time I began work in 1967. The tremendous wildlife spectacle generated more money for the government and the district council than any other area in East Africa. However, the local Maasai received none of the profits even though their culture was fast changing toward a cash economy under pressure of expanding human numbers. Noting the inequality, the Maasai sought to establish ranches on what was still a game reserve so that they could preempt the mounting international pressure to establish a national park. Protection of wildlife seemed justified in light of the collapse of the woodlands, which, it was presumed, signaled excessive overgrazing by livestock.

I began my studies by looking at the migratory patterns to explain when, where and why wildlife migrated, why Maasai had similar routes, and the extent to which they competed with each other. Using aerial and ground counts I found the migrations covered 3000 square miles and in dry seasons water was so limited that all migrants clustered within a small radius around the few swamps. Next I examined the ecology of the Maasai more closely to work out the nature of their traditional balance with the ecosystem and the factors pushing them progressively into a cash economy and a lifestyle incompatible with wildlife.

The ecological dynamics were to prove complex, yet vital to later planning. Oscillations in climate and periodic drought clearly governed the dramatic changes in woodlands as well as other habitats. They also explained the fluctuating balance of livestock and wildlife numbers. Additional studies were undertaken once we began to consider options in planning. We needed to know what roles pastoralism, ranching and tourism could play in the future development of the area.

The final outcome of protracted studies was a plan which recognized the need to establish both Maasai ranches and a national park. Amboseli as a revenue source for Kenya was vital and could, at the local level, yield a return from wildlife-based tourism fifty times the potential income from ranching. To protect that asset, a national park of 150 square miles

was established in the dry season concentration area. To protect the Maasai's interests and to promote their emerging ranching practices, they were given legal title to the remaining lands, including those made available by water developments beyond their normal dry season range.

A separation of the major spheres of interest was a necessary measure but not a desirable solution. So, to guarantee the Maasai a direct share of the lucrative wildlife profits and to ensure that the migrants would not be denied their seasonal dispersal paths, incentives were established. The surrounding ranchers were first paid an annual grazing fee to cover their costs in supporting wildlife migrants. Such losses are calculated from the monitoring that I still conduct. Then, to provide more substantial incentives, the prospect of accommodating campsites and lodges on their land around the park was offered to landowners. In adopting the scheme, the Maasai around Amboseli and Mara have fast become the wealthiest group of ranchers. Here and in Samburu the park headquarters are being relocated at the boundaries where they can provide communal services – shops, schools, dispensaries – to the local, rural population as well as to the staff. The relocation of facilities neatly solves two issues at once: it gets benefits to where they are most needed and most relevant to the future of wildlife, and at the same time reduces tourist congestion in the parks.

Added rural benefits from Amboseli include employment, markets for produce and handicrafts, and technical assistance in ranch developments. Equally important, they are available locally at a time when rapid changes in culture among the Maasai make them most necessary. Without those options, both their late start in entering the competitive market economy and their isolation would leave the Maasai as another of the numerous wayward and conveniently forgotten pastoral societies. Amboseli effectively updates their options and the evidence suggests little hesitancy remains in taking them up. Indeed, the Maasai have established a wildlife committee which meets regularly with the national parks warden, Bob Oguya, to discuss ways and means of cooperating further to the benefit of both parties. Since the new policies were implemented, poaching has virtually ceased. The rhino population, which plummeted from 150 in the late 1950s to seven in 1977, has since increased to twelve, despite the value of horn on the international market equaling its weight in gold.

Here, then, is a specific example of one test case. Though years in the development, it does seem to be working. It has involved a bewildering amalgam of research, planning, legislation and financial support from the Kenya government and international donor agencies such as the World Bank and the New York Zoological Society. However, that scale evolved from small, localized efforts.

Can it be repeated? I believe so. In 1978, to further that effort on a national scale, I was instrumental in laying ground for the Wildlife Planning Unit within the Ministry of Environment and Natural Resources. In conjunction with other agencies, the large professional team is planning various programs nationally that aim at reconciling wildlife conservation with human development. Despite the numerous problems ahead, I consider it the appropriate direction for the future, the best hope that the savannas can survive as more than a few isolated faunal islands.

