

## Final Program

**Paleoanthropology Society  
April 9, 10 1996 New Orleans  
New Orleans Marriott Hotel**

### Tuesday, April 9: 9:00 - 12:20

9:00-9:15 Introduction

- 9:15 Ragir, Sonia (CUNY, Staten Island). Early hominids were not scavengers.  
9:35 Gifford-Gonzalez, Diane (UC, Santa Cruz). Getting fat in the Pleistocene: proximate agency in the first transition to greater carnivory.  
9:55 Potts, Richard (Smithsonian) Habitat variability as a selective factor in hominid evolution.  
10:15 McHenry, Henry M. (UC, Davis) Free hands? postcranial adaptations of Australopithecus.

(10:35 - 11:00 Coffee Break)

- 11:00 Lee-Thorp, Julia A. (Cape Town) and J. Francis Thackeray (Transvaal Museum) Isotopic ratios and diets of Homo and Australopithecus robustus compared at Swartkrans.  
11:20 Feibel, Craig S. (Rutgers), Ian McDougall (Australia National University), Meave G. Leakey (National Museums of Kenya), John M. Harris (Natural History Museum of Los Angeles) and Alan Walker (Penn. State) Geology and paleontology of the Lower Kerio Valley.  
11:40 Blumenschine, Robert J. (Rutgers), Fidelis T. Masao (Dar es Salaam), Gail M. Ashley (Rutgers), James I. Ebert (Ebert and Associates), Charles R. Peters (Georgia) and Nancy E. Sikes (Smithsonian) Spatial patterning among archaeological traces at several landscape scales in the lowermost Bed II Olduvai Basin.  
12:00 Monahan, Christopher M. (Smithsonian) New zooarchaeological data from Bed II, Olduvai Gorge, Tanzania: implications for hominid foraging strategies in the Early Pleistocene.

### Tuesday, April 9: 2:00 - 6:00

- 2:00 West, Jolee A. (Illinois, Chicago Circle) Reptile lipid storage and utilization patterns: significance for early hominids at Olduvai Gorge, Tanzania.  
2:20 Sikes, Nancy E. (Smithsonian) and Richard Potts (Smithsonian) Reconstruction of floral habitat context at Olorgesailie.

- 2:40 Solecki, Rose L. (Texas A&M) and Ralph S. Solecki (Texas A&M) Was there an Acheulian occupation at Yabroud Shelter I?
- 3:00 Hertz, Michael (Colorado, Colorado Springs), Thomas Wynn (Colorado, Colorado Springs) and Forrest Tierson (Colorado, Colorado Springs) Handaxe variability revisited.

(3:20 - 3:40 Coffee Break)

- 3:40 Chase, Philip G. (Pennsylvania), Harrold L. Dibble (Pennsylvania), Shannon McPherron (Bishop Museum) and Brooks Ellwood (Texas, Arlington) Cagny l'Épinette: an Acheulian living surface?
- 4:00 Protsch von Zieten, R. (Goethe University) New research results on the mandibula of *H. e. heidelbergensis*.
- 4:20 Ferring, C.R. (North Texas), C. C. Swisher (Berkeley Geochronology Center), G. Bosinski (Roemisch-Germanischen Zentralmuseum) and B. Tutberidze (Georgian Academy of Sciences) Progress report on the geology of the Plio-Pleistocene Dmanisi site and the Diliska Gorge, Republic of Georgia.
- 4:40 Swisher, C.C. (Berkeley Geochronology Center) Towards a revised geochronology for the hominid-bearing strata of Java, Indonesia.
- 5:00 Brooks, Alison S. (Smithsonian) and John E. Yellen (National Science Foundation) The Middle Stone Age of the Middle Awash: a preliminary report of recent research in Ethiopia.
- 5:20 Sampson, C. Garth (Southern Methodist) Middle Stone Age site distribution in the Upper Karoo, South Africa does not reflect modern human spatial organization.
- 5:40 Kelly, Alison S. (Southern Methodist) Technological variability in Kenyan Middle Stone Age assemblages.

**Wednesday, April 10: 8:30 - 12:10**

- 8:30 McBrearty, Sally (Connecticut) and John Kingston (Yale) Environmental context of Rift Valley sites with evidence for Middle Pleistocene blade production in the Kapthurin Formation, Kenya.
- 8:50 - 9:50 1. Bar-Yosef, O. (Harvard) The excavations at Hayonim Cave in the context of Levantine Middle Palaeolithic chronology and industries.  
 2. Meignen, Liliane (Centre de Recherches Archeologiques) The Mousterian assemblages of Hayonim Cave in their Levantine context.  
 3. Stiner, Mary C. (Arizona) Species trends in Pleistocene archaeofaunas of Hayonim Cave: climate versus behavior change.  
 4. Goldberg, Paul (Boston) Site formation processes in Mousterian and Upper Paleolithic deposits in Hayonim and Kebara caves.
- 9:50 Speth, John D. (Michigan) Middle Paleolithic hunting in the Near East: the view from Kebara Cave (Israel)

(10:10 - 10:30 Coffee Break)

- 10:30 Trinkaus, Eric (New Mexico), Christopher B. Ruff (Johns Hopkins) and Steven E. Churchill (Duke) Upper limb versus lower limb robusticity in Near Eastern Middle Paleolithic hominids.
- 10:50 Anton, Susan C. (Florida) Tough breaks: behavioral implications of fracture rates in Neanderthals.
- 11:10 White, Tim D. (UC Berkeley) Modifications of hominid bones at the Vindija Neanderthal site, Croatia.
- 11:30 Cecchi, Jacopo Moggi (Florence) and Brunetto Chiarelli (Florence) Evaluation of asymmetry of the internal cranial vault of Circeo I at the level of the Broca's area.
- 11:50 Conrad, Nicholas J. (Tubingen) Find densities at Middle Paleolithic open air sites in the Rhineland.

**Wednesday, April 10: 2:00 - 6:30**

- 2:00 d'Errico, Francesco (CNRS Talence) and Paola Villa (Bordeaux) Holes and grooves: the contribution of anatomy and taphonomy to the problem of art origins.
- 2:20 Hidjrati, Nazim I (North-Ossetian State Univ.), Larry R. Kimball (Appalachian State) and Todd A. Koetje (Indiana Univ. of Pennsylvania) Paleolithic archaeology at Weasel Cave, north-central Caucasus, Russia: background, dating, site structure and traceology.
- 2:40 Ambrose, Stanley H. (Illinois, Urbana) Prospects for stable isotopic analysis of Later Pleistocene hominid diets in Central Europe and Western Asia.
- 3:00 Juell, Kenneth E. (Utah) and Richard G. Milo (Chicago) Contrasting predator-prey relationships at Klasies River Mouth Cave 1 (MSA) and Nelson Bay Cave (LSA), South Africa.

(3:20 -3:40 Coffee break)

- 3:40 Stockton, T.C. (Northern Illinois) Later Pleistocene evolutionary relationships in central Europe and the Mladec postcranial remains.
- 4:00 Peterkin, Gail Larsen (Tulane) Weapons of choice in the French Upper Palaeolithic
- 4:20 Straus, Lawrence G. (New Mexico) The Magdalenian "Community": from Belgium to Portugal.
- 4:40 Zilhao, Joao (Universidade de Lisboa) Paleolithic rock art and paleolithic archaeology of the Coa Valley (Portugal).
- 5:00 Lee, Sang-Hee (Michigan) Changes in sexual dimorphism during Late Pleistocene and Early Holocene Europe.
- 5:20 Olszewski, Deborah (Bishop Museum) and Nancy Coinman (Iowa State) Pleistocene "Oases:" settlement patterning and the lake/marsh effect as viewed from the Wadi al-hasa, Jordan.

5:40 Simmons, Tal (Western Michigan) The avifauna of Ohalo II: a preliminary analysis of migratory patterns and site seasonality.

6:00 - 6:30 Business meeting

# **PALAEOANTHROPOLOGY SOCIETY**

## ***ABSTRACTS***



**NEW ORLEANS  
APRIL 9-10, 1996**

**Prospects for stable isotopic analysis of later Pleistocene Hominid diets  
in Central Europe and Western Asia**

**Stanley H. Ambrose**  
University of Illinois, Urbana, IL

If proteins are well-preserved, stable carbon and nitrogen isotopic analysis of bones of Middle and Upper Palaeolithic humans and other mammals can be used to determine if there were significant differences in trophic levels between behaviorally and/or anatomically archaic versus modern humans. Apatite carbonate carbon isotopes provide additional evidence for trophic level adaptations. The carbonate phase of bone (but not tooth enamel) is more susceptible to diagenesis when collagen has degraded. Collagen preservation is best in cold environments. Collagen of Upper Pleistocene eastern/central European mammals has been purified for stable isotopic analysis. Stable carbon and nitrogen isotope ratios of collagen of archaeofaunas from Milovice, Dolni Vestonice and Vindija are consistent with those of modern European mammal communities. Carnivores and herbivores can be distinguished with nitrogen and apatite carbon isotopes. It should thus be possible to use isotopic analysis of collagen and apatite to reconstruct the diets of Middle and Upper Paleolithic hominids in Europe.

Mammal and Neanderthal bones from Dederiyeh Cave, Syria, have also been analyzed. They have very poorly preserved organic matter and the apatite carbonate may have been affected by diagenesis. Testing hypotheses regarding dietary niche differences between archaic and modern hominids may be problematic in West Asia, because the warmer climate may have accelerated diagenesis of collagen and bone apatite.

**Tough breaks: Behavioral implications of fracture rates in Neanderthals**  
**Susan Anton**

University of Florida, Gainesville, FL

Neanderthal skeletons preserve a large number of healed fractures. This apparent abundance has been interpreted as further evidence of the rough and tumble life of the Neanderthal; suggesting that Neanderthal fracture rates were higher than contemporaneous anatomically modern human (AMH) and recent modern human rates. This difference has been attributed to specific-level behavioral differences in hunting styles and technical skills (e.g., close range versus long range weapons) between Neanderthals and AMH. However, this interpretation is somewhat misleading because fracture rates are calculated using different methods in different studies and Neanderthals from a wide geographic and temporal span are considered together although fracture rates and patterns differ significantly amongst modern hunter-gatherers from different regions. Here, fracture rates for the postcranial skeleton were compared within and between groups of relatively complete Neanderthals (e.g., Shanidar, Kebara, Tabun, Le Moustier, La Ferrassie, La Chapelle, La Quina), fossil AMH (e.g. Qafzeh, Skhul, Afalou/Taforalt, Cro Magnon), and recent modern humans (multiple sites from pre-contact North America) using standardized techniques developed by Lovejoy and Heiple. While hampered by small sample sizes, the standardized calculation of fracture rates does show that some Neanderthal groups, such as Shanidar, have higher rates than some contemporaneous and recent AMH. However, these rates are also higher than Neanderthals in other regions. Fracture rates amongst Neanderthal groups may be as likely to reflect regional behavioral differences amongst Neanderthals as they are to reflect specific-level behavioral differences between Neanderthals and AMH.

**The excavations at Hayonim Cave in the context of Levantine Middle Palaeolithic  
Chronology and Industries**  
**O. Bar-Yosef**

Peabody Museum, Harvard University, Cambridge, MA

The joint project initiated in 1981 was aimed at the re-excavating and dating of three cave-sites - Kebara, Hayonim and Qafzeh. Since then several radioisotopic dating techniques provided different chronological schemes. To date we note the divergence between ESR and TL based chronologies.

The current chronology indicates that the Levantine sequence of Middle Paleolithic industries (as present in Tabun cave) is comprised of "Tabun B-type" (Kebara, Amud, Tor Faraj, etc.), "Tabun C-type" (Qafzeh, Hayonim upper E) and "Tabun D-type" (Rosh Ein Mor, Hayonim lower E and others). Human remains were only found with Tabun B and C type industries (including the Dederiyeh skeleton found recently in Syria).

The excavations at Hayonim have exposed to date a sequence of ca. 3.0 meters of Mousterian deposits (known as layer E). Preliminary radiometric dates indicate that the accumulation took place from about 200 Ka to 100/90 Ka. The upper two meters of the deposits accumulated during a wet period that was also responsible for the formation of stalagmites (isotope Stage 6?). Preservation of bones (see M. Stiner abstract from this conference) and hearths is therefore better in the deeper part of the sequence. The uneven spatial distribution of the diagenetic processes (also expressed in the readings of dosimeters) caused the chemical alteration of ashes and clays (see P. Goldberg abstract from this conference). The lower part of the sequence partially exposed in the central area of the cave and in part in the deep sounding at the entrance, where numerous burrows were identified, contains the Tabun D-type industry (L. Meignen abstract from this conference). The assemblage is characterized by elongated, often pointed, blanks also demonstrate a technological variability. Certain assemblages present higher frequencies of Levallois technique while other are dominated by semi-prismatic uni- or bi-directional cores. The Hummalian industry from El-Kowm basin (northeast Syria) is included in this general culture category.

The overall time frame for the exposed Mousterian sequence at Hayonim Cave, as suggested by TL dates in Tabun Cave, indicates a time range from about 200 to 100/90 Ka years. Such a long Mousterian chronology, from ca. 270 Ka to ca. 45 Ka raises interesting questions concerning the relationship of human fossils and lithic industries and the meaning of the persistence of chaines operatoires for such long periods of time. In addition, information of behavioral aspects (hunting, spatial distribution of hearths and dumps, burials, the use of red ochre, the presence of a few non-edible marine shells, etc.) makes the identification of modern human 'fingerprints' in the archaeological record more challenging.