The ecological study that I began in Amboseli continues. Indeed, it gains more value in time, for if there is one thing that it has demonstrated, it is the inherent changes that are, I suspect, characteristic of the savannas. We must understand more about those changes for many reasons: for effective conservation, as a baseline in interpreting the ecology of natural ecosystems, and as a guideline in placing numerous other short term studies in long term perspective. □

photo: David Western

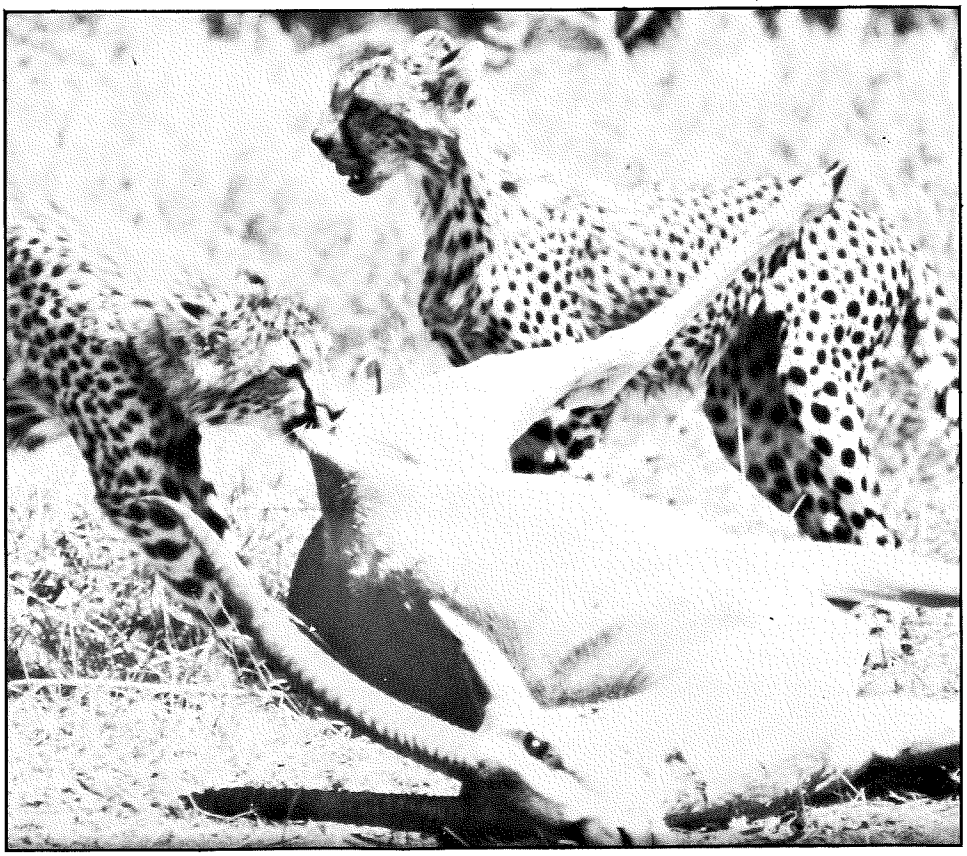
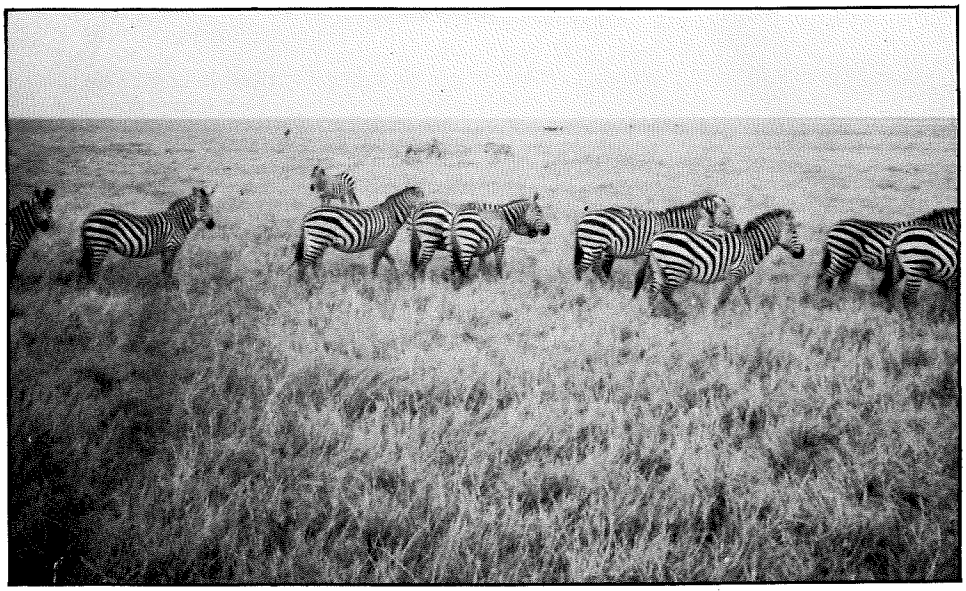
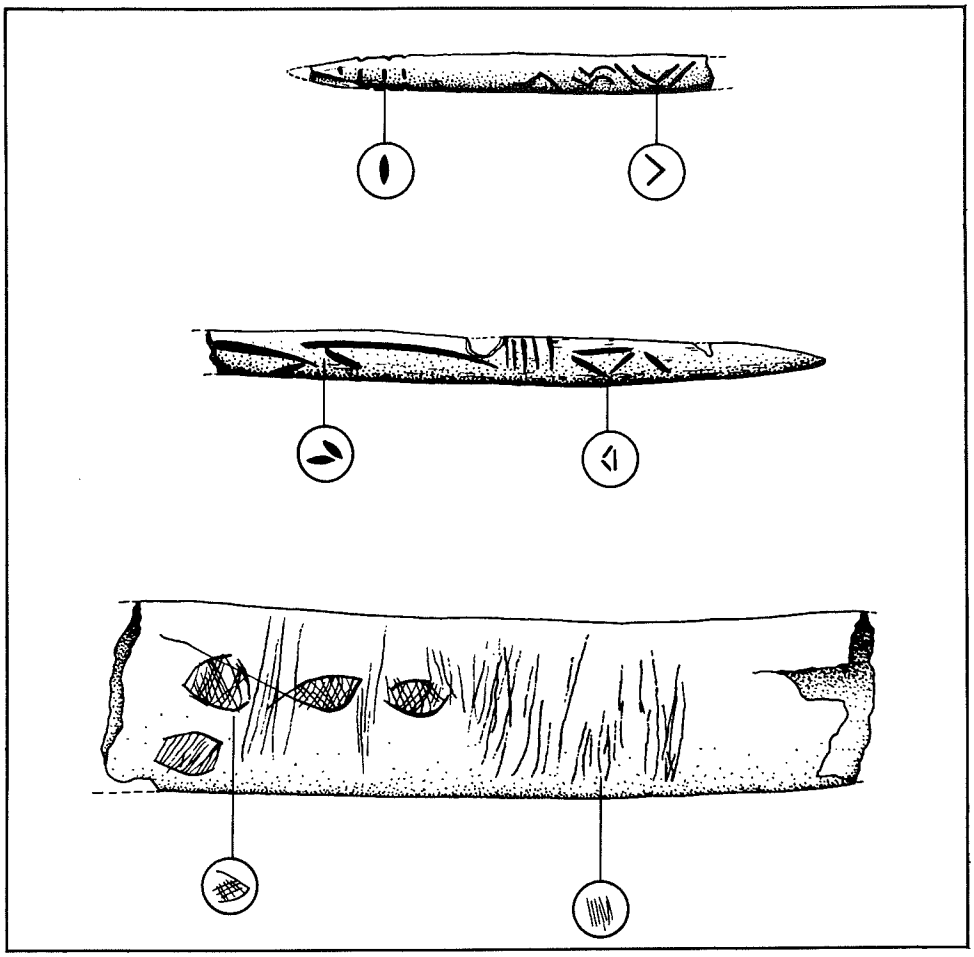


photo: Tad Brady



Amboseli is perhaps the most photographed of all East Africa's parks. This is largely due to a combination of wildlife diversity, accessibility of the animals and varied scenery.