**Spacial patterning among archaeological traces at several landscape scales  
in the lowermost Bed II Olduvai Basin**

**Robert J. Blumenschine<sup>1</sup>, Fidelis T. Masao<sup>2</sup>, Gail M. Ashley<sup>3</sup>,  
James I. Ebert<sup>4</sup>, Charles R. Peters<sup>5</sup> & Nancy E. Sikes<sup>6</sup>**

<sup>1</sup>Rutgers University, <sup>2</sup>University of Dar es Salaam, <sup>3</sup>Rutgers University,  
<sup>4</sup>Ebert & Associates, <sup>5</sup>University of Georgia, <sup>6</sup>Smithsonian Institution

Interim results of ongoing landscape archaeological sampling at Olduvai Gorge, Tanzania, are used to reveal spatial patterning in penecontemporaneous Oldowan occurrences at three larger-than-site scales. Data are derived from 61 trenches into a single stratum, Lowermost Bed II, distributed over an area of approximately 300 km<sup>2</sup> within four portions of the ancient lake basin's lacustrine plain and the distal portion of its eastern alluvial/depositional plain. The finest landscape scale of analysis is provided by two lithologically defined facets within the Southeastern Lacustrine Plain, each 1-2 km<sup>2</sup> in area. Stone artifacts and bones are widely but patchily distributed in each facet, with densities ranging upwards to 45 artifacts/m<sup>2</sup>. Data at this scale are used to test key premises of Isaac's central place

foraging model. Patterning in artifacts assemblages with respect to proximity to local raw material sources is detectable using a broader scale of spatial analysis defined by the whole 4 km<sup>2</sup> of the exposed portion of the Southeastern Lacustrine Plain. Data on artifact densities and proportions of raw materials are used to evaluate patterns of material transport by Oldowan hominids, including those guided by least-effort principles. The broadest scale of analysis possible for Lowermost Bed II archaeological occurrences is the near-basin-wide scale. *In situ* Oldowan assemblages are now available from all exposed portions of the prehistoric landscape, including newly discovered, high-density occurrences from the Western and Southwestern Lacustrine Plain. While relatively few trenches have been dug into these and other previously unexcavated portions of the ancient landscape thus far, they permit preliminary tests of Peters and Blumenschine's hominid land use models, and the alternative reconstructions of Lowermost Bed II paleogeography upon which these are based.

**The Middle Stone Age of the Middle Awash:  
A preliminary report of recent research in Ethiopia**

**Alison S. Brooks<sup>1</sup> & John E. Yellen<sup>2</sup>**

<sup>1</sup>Smithsonian Institution, Washington DC

<sup>2</sup>National Science Foundation, Arlington, VA

The Middle Stone Age of Ethiopia is of particular interest both because of very early dates for one of the few excavated sequences (Wendorf and Schild 1974), and because of Ethiopia's intermediate geographical location between Middle Stone Age sites of eastern and southern Africa and certain Middle Paleolithic sites of the Levant, both associated with early anatomically modern humans. Despite the recovery of an early anatomically modern hominid from a presumed MSA context at Omo Kibish, fossiliferous sites with MSA archaeological associations have been relatively rare in this region.

Recent survey on both banks of the Middle Awash River in the Afar rift has indicated the presence of Middle Stone Age surface materials, and more extensive survey and excavation on the west bank from 1993-5 has revealed a long sequence of Middle Stone Age horizons in the Aduma region. These appear to be associated with a riparian landscape of small stream channels, lake shores and ephemeral marshes. Faunal remains are variably preserved, but are present at all localities so far studied, and the potential for recovery of both human behavioral information and the fossil hominids themselves has been demonstrated. Of particular interest is the sequence of typological development suggested by the three sites excavated to date, from a very early industry with large blades and leaf-shaped points made on both Levallois and prismatic cores, to a much later industry with very small triangular bifacial and unifacial points with trimmed butts, micro-Levallois and micro-discoidal cores, and a few small blades and pyramidal blade cores.

A parallel investigation directed by J. D. Clark at Bouri, 20 km south of Aduma, has revealed a long sequence of Acheulean horizons in similar depositional contexts. The Middle Awash region thus offers the potential for a study of human behavioral change across a large span of Pleistocene time, including a long period of Middle Stone Age development. Preliminary age determinations for at least the base of the Middle Stone Age sequence are pending.

Reference

Wendorf, J. & R. Schild (1974) A Middle Stone Age sequence from the Central Rift Valley, Ethiopia. Wrocław, Polska Akademia Nauk.



**Evaluation of the asymmetry of the internal cranial vault of Circeo I at the level of  
at the level of the Broca's area**

**Jacopo Moggi Cecchi & Brunetto Chiarelli**  
Inst. of Anthropology, Univ. of Florence

Researches concerning the temporal origin of human language are based upon necessarily indirect information, because the organs (brain, pharynx, larynx, and tongue) involved in this function are not available from the fossil record. We have recently proposed a technique based on the CAT analysis, which permitted us to reveal the existence of symmetry in the Broca's area, on the left side of the internal skull vault. In this study of the internal cranial vault of Circeo I, we verified the existence of eventual cerebral asymmetries connected with the neurological structures used for the production of speech. The existence of such asymmetries seems to indicate the presence of a neurological basis for articulate language among Neanderthals.

**Cagny l'Épinette: An Acheulian living surface?**

**Philip G. Chase<sup>1</sup>, Harold L. Dibble<sup>2</sup>, Shannon McPherron<sup>3</sup>,  
Brooks Ellwood<sup>4</sup> & Alain Truffeau<sup>5</sup>**

<sup>1</sup>University Museum, University of Pennsylvania; <sup>2</sup>Dept. of Anthropology, University of Pennsylvania;

<sup>3</sup>Bishop Museum, Honolulu; <sup>4</sup>Center for Geoenvironmental and Geoarchaeological Studies, University of Texas/Arlington; <sup>5</sup>University of Lille

Previous excavations at the Acheulian site of Cagny l'Épinette (Somme, France) have suggested the presence of an in situ occupation surface or "living floor" containing numerous lithic and faunal remains. If true, such a surface would have enormous potential for behavioral interpretations as to the use of the site. Unfortunately, however, the history of other claims for living floors clearly shows the need for applying a variety of tests to determine whether or not this surface is real or an artifact of some natural formation process or processes. This was the purpose of the new excavations at this site: to delineate and assess the behavioral and natural processes that may have formed and/or disturbed this assemblage. Building on the chronostratigraphic and sedimentary analysis of the deposits that were applied earlier, the new excavations at Cagny l'Épinette emphasized many different sources of archaeological evidence (including artifact orientations and distributions, small artifact distributions, lithic artifact and bone refits, faunal taphonomy, reduction sequences and patterns of use/reuse of lithic artifacts) and geophysical data. While none of these techniques are new, their combined application, integrated with sophisticated computer analysis, has not been standard practice at these types of sites. This paper reviews these methods, their integration, and the results of their application to this site.