Three engraved artifacts from Magdalenian levels in Cantabrian sites that show how design elements are identified. Top and middle: La Paloma; Bottom: Altamira.

ALTAMIRA:

continued from page 3

mentation was in the form of drawings and paintings. More so than most other early workers, the Abbé Henri Breuil devoted his time and skills to these tasks. Magnificent chalk drawings of the Altamira paintings were done, as were sketches, tracings and still accurate renderings of most known cave art of the time. Much of later interpretive work would be based primarily on secondary observations and these drawings.

Once discovered and recorded, there was the challenging task of ordering and arranging the finds. Even today, a chronology of Paleolithic art, particularly of most wall art, remains incomplete; a way of dating the paintings, except on relative stylistic and geological grounds, remains to be found. However, by drawing on assumptions about hunter-gatherers, primitive magic and religion, and the evolution of art, Breuil developed the first and singularly most influential chronology of wall art. This was published in its entirety in his *Four Hundred Centuries of Cave Art* in 1952. Most scholars adopted Breuil's chronology that proposed two similar sequential cycles of artistic production and evolution.

> ". . . the archeological deposits found in the cave's vestibule area, were attributed to the Solutrean and Lower Magdalenian periods, placing one occupation at Altamira at c. 15,500 years ago."

The second cycle of Breuil's scheme was said to culminate in the most complex wall art of the Paleolithic: the polychrome paintings of the later Magdalenian period (c. 11–13,000 years ago). Clearly, within this scheme, the Altamira ceiling would be the product of Late Magdalenian artists, although we now know that the roof over the cave entrance probably collapsed about this time, effectively sealing the entrance to no more than a crevice. However, the archeological deposits found in the cave's vestibule area, adjacent to the "Great Hall of Paintings," were attributed from the first excavations in 1904 to the Solutrean and Lower Magdalenian periods that preceded the Late Magdalenian. We have a carbon 14 date for the Lower Magdalenian level, placing one occupation at Altamira at c. 15,500 years ago. We are still unsure about the relationships between painted areas and occupied areas of caves, but, to Breuil, it was not often that the two should co-occur, for painted areas were sacred.

Drawing direct analogies from the ethnographic interpretations of the early 1900s, Breuil saw the motives and explanations for cave art rooted in the life of the hunter. Anxiety over the search for food, the dynamism of the chase, and the confrontation between hunter and prey were adequate to explain an artform in which the many naturalistic depictions were so forceful and vital to modern observers. This was an artform that was central to sympathetic magic – magic that could ensure the fertility of the prey and the success of the hunter. The hunting way of life "explained" the origins of the art; the negative hand outlines, possibly achieved by blowing red ochre or manganese paint around a hand held flat against the cave wall, were seen by Breuil as imitations of animal footprints, and were to him some of the first experiments with visual imagery. And it was the retreat of the glaciers and of the once abundant herbivores, and hence a disappearance of big-game hunting, that could account for the abandonment of cave painting. Even the "signs" or geometric, non-naturalistic depictions were interpreted as part of a magic hypothesis; some were seen as traps, wounds or weapons.

> "Breuil saw the motives and explanations for cave art rooted in the life of the hunter. Anxiety over the search for food, the dynamism of the chase, and the confrontation between hunter and prey were adequate to explain the artform. . ."

Cave art as hunting magic and Breuil's two-cycle stylistic chronology dominated the literature well into the second half of the Twentieth Century. By 1960, however, there were exciting new currents of thought in the air that were to have dramatic effects on the study of Paleolithic art.

> ". . . to Leroi-Gourhan, Paleolithic art is an expression of an entire organizational, perceptual world view, a cosmology, a system of thought."