**Find-densities at Middle Paleolithic open air sites in the Rhineland**

**Nicholas J. Conard**

Institut für Ur- und Frühgeschichte, Abt. Ältere Urgeschichte und Quartarökologie  
Schloss Hohentubingen, Tübingen/Germany

The densities of both lithic and faunal materials from open air Middle Paleolithic sites vary enormously. Some important factors influencing find-densities include: rate and energy of sedimentation, nature of faunal accumulation and preservation, and intensity and length of hominid occupation. This paper will consider the relationship between faunal and lithic densities and will look at examples from the Rhineland in an attempt to determine key factors that influence the structure of open air find horizons. In some cases hominid behavior plays a dominant role, while in other cases natural factors are more important. Particular attention will be paid to very low density sites and their implications for understanding the archaeology of the region.

**Star performers and cameo roles: The role of minority species  
in the Upper Paleolithic**

**James G. Enloe & Clare Tolmie**  
Dept. of Anthropology, University of Iowa

The late Upper Paleolithic is quite often viewed as characteristic of logistical foragers or specialized hunters, most particularly as reindeer hunters in France and northern Europe. While many late Magdalenian sites in the Perigord exhibit alternating seasonal exploitation of reindeer and horse, those in the Paris Basin are nonetheless dominated by reindeer until the end of the glacial period. Even on those sites with over 95% reindeer and with extremely limited occupation duration and seasonality, other species are present. The site of Verberie is primarily a fall reindeer migration interception hunting site, but also includes mammoth, horse, fox ground squirrel, goose, duck, grouse and other bird remains. The role of those other species within an otherwise specialized subsistence system is examined.

**Holes and grooves**

**The contribution of anatomy and taphonomy to the problem of art origins**

**Francesco d'Errico<sup>1</sup> & Paola Villa<sup>2</sup>**

<sup>1</sup>UMR 9933 du CNRS, Institut du Quaternaire, Talence, France

<sup>2</sup>Universite Bordeaux 1, Institut du Quaternaire, Talence, France

Optical and scanning electron microscopy, comparative anatomy, data from modern and Pleistocene carnivore accumulations and analysis of archaeological materials show that some of the pieces interpreted by various scholars as engraved or perforated bones from European Lower and Middle Paleolithic sites such as Pech de l'Aze II, Stranska Skala, Kulna, Bois Roche and Cueva Morin are not early manifestations of non-utilitarian behavior. Putative engravings are in fact vascular grooves while perforated pieces are partially digested bones regurgitated by hyenas. The current debate on art origins has most often been centered on the symbolic value and cognitive implications of these and similar pieces without a first hand analysis of the objects providing convincing proof of the human origins of the marks. Such proof is a necessary prerequisite to any discussion of their significance for the evolution of symbolic behavior.

**Progress report on the geology of the Plio-Pleistocene Dmanisi Site  
and the Diliska Gorge, Republic of Georgia**

**C. R. Ferring<sup>1</sup>, C. C. Swisher<sup>2</sup>, G. Bosinski<sup>3</sup>, L. Gabunia<sup>4</sup>, Z. Kikodze<sup>4</sup>  
D. Lordkipanidze<sup>4</sup>, M. Tvalrelidze<sup>4</sup>, & B. Tutberidze<sup>4</sup>**

<sup>1</sup>Center for Environmental Archaeology, University of North Texas; <sup>2</sup>Berkeley Geochronology Center;

<sup>3</sup>Roemisch-Germanischen Zentralmuseum; <sup>4</sup>Georgian Academy of Sciences

The 1995 season of an American-Georgian-German cooperative investigation of the Plio-Pleistocene geology of southern Georgia concentrated on the Homo erectus site of Dmanisi and the newly discovered succession of Plio-Pleistocene sediments and associated faunas in the Diliska Gorge near Akalkalaki. Detailed geologic studies at Dmanisi revealed that the previously described Villafranchian faunas as well as the Homo erectus mandible from Stratum V occur in infilled mammalian burrows/dens, and probably originated from the fauna and artifact bearing Stratum III. Oriented samples reveal that undisturbed sediments in Strata VI, V and IV, as well as the underlying Mashavera Basalt show normal geomagnetic polarity. The fossil-bearing disturbed zones in Strata VI-IV, as well as the undisturbed Strata III, II and I were of reversed polarity. Thus the mammalian fauna, the H. erectus mandible and lithic artifacts must be of Matuyama age (780ka to 1.8ma). A <sup>40</sup>Ar/<sup>39</sup>Ar age of ca. 1.9Ga is concordant with previous determinations.

In the Diliska Gorge, about 85 km west of Dmanisi, a 75 m thick section of Plio-Pleistocene sediments with interstratified basalts and ashes was surveyed for archaeological and paleontological localities. Rich vertebrate faunas and pollen-bearing sediments have been found at several locations, and excellent potential contexts for archaeological sites were identified. The faunal-bearing sediments and interstratified volcanic rocks all exhibit reversed geomagnetic polarity. They occur above and below a basalt dated to ca. 1.9 Ga that exhibits transitional geopolarity; This basalt probably dates to the Olduvai event. This entire suite occurs above a basalt dated to ca. 2.9 Ga; the basalt shows normal geomagnetic polarity and is probably of Gauss age. The geologic and paleontologic data show that the Diliska Gorge sediments can be correlated with the section at Dmanisi, and that a quite long Plio-Pleistocene composite section can be established. Our continuing research will include further survey, dating, paleoenvironmental reconstruction and site formation studies in this important region.

**Geology and Paleontology of the Lower Kerio Valley**  
**Craig S. Feibel<sup>1</sup>, Ian McDougall<sup>2</sup>, Meave G. Leakey<sup>3</sup>, John M. Harris<sup>4</sup>,**  
**and Alan Walker<sup>5</sup>**

<sup>1</sup>Rutgers University, <sup>2</sup>Australia National University, <sup>3</sup>National Museums of Kenya, <sup>4</sup>Natural History Museum of Los Angeles County, <sup>5</sup>Pennsylvania State University

Field work undertaken between 1990 and 1995 documented a wide range of Miocene and Plio-Pleistocene localities in the lower Kerio Valley of Kenya. This includes the previously known sites Lothagam, Kanapoi and Ekora, as well as related exposures at Eshoa Kakurongori, Longarakak and Nakoret. The results of this work have wide-ranging implications for our understanding of geologic and biotic evolution in East Africa.

Miocene strata are well exposed at Lothagam, documenting a large fluvial system with an associated mosaic of habitats from which a very rich fauna has been recovered. Possibly coeval sediments were encountered at Nakoret. Ekora presents limited exposures of Miocene strata as well. The Plio-Pleistocene record is variably represented at all localities. An Early Pliocene sequence of fluvial and lacustrine strata is present in most of the localities. At Nakoret, a thick sequence represents most of the interval seen in the Omo Group Plio-Pleistocene to the north. Detailed study of the lower Kerio Valley exposures has allowed us to test our understanding of stratigraphic relationships, paleogeographic models and paleoenvironmental reconstructions in the basin as a whole. Results from work in the northern Turkana Basin (Koobi Fora, West Turkana and the lower Omo Valley) have carried into the Kerio with remarkable continuity. At the same time, local variations are seen in the southwest corner of the basin, which reflect particularly the influence of major axial drainage from the Rift Valley to the south.

The fossil faunas from these localities have likewise expanded our understanding of the biotic record of the basin. The new hominid species, *Australopithecus anamensis*, is well represented at Kanapoi, and other hominid finds have been made at Lothagam, Eshoa Kakurongori and Nakoret. The turnover from archaic Miocene communities to the Plio-Pleistocene savanna associations is seen at Lothagam. The early Pliocene faunas recovered from these sites expand the record of diversity and habitat associations known from the basin.

**Getting fat in the Pleistocene:**  
**Proximate agency in the first transition to greater carnivory**  
**Diane Gifford-Gonzalez**  
University of California, Santa Cruz, CA

Since 1981, zooarchaeological research has confirmed hominid impacts on larger vertebrate bones found at the earliest Plio-Pleistocene archaeological sites in eastern Africa. Recent

paleoanthropological literature has argued brain growth-driven physiological needs for higher-quality foods emerged more or less coincidentally with such hominid-modified faunal assemblages and perhaps spurred this shift in foraging strategy. Influenced by fossil evidence and actualistically derived arguments, many if not all archaeologists have come to the opinion that hominid scavenging, rather than hunting in the modern sense, probably produced much of the large vertebrate bones in these sites. We thus have concrete evidence for a shift in hominid foraging tactics toward more intensive acquisition and use of larger vertebrate carcasses, by whatever means, as well as a physiologically based rationale for such a shift. The latter may be seen as the ultimate cause for the shift in Mayr's sense. This paper deals with the proximate cause, or agency, involved in this transition. Using theory drawn from nutritional physiology and behavioral ecology, especially as it relates to foraging and reproductive strategies, I argue that reproducing females would have been most motivated to engage regularly in scavenging lower-ranked carcass remnants. Remarks will be directed toward the role of mature males in such an adaptive scenario.

**Site formation processes in Mousterian and Upper Paleolithic deposits  
in Hayonim and Kebara Caves**

**Paul Goldberg**

Dept. of Archaeology, Boston University

Prehistoric caves constitute the locus of a number of depositional and post-depositional processes that are uncommon in open-air environments. These processes often influence the nature and quality of the archaeological record. This paper illustrates a number of these processes that were studied by micromorphology and mineralogical analysis and attempts to show their value in interpreting archaeological data, particularly in the nature of Middle Palaeolithic occupations.

Site formation in caves embodies depositional and post-depositional processes that relate to geogenic (*sense lato*) and anthropogenic effects. Geogenic processes include deposition of allochthonous materials by wind, sheetwash, and gravity. Anthropogenic deposition is particularly visible in Levantine caves, and is expressed by numerous burnt layers and sediment that was most likely tracked into the cave by humans or other fauna. Post-depositional modifications are represented by both physical and biochemical processes. Physical processes are dominated by trampling by humans, and burrowing by various fauna ranging from insects up to small mammals. Chemical activity is marked in these caves, and characterized by calcite cementation associated with dripstones, and the precipitation of numerous phosphate minerals which are mostly derived from bird and bat guano as well as bones. Phosphate diagenesis in articular, plays a large role in the preservation and distribution of bones.

Deciphering site formation processes will have a major impact on the way in which Mousterian industries are interpreted. The modifications of the sediments were often penecontemporaneous processes. Therefore the time depth of lithic traditions is best understood when both TL and ESR dates are taken into account together with the current understanding of the post-depositional effects. Several cases of type localities will be presented in the course of the oral presentation.

**Paleolithic archaeology at Weasel Cave, north central Caucasus, Russia:**

**Background, dating, site structure, and traceology**

**Nazim I. Hidjrati<sup>1</sup>, Larry R. Kimball<sup>2</sup>, Todd A. Koetje<sup>3</sup>**

<sup>1</sup>North-Ossetian State University, <sup>2</sup>Appalachian State University,

<sup>3</sup>Indiana University of Pennsylvania

A number of Palaeolithic sites have been investigated in North Ossetia over the past 16 years. The most significant is Mustylagty Lagat (Weasel Cave), excavated continuously since 1981. Weasel Cave is the first multi-component Paleolithic site investigated between the Caspian Sea and

northwestern Caucasus. The cave is filled with loose deposits and the original mouth of the cave and associated roof-falls are deeply buried (>15 vertical meters). So far, 28 culture-bearing layers have been investigated. Layers 5-28 comprise the Paleolithic components. The base of the Paleolithic occupation has not yet been reached. Layer 5 is radiocarbon dated to: 32,980+/-1070 BP and 34,288+/-1235 BP, and has a Mousterian industry. The provisional chronology of the Middle Paleolithic deposits at Weasel Cave is: Layers 12-14 are Riss-Wurm Interglacial; Layers 15 is Riss, and Layers 19-28 are possibly Mindel-Riss. Two volcanic ash layers are present in Layers 18 and 21. The archaeological contexts are in an excellent state of preservation and have not been significantly modified by natural forces. Faunal and botanical preservation (including carbonized wood and nutshell) are excellent. The lithic assemblages provide an excellent record for the Middle Paleolithic human adaptation of the northern Caucasus Mountains. A status report of this on-going investigation will be presented including recent Argon-Argon dating of the two volcanic ash levels, Site structure of the upper Mousterian layers 5-7, and microwear analysis of the tools from the same.

**Contrasting predator-prey relationships at Klasies River Mouth Cave 1 (MSA)  
and Nelson Bay Cave (LSA), South Africa  
Kenneth E. Juell\* & Richard G. Milo\*\*  
\*University of Utah, \*\*University of Chicago**

Among several proposed behavioral differences between MSA and LSA hominids of southern Africa, LSA modern humans seem to have acquired truly dangerous terrestrial animals more regularly than their MSA predecessors. Such generalization, based mostly on taxonomic abundance measures, would be strengthened by taphonomic analyses that systematically record bone damage morphologies to identify specific agents of accumulation. This paper presents results of microscopic examination of two dangerous prey species - leopards and chacma baboons. At KRM Cave 1 (SAS Member; ca. 80-100,000 BP), leopard bones exhibit damage consistent with natural deaths and weathering, while baboon bones commonly show carnivore tooth damage probably resulting from leopards; no evidence for hominid involvement was found. At Nelson Bay Cave (LSA layers; 18-5000 BP), leopard and baboon bones commonly exhibit marks and damage related to dismemberment, cooking, and marrow extraction by humans. Results indicate that differing predator-prey interactions among hominids, leopards, and baboons operated at these two sites. Larger implications and future research pursuits are then discussed.