It was Leroi-Gourhan, particularly with his 1965 masterpiece, *The Treasures of Paleolithic Art*, who explicitly challenged much of Breuil's interpretation. He also offered an alternative stylistically-based chronology that has replaced Breuil's. But even within the study of Paleolithic art, Leroi-Gourhan was not working in an intellectual vacuum. Other researchers, such as Annette Laming-Emperaire, had also begun to offer reinterpretations of Paleolithic art. Further, there were at least three major intellectual trends of the 1960s that paralleled Leroi-Gourhan's work and influenced his thinking as well as most subsequent research. The three trends that have widened our perspectives have been

(1) the rise of structuralism; (2) a revitalization of the anthropological study of primitive art and symbolic behaviors: and (3) reinterpretation of hunter-gatherer lifeways.

Leroi-Gourhan's approach, and more recently, that of Alexander Marshack, assume Paleolithic art to be a system of meanings. The depictions — or the notations that Marshack has elucidated — are not just random as Breuil thought; they are organized into various systems, presumably systems of representation. The content and arrangement of paintings in caves cannot be explained merely in terms of sacred locales for painting. Rather, to Leroi-Gourhan, Paleolithic art is an expression of an entire organizational, perceptual world view, a cosmology, a system of thought. This system is based on the division of the natural world into female and male components. Certain parts of the caves as well as certain groups or kinds of animals and signs also have a masculine or feminine association. The way in which depictions are arranged on a panel, where they are placed in a cave and in relation to each other all derive from this organizational structure.

A giant aurochs on the wall at Lascaux, Dordogne, France.

"... horses are very frequent on most kinds of artifacts except harpoons, whereas bison do not occur on spears."

Leroi-Gourhan's numerical counts of subject matter show that Paleolithic artists were selective in their choice and placement of subject matter. These counts challenged the long-held notion that most cave art is in the deep, dark, inaccessible reaches of presumably sacred caves. Some specific themes or artforms, in fact, tended to be in rock shelters or daylit locals, such as depictions of females. And among the portable art, some themes or depictions were significantly correlated with certain artifact forms or types; for instance, horses are very frequent on most kinds of artifacts except harpoons, whereas bison do not occur on spears. Thus, Leroi-Gourhan initiated the study of context as well as content.

Marshack's superb microphotographic work on the past decade, particularly of portable objects, has drawn our attention to the fact that many of the visual forms are seasonally and ecologically related. He has also highlighted the multiplicity of markings on any one piece that could have been notational in intent, or even calendrical. We have recently come to appreciate how many human groups employ ritual and art in synchrony with relevant and important seasonal changes. Given that the anatomically modern peoples of the Upper Paleolithic were successful hunter-gatherers in the rigorous periglacial environments during the last glacial period, it should not surprise us that they were ecologically sophisticated. This is particularly so given the recent studies of hunter-gatherers that demonstrate their ecological knowledge and skills.

The implications of Marshack's and Leroi-Gourhan's work are clear. Upper Paleolithic populations were creating and manipulating visual forms in order to structure and give meaning to their existence. This central aspect of human life has been recently detailed by many studies of visual symbolic forms. Particularly in nonliterature societies visual imagery may take on many more significant roles in communication and information transmission.

"A single, generalized view of the hunting-gathering stage is no longer acceptable. In the case of the Magdalenians, there is little evidence to support the view that they would have been hard-pressed and anxiety-ridden in the search for food."

When we take into consideration some of the observations drawn from such studies of primitive art, it is clear that we can no longer be satisfied with a single monolithic explanation for at least 20,000 years of artistic activity during the Upper Paleolithic. This is particularly the case if the explanation is at such a specific level as that of Breuil's hunting magic interpretation. A great diversity of media of Paleolithic art is now recognized. The range of subject matter has been widened greatly. There are recent discoveries, such as Pales' work on the many slabs incised with female depictions at La Marche and new ways of looking at the art, such as Marshack's elucidation of notational and/or seasonal depictions.