**Technological variability in Kenya Middle Stone Age assemblages  
Alison J. Kelly  
Southern Methodist University, Dallas, TX**

A technological analysis of several Kenyan Middle Stone Age lithic assemblages indicates that their morphological and typological differences are only partially attributable to raw material variability. The remainder of the variability appears to be related to diversity in the organization of technology. In particular, although the techniques utilized to manufacture the Middle Stone Age assemblages are comparable on both intra- and inter-regional scales, raw material procurement and transport strategies, artifact import and export patterns, and degrees of raw material reduction vary considerably on both scales. Moreover, preliminary comparison of Kenyan middle Stone Age technological patterning to that found within other areas of Africa suggest that the patterns are comparable. Finally, comparison of the African Middle Stone Age technological organization to overall organization patterns seen within earlier and later periods suggests that the Middle Stone Age pattern is unique. The unique character of African Middle Stone Age technological organization may in turn indicate that the technological behaviors of Middle Stone Age hominids were different from those of earlier hominids and later fully modern

humans.

### **Changes in sexual dimorphism during Late Pleistocene and Early Holocene Europe.**

**Sang-Hee Lee**

University of Michigan, Ann Arbor

It has been argued that post-Pleistocene Europe is characterized by decrease in sexual dimorphism (Fruyer 1984). Using dental and cranio-facial measurements as well as stature, Fruyer (1984) tests for differences in sample means of temporal periods using Student's t-test. Statistical testing of cases such as this is difficult as the data points may not satisfy the assumptions necessary for the statistical testing methods. This is because the population properties of the data points are unknown, the data points cannot be assumed to have come from the same statistical population, and they cannot be assumed to be independently sampled as they are temporally dependent. Conflicting arguments (e.g., Collier 1993) may be a product of violating such assumptions. An alternative approach of data resampling, also known as bootstrapping, has the advantage of not making assumptions about the population properties. This study applies data resampling to test the statistical significance in observed changes in sexual dimorphism as expressed in the postcranial remains in Late Pleistocene/Early Holocene Europe, using the data collected by Fruyer.

#### References:

- Collier S. (1993) Sexual dimorphism in relation to big-game hunting and economy in modern human populations. American Journal of Physical Anthropology 91:485-504.
- Fruyer, DW (1984) Biological and cultural change in the European Late Pleistocene and Early Holocene. In, The Origins of modern humans: A world survey of the fossil evidence, edited by FH Smith & F Spencer, pp.211-250. New York: Alan R Liss.

### **Isotopic ratios and diets of Homo and Australopithecus robustus compared at Swartkrans**

**Julia A. Lee-Thorp\* & J. Francis Thackeray\*\***

\*University of Cape Town, Private Bag, Rondebosch, S.Af.

\*\*Transvaal Museum, Pretoria, S.Af.

An earlier carbon isotope study at Swartkrans showed that Australopithecus robustus included both C<sub>3</sub> and C<sub>4</sub> foods in their diets. Since the approximately 25% C<sub>4</sub> contribution must have come either from direct consumption of grass, or, as seems more likely, animals which ate grass, the isotopic data was interpreted as an indication that this hominid was probably omnivorous, and at any rate more of a generalist than previously believed. This finding led to the question of how A. robustus differed from coeval Homo hominids occurring in the same Members at Swartkrans that are generally considered to have been omnivorous. Elsewhere in Africa, robust Australopithecines apparently also co-existed with early forms of Homo for a considerable period of time - more than a million years. At Swartkrans, however, isotopic analysis of the few existing Homo specimens has only become possible after development of new instrumentation and micro-sampling strategy that requires very small amounts of enamel (about 2-3mg) drilled from the tooth using a diamond-tipped drillbit. Here we present isotopic data that shows two specimens assigned to Homo, SK 27 and SK 2635, are isotopically indistinguishable from the larger A. robustus sample analyzed earlier. As before, the results are consistent with a diet dominated by C<sub>3</sub> foods, but including a significant proportion derived from C<sub>4</sub> sources that are more likely to have been animal foods than grass-eating. This result is unexpected given that Homo is widely believed to have participated more extensively in behaviors aimed at obtaining animal foods, which in a savanna environment would be predominantly C<sub>4</sub> in origin. Although the diets are isotopically similar, it does not necessarily follow that they were the same in all respects; nevertheless, it remains difficult to explain how two similar species could continue to co-exist for such a long period with similar dietary adaptations.

**Environmental context of Rift Valley sites  
with evidence for Middle Pleistocene blade production  
in the Kapthurin Formation, Kenya  
Sally McBrearty<sup>1</sup> & John Kingston<sup>2</sup>**

<sup>1</sup>Dept. of Anthropology, University of Connecticut, Storrs; <sup>2</sup>Geology and Geophysics, Yale University.

Materials from the upper part of the Kapthurin Formation, Baringo District, Kenya, reveal the presence of a formalized system of blade production dating to the Middle Pleistocene. Reexamination of museum collections, our own field collecting, and artifact refitting and replication show that blades were repeatedly produced by both unidirectional and bidirectional flaking with both hard and soft hammer. Our largest refitted set thus far includes a core with 11 conjoining whole blades. Sites containing the blades are overlain by a tuff dated by K/Ar to at least 240 Ka, and thus the Kapthurin blades are probably the world's oldest known securely dated formal blades. To date, the largest numbers of Kapthurin blades have been found at two sites, GnJh-03 and GnJh-15. We have examined the ancient landscape in the vicinity of GnJh-15 in some detail in order to establish the site's relation to aspects of ancient topography, vegetation, and resource availability. Small fossil channels within and adjacent to the occupation itself probably provided the lava cobbles from which the blades were manufactured. These small streams probably emptied into the axis of the Rift to the east. The landsurface surrounding the site at the time of its occupation was nearly horizontal, and consisted primarily of overbank deposits from these aggrading streams. There are pronounced signs of soil development, indicating relative stability for the landsurface, on the order of thousands, if not tens of thousands of years. Isotopic analysis of carbonates from this paleosol indicates wooded grassland conditions, but a more closed vegetation community may have been in place c. 2 km to the south. Fossil fauna from this part of the Kapthurin Formation includes forms with both open and more closed habitat preferences.

**Free hands? Postcranial adaptations of Australopithecus  
Henry M. McHenry  
University of California, Davis CA**

Bipedalism is a defining characteristic of Australopithecus. This became widely appreciated in the late 1940s and 1950s with the discovery of human-like pelvic remains from Sterkfontein, Makapansgat, Kromdraai, and Swartkrans. It was confirmed by discoveries at Hadar and Laetoli in the 1970s. The vision of bipeds striding in open savanna habitats materialized in reconstructions complete with hands free for carrying and making tools. With hands no longer constrained by the demands of locomotion, selection favored dexterity.

How complete was the hand's liberation from locomotion in the earliest species of Australopithecus? Bipedalism appears at least by 4 Ma in A. anamensis and this species is human-like in its ankle, knee, and elbow. Its wrist is not adapted for African-ape-like knuckle-walking. Australopithecus afarensis is a committed biped as well, although it has many traits that may indicate greater arborealism than seen in modern people. Australopithecus africanus is later in time and shares many craniodental synapomorphies with early Homo, yet its body proportions are more ape-like than those of A. afarensis. The earliest partial skeletons of Homo also had more ape-like proportions. Arborealism may have constrained the dexterity of the human hand for at least the first half of hominid evolution.

**The Mousterian assemblages of Hayonim Cave in their Levantine context**  
**Liliane Meignen**

Recherche Scientifique, Sophia Antipolis, Valbonne;  
ERA 28 du Centre de Recherches Archeologiques, Centre National de la France

Hayonim Cave is located on the western hilly flanks of the Galilee. Previous excavations (1965-1970) directed by O. Bar-Yosef, B. Arensburg and E. Tchernov exposed an important stratigraphic sequence of Natufian, Kebaran, Aurignacian and Mousterian layers. Since 1992, a joint international research project began a new series of excavations focused on the Mousterian layers. Compiling both old and recent collections, Middle Paleolithic assemblages have been recovered from a 3.0 m thick stratigraphy.

Preliminary studies have already shown two different kinds of lithic industries. The upper levels contain a "classical" Levallois assemblage, with production of short blanks, mainly by centripetal or bidirectional flaking. The lower levels (especially in the Deep Sounding at the entrance of the cave) contain mainly elongated blanks (blades and points) often retouched. These blanks are obtained by two different reduction strategies. The first one seems to be linked to the Levallois method. The second one shows a more diversified core exploitation of the raw material blocks by bidirectional or unidirectional flaking. Such coexistence of two core reduction strategies has already been reported in the industries of Rosh Ein Mor, in the Negev (Marks and Monigal, in press).

These preliminary results confirm the presence of elongated blank production during the Early Mousterian, always preceding the Levallois short blanis production as already observed in other Levantine sites (Tabun Cave, Douara Cave, El Kowm). They demonstrate the existence of diverse blade production strategies for time-spans older than 100,000 years. More precise dating by biostratigraphy and radiometric methods (TL, ESR, OSL, U/Th) are under way.

**New zooarchaeological data from Bed II, Olduvai Gorge, Tanzania:  
Implications for hominid foraging strategies in the Early Pleistocene**

**Christopher M. Monahan**

University of Wisconsin, Madison  
National Museum of Natural History, Smithsonian, Washington DC

In the context of experimental, natural and archaeological control samples, new zooarchaeological data are reported from Early Pleistocene assemblages in Bed II, Olduvai Gorge: (1) stone tool and tooth marks, (2) skeletal part frequencies focusing on variability in long bone meat- and marrow-yields, and (3) measures of long bone fragmentation and portion representation. Results suggest that HWK E 1-2 are carnivore bone collections modified in low competition settings (e.g., safe refuge). Given evidence for a wooded vegetation and stone tool discard throughout the basal Bed II paleosol (=HWK E 1), this calls into question the basic tenets of the woodland scavenging models of hominid foraging. BK and MNK (Main site) appear to be primary hominid bone collections subsequently scavenged by bone-crunching carnivores. Aspects of hominid carnivorous foraging can be inferred from BK and, more equivocally, MNK: (1) early carcass acquisition; (2) greater emphasis on long bone meat rather than marrow; (3) focus on larger (size 3/4) animals; (4) exploitation of a wide variety of carcass resources. Broader comparisons to artifact sites in Bed I, Olduvai, and to the Turkana Basin in Kenya suggest that hominid behavioral variability, probably attributable to early Homo erectus/ergaster, significantly increased starting approximately 1.7 Ma.



**Pleistocene "Oases:" Settlement patterning and the Lake/Marsh Effect  
as viewed from the Wadi al-Hasa, Jordan  
Deborah Olszewski\* & Nancy Coinman\*\*  
\*Bishop Museum, \*\*Iowa State University**

During the Pleistocene, the Levant was characterized by a number of large lakes and marshes, particularly in the el Kowm, Damascus and Jafr Basins, in the Azraq and eastern Wadi al-Hasa, and in the Wadi al-Hammeh bordering Lake Lisan. Previous field investigations in these areas have documented intensive prehistoric use of these locales, especially during the late Upper Paleolithic and Epipaleolithic periods. However, the modelling of Pleistocene settlement systems in the Levant has focused on areas either lacking large-scale marshes/lakes (Negev/Sinai), or characterized by small seasonal ponds (Sinai/southern Jordan), or distinguished by elevational contrasts that appear to have influenced settlement patterning (southern Jordan). Thus, the influence of lake/marsh Pleistocene "oases" on settlement systems has not been fully explored. We examine this aspect of terminal Upper Paleolithic and Epipaleolithic hunter-gatherer settlement systems using preliminary data from the eastern Wadi al-Hasa in west-central Jordan.

**Weapons of choice in the French Upper Palaeolithic  
Gail Larsen Peterkin  
Tulane University, New Orleans, LA**

The traditional typological classification system for French Upper Palaeolithic lithic and organic weapon armatures is underlain by broad, morpho-functional classes that transcend both cultural and temporal boundaries. Attribute-based multivariate analysis of 984 complete lithic weapon armatures and 167 complete organic weapon armatures from 19 archaeological sites in southwest France permits the recognition of discrete classes of weapon armatures based upon general morphology and the mechanics of hafting. Additional multivariate analysis of paired artifactual and faunal samples from 30 of the same assemblages confirms the existence of the patterned exploitation of specific faunal species throughout the French Upper Palaeolithic. The analytic results suggest the preferential use of specific weapon systems against select game targets. For example, the Gravettian exploitation of red deer is related to the use of macrolithic "elements tronques" and macrolithic points with hafting specializations. The somewhat rare Upper Palaeolithic exploitation of megafauna, including woolly mammoth and woolly rhino, on the other hand, is associated with the use of robust foliate points. During the later Upper Palaeolithic, the introduction of small backed microliths and composite weaponry is related to the introduction of the atlatl and the resulting ability to exploit routinely prey species, like ibex, that inhabit less accessible environmental zones.