Further, the monolithic characterization of Paleolithic hunter-gatherers that Breuil drew upon for his interpretations has been replaced in the past fifteen years. A single, generalized view of the hunting-gathering stage is no longer acceptable. In the case of the Magdalenians, for example, there is little evidence from archeology or from the ethnography of similarly adapted hunter-gatherers to support the view that they would have been hard-pressed and anxiety-ridden in the search for food. It is not likely that all of the meanings, all of the activities of Paleolithic art can be attributed to ritual and sympathetic control over desired but scarce resources to be hunted. Although surely there may be some interconnection between the art and subsistence activities, these activities alone do not cause or create art. Among Leroi-Gourhan's many quantitative documentations is the observation that certain animals were being depicted far more than others, often in contrast to factors of ecological availability or their relative percentage among the food debris. This, as well as Patricia Vinnicombe's elegant study of the rock art of the !Kung San (Bushmen) of South Africa, reminds us of Levi-Strauss' observation that certain natural species were selected — in these cases, as the subject of rock art — not because they were "good to eat," but because they were "good to think."

"The implications of Marshack's and Leroi-Gourhan's work are clear. Upper Paleolithic populations were creating and manipulating visual forms in order to structure and give meaning to their existence."

Leroi-Gourhan's attention to structure, to context, and associations has allowed us

Dr. Conkey with members of the Leakey Foundation at Marsoulas, France, October, 1980.

to see new facets of Paleolithic art. Although it has always been the naturalistic animal forms that have seemed most spectacular to us, there is much more to Paleolithic art than carved or painted animals. Among 1200 engraved bones and antlers that came from twenty-six Spanish (Cantabrian) Magdalenian sites, including Altamira, only a maximum of seventy animal depictions were identifiable. In trying to study the variability in engravings within this particular sample of portable art that is relatively restricted in time and space, yet another approach had to be applied.

One kind of structural approach to decorative objects involves the analysis of the structure or organization of the designs themselves. Among the 1200 engraved Cantabrian Magdalenian pieces for example one could identify more than 200 distinct design elements or basic units of the design system. The analysis of their occurrence among the twenty-six sites has identified a core set of fifteen basic design elements that were in use throughout the Magdalenian and widespread throughout Cantabria – a basic Magdalenian engraving repertoire. Many of these basic elements, such as the chevron or lunate, are characteristic of engraved pieces found in sites outside of Cantabria, and may contribute to our identifying these pieces as belonging to the "style" of Paleolithic art. The analysis also showed that most design elements were in use from the Early Magdalenian onward. Despite a three-fold increase in the number of decorated objects from the Early to Late Magdalenian, the engraving repertoire, in terms of different design elements, does not notably increase. The engraving tradition seems to have been set by at least 15,000 years ago.

When comparing the selection of design elements and certain other structuring or organizational principles that have been recognized in the arrangement of designs, the diversity of the engravings on pieces from Altamira is striking. And it is the kind of diversity we might expect if otherwise dispersed engravers were coming together at Altamira which suggests the site may have been a regional aggregation locale. Although the Altamira excavations are very old and there are many problems in using data from these excavations for this kind of an interpretation, we can at least get a glimpse into how a design structural approach can contribute to the testing of hypotheses about prehistoric settlement patterns.

Since the first viewing of Paleolithic cave art in 1879, at least 150 painted caves have been discovered in southwestern Europe; complete documentation of these is still, however, a serious challenge. Despite the attempts of Breuil and Leroi-Gourhan, there is still no completely satisfactory chronology of cave art. But there is much we now know and can know about this prehistoric art and design, the adaptive systems of the people who produced it, and the fundamentals of human symbolism that can be inferred from its study.

The transformation of a piece of raw material, whether bone, antler, or cave wall, into an artifact or a cultural product is a form of communication. We now know that Paleolithic artists did not select just any bone, antler, or cave wall. What they selected, as raw material, as subject matter, are significant clues to the meaning of Paleolithic art. The search for the underlying structure is emerging as just as provocative as trying to know precisely what each image or symbol "means."

> "The transformation of a piece of raw material into an artifact or a cultural product is a form of communication."

The art from Altamira provides some of the most striking examples of Paleolithic artistic achievements. Although the portable art collection has not been augmented by recent excavations, and the ceiling composition has been well known for a century, we can see how changing intellectual climates have affected the interpretations of art from Altamira. New methods and theories in archeology have also influenced our understanding of prehistoric life at Altamira. It is ironic that, after being preserved for more than 10,000 years, the decorated walls of Altamira have barely survived 100 years of study and inquiry. It would be even more ironic, if not tragic, if our own interest in humanity were the cause of the destruction of these important human works. The next century of research is indeed a challenge to archeologists, but in ways that Sautuola and his daughter could not possibly have imagined.

An article by Dr. Conkey on this subject appeared in *Archaeology* magazine, July, 1981. □

WHAT KILLED THE DINOSAURS?

A scenario for the catastrophic extinction of the dinosaurs 65 million years ago from an immense meteorite has been spun out by two California Institute of Technology geophysicists. Their computer simulations reveal how a postulated eight mile-diameter meteorite, weighing one trillion tons, would have affected the earth as it impacted, releasing the energy equivalent of a billion megatons of TNT.

The meteorite would have lost little of its energy in its trip through the atmosphere, concluded the scientists, releasing the greatest portion when it hit the earth's surface. In addition, a ten-mile meteorite would have plowed through even the deepest part of the ocean like a bullet through a mud puddle. Thus, the difference in the effects of a land and water impact was insignificant.

Their studies showed that the meteorite may well have killed off the dinosaurs by releasing upon impact a flash of heat great enough to almost instantaneously raise the temperature of earth's atmosphere by about ten degrees. The flash could also have raised the temperature of the ocean's upper layer by several degrees, destroying the large marine reptiles and other species, and drastically affecting the marine food chain. Surviving would have been the smaller animals, including the primitive mammals that eventually evolved to become man. According to the scientists, the heat blast explanation for the dinosaur's demise may prove more satisfactory than theories that dust from a meteorite obscured the sun for many years, killing off the dinosaurs.

The scientists are, Professor of Geophysics Thomas J. Ahrens and Visiting Associate in Planetary Science John D. O'Keefe, who specialize in developing computer models to explain the impacts of asteroids and comets on the earth, moon and other planets. □

NEW FELLOWS

The L.S.B. Leakey Foundation is proud to welcome to its Fellows' roster:

Ms. Ann King Cooper, Arcadia, Califórnia; Noreen Curry, Novato, California; Dr. and Mrs. John Harris, Los Angeles, California; Mrs. Barbara P. Hilliard, Woodside, California; Mr. and Mrs. John A. Keith, Los Altos, California; Mr. Ross O. Leventhal, Los Angeles, California; Mr. and Mrs. Paul Mac Cready, Pasadena, California; Mr. Winslow Maxwell, Balboa, California; Mr. and Mrs. Roger W. Robinson, Quartz Hill, California; Mrs. Jack Samson, Pasadena, California; Mr. and Mrs. Barry Sterling, Sebastopol, California; Mr. and Mrs. Craig Wallace, Ross, California.

BOOKS FOR THE HOLIDAYS

NEW SELECTIONS:

MAASAI, by Tepilit Ole Saitoti and Carol Beckwith, 1980, 276 pp. $39.85 to members (including tax and mailing); $44.00 to non-members.

A pictorial account of these tall, proud and handsome people. A truly beautiful experience for the mind and eye.

LUCY, THE BEGINNING OF HUMANKIND, by Don Johanson and Maitland Edey, 1981, 385 pp. $17.00 members; $18.75 to non-members.

With the suspense and intrigue of a fast-paced adventure novel, filled with lively scientific detail and fine illustrations, this major book of the year unfolds the extraordinary story of Johanson's discovery of "Lucy" – the oldest, most complete, and best preserved skeleton ever found of an erect-walking human ancestor. The book reveals the controversial change Lucy makes in our view of human origins and provides a vivid account of the history of paleoanthropology and the colorful characters who are and were part of it.

MISSING LINK, by John Reader, 1981, 243 pp. $20.24 to members; $22.24 to non-members.

Since Darwin proposed the theory of evolution, modern man has been intrigued by hunting for the missing link. John Reader takes us back to the discovery of Neanderthal Man in Europe in 1857 and quickly covers all the other finds from East Africa to the Far East. The book is illustrated with colored photographs of fossil imprints, bones and tools.

AND STILL AVAILABLE:

BY THE EVIDENCE, by L.S.B. Leakey, 1974, 276 pp. $10.30 to members; $11.30 to non-members.

The focus of these memoirs is on Louis Leakey's post Cambridge years in Africa and his discoveries during that era (1932–1951). He conveys the excitement of his finds through colorful description and numerous anecdotes.

LEAKEY'S LUCK, by Sonia Cole, 1975, 448 pp. $16.00 to members; $17.70 to non-members.

As a long-time friend of the Leakey family, Sonia Cole has written an insightful account of Louis Leakey's life (1903–1972). It weaves together his professional career and his personal life in a fascinating biography.

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CALENDAR

DR. BERNARD CAMPBELL

January 31 — Dickson Hall, UCLA, Los Angeles, California

DR. DIAN FOSSEY

May 7 — Morris Museum, Convent, New Jersey

May 8 — Chicago Academy of Sciences, Chicago, Illinois

May 13 — Cincinnati Zoo, Cincinnati, Ohio

May 15 — American Museum of Natural History, New York City, New York

DR. BIRUTÉ GALDIKAS

May 8 — Chicago Academy of Sciences, Chicago, Illinois

May 15 — American Museum of Natural History, New York City, New York

DR. JANE GOODALL

January 18 — St. Mary's College, Raleigh, North Carolina

January 20 — Sweet Briar College, Sweet Briar, Virginia

January 21 — Florida State University, Tallahassee, Florida

April 25 — Long Island University, Greenvale, New York

April 26 — Cornell University, Ithaca, New York

April 28 — San Jose State University (in residence), San Jose, California

April 30 — Washington Park Zoo, Portland, Oregon

May 6 — San Diego State University Extension and the Zoological Society, San Diego, California

May 8 — Chicago Academy of Sciences, Chicago, Illinois

May 11 — School of American Research, Santa Fe, New Mexico

May 15 — American Museum of Natural History, New York City, New York

DR. DONALD JOHANSON

March 7 — California Institute of Technology, Pasadena, California

March 31 — Washington University, St. Louis, Missouri

May 8 — Chicago Academy of Sciences, Chicago, Illinois

May 15 — American Museum of Natural History, New York City, New York

PETER JONES

February 1 — University of Wisconsin, Eau Claire, Wisconsin

February 21 — Dickson Hall, UCLA, Los Angeles, California

DR. MARY LEAKEY

March 2 — El Camino College, Torrance, California

March 6 — San Diego Museum of Natural History, San Diego, California

March 10 — Portland University, Portland, Oregon

March 19 — Morris Museum, Convent, New Jersey

March 23 — Washington University, St. Louis, Missouri

March 30 — University of Cincinnati, Cincinnati, Ohio

April 1 — Kenyon College, Gambier, Ohio

ALEXANDER MARSHACK

February 25 — California Institute of Technology, Pasadena, California

ELIZABETH MEYERHOFF

January 6 — Westlake School, Los Angeles, California

January 7 — Mira Costa College, Oceanside, California

January 11 — Santa Catalina School, Monterey, California

January 27 — California Institute of Technology, Pasadena, California

DR. ROGER PAYNE

January 8 — Greenwich High School, Greenwich, Connecticut

January 17 — American Museum of Natural History, New York City, New York

April 23 — Morris Museum, Convent, New Jersey

TEPILIT OLE SAITOTI

February 19 — DePauw University, Greencastle, Indiana

HUGO VAN LAWICK

March 3 — California Institute of Technology, Pasadena, California

DR. DAVID WESTERN

March 14 — Dickson Hall, UCLA, Los Angeles, California

March 17 — Santa Catalina School, Monterey, California

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