**Habitat variability as a selective factor in hominid evolution  
Richard Potts  
National Museum of Natural History, Smithsonian, Washington, DC**

Major adaptive change is considered to arise by long-term directional selection, consistent in its effect over many generations. The early Pliocene through Pleistocene trend toward cooler, more arid conditions suggests that selection and progressive change in hominids were related to increasingly open habitats. Hominid lineages also experienced, however, the Cenozoic's most dramatic fluctuations in climate, vegetation, and resource regimes. Proxies used to indicate a long-term environmental trend in fact demonstrate an increase in habitat variability over the span of hominid evolution. A new hypothesis is proposed: major developments in hominid behavior and ecological strategy did not evolve by consistent selection in relation to a trend or a stable biotic and social environment, but by a process of accommodating to habitat variability and disruption. Data on Pleistocene large mammals of the

southern Kenya rift test this hypothesis, and indicate that lineages possessing versatile dietary and social strategies outsurvived related large-bodied, dietary specialists during a period of intense environmental fluctuation. Behavioral flexibility in hominids also increased with extreme habitat oscillations over the past 700,000 yrs. The process of variability selection is introduced. It favored key hominid traits in response to long-term disparities in the habitat-specific effects of natural selection. This process may also have operated in the Mio-Pliocene when early bipedal behaviors evolved, and in the Plio-Pleistocene when early toolmakers utilized multiple habitats rather than a narrow range (contra riparian scavenging).

### **New research results on the mandibula of H. e. heidelbergensis**

**R. Protsch von Zieten**

Institute of Anthropology and Human Genetics  
J.W. Goethe University, Frankfurt/Main, Germany

The Mauer mandible has not been subjected to modern research methods since it was found in 1907. Its chronological placement is still relative, between 450,000 to 720,000 years BP. In addition, the mandible was handled badly, and the old, improperly constructed casts, that almost completely obliterated the osteological structure, hardly present an accurate image of its real morphology. New preparation and casting, X-ray analysis, CT's, CT-imaging, macro- and micro-morphological analysis, total dental reconstruction, thin-section polarization-microscopy and enamel-prismen analysis have been done over a period of two years. The results yielded new information on a unique osteological structure of the compacta that seems typical for all mandibles of H. erectus. In addition new biomechanical and pathological information including the discovery of organic material (DNA analysis?) were extracted from the Canalis mandibulae. The mandible can be fairly securely placed within H. erectus.

### **Why early hominids were not scavengers.**

**Sonia Ragir**

City University of New York, College of Staten Island

Comparative data on intestinal length, absorption rates, and transit times of dogs, wild felids, pigs, monkeys, and apes--carrion and non-carrion eating carnivores, frugivorous-folivores, frugivorous-carnivores, and folivores--supports the hypothesis that hunting may have been the only way for early hominids to ingest quantities of animal protein comparable to those consumed by baboons and chimpanzees until fire was used for cooking.

Food passes more rapidly through the short hindgut of carnivores than the longer hindgut of primates, thus, circumventing the reproduction of microbial spores, preventing them from overwhelming native intestinal flora and moving into the bloodstream. If eating carrion frequently made an animal sick, then revulsion based on an association between the smell of rotting meat and the subsequent cramping, vomiting, and diarrhea would keep monkeys and apes from eating it.

The reduction in the length of the small intestine apparent in modern humans began in Homo erectus and reached modern proportions in archaic H. sapiens; reductions are associated with two progressive dietary shifts: (1) an increased proportion of fresh meat in the diet; and (2) the use of fire for cooking meat and possibly the tough, hard-to-digest, roots and vegetation as well. Variation in primate dietary patterns can confound metabolic limitations on intrauterine and postnatal growth; clearly such differences are particularly important in the evolution of hominids, where at least four major dietary innovations in nutrient sources, preparation, and distribution took place.

**Middle Stone Age site distribution in the Upper Karoo, South Africa,  
does not reflect modern human spacial organization**

**C. Garth Sampson**

South African Museum & Southern Methodist University

Although various Middle Stone Age (MSA) remains have been proposed as evidence of precociously modern human behavior, this is not supported by settlement pattern analysis. A foot survey of 5,000 sq km of the Seacow River Valley in the upper Karoo, South Africa, netted an inventory of nearly a thousand MSA surface sites. This distribution pattern is compared with that formed by more than a thousand terminal Pleistocene/early Holocene sites plus several thousand later Holocene sites. Modern human spatial organization in this scrub desert is clearly reflected in the later set of maps. Then, large dense lithic scatters formed mainly around permanent waterpoints at spring eyes. Most sites are in rocky uplands with carefully sheltered views of the waterhole and good protection from prevailing winds. The lesser scatters and isolated finds are thinly distributed near hornfels quarries and lookout points in the regions between springs. Such distributions must reflect the familiar mobility pattern of daily (radiating) foraging and periodic (rotating) camp moves between springs. By contrast, MSA sites are more diffusely distributed on the landscape with a very weak focus on spring eyes. In some areas there is an anti-correlation with waterholes, a weak association with stream channels, and a strong focus on playa edges. This has more in common with the preceding Acheulian sites distribution, but does not mimic it exactly. The seemingly random, exposed, waterless locations of many MSA sites may be the result of opportunistic settlement around the carcasses of large mammals, either felled by MSA hunters or obtained by driving off predators from their own kills. Geophyte concentrations may have induced a similar response, but extreme organic destruction (zero everywhere) prevents testing either of these propositions.

**Reconstruction of floral habitat context at Olorgesailie**

**Nancy E. Sikes\* & Richard Potts**

\*Museum Support Center, Smithsonian, Suitland, MD

Stable carbon isotope analysis of a ~0.99 Myr paleosol (buried soil) from Olorgesailie (Kenya) is used to generate information on the site-specific floral context of the foraging behavior of early Acheulean toolmakers. Samples were collected from 35 trenches placed along ~3.5 km of the upper Member 1 outcrop face at Olorgesailie in collaboration with a landscape archaeology project. The stable carbon isotopic composition of soil carbonate and organic matter is related to the proportion of woody vegetation ( $C_3$  plants) to tropical grasses ( $C_4$  plants) across a land surface. The Olorgesailie paleosol carbonate stable carbon isotopic values range from -1.2 to +3.0 permil. These values indicate the land surface exploited by early Homo erectus near freshwater paleolake Olorgesailie during the late Early Pleistocene supported a local plant biomass of about 75-100%  $C_4$  plants. By analogy with the carbon isotopic values of modern East African floral microhabitats, the majority (85%) of the paleosol carbonate values represent an open  $C_4$  grassland; the remainder represent wooded grassland. Spatial analysis of the excavated large mammal fauna independently indicates a habitat populated uniformly by grazing herbivores.

**The Avifauna of Ohalo II: A preliminary analysis  
of migratory patterns and site seasonality**  
**Tal Simmons**  
Western Michigan University, Kalamazoo

The Epipaleolithic site of Ohalo II (19,00 BP) was exposed in 1989 during a year of record draught in Israel. As the Sea of Galilee receded, this shore habitation site, previously underwater and covered by 2-4 m of sands, was revealed for the first time in millennia. Subsequent excavations revealed multiple layers of occupation by the Kebaran culture, which included the remains of clearly delineated structures surrounded by a series of hearths, a waste dump, and a burial. Characteristic of the Kebaran broad spectrum economy, the well preserved faunal remains of Ohalo II are eclectic, ranging from articulated bones of large mammals to those of innumerable fish. Botanical evidence indicates that the site was occupied at least biseasonally, during the Spring and Autumn. However, as the most abundant dietary remains are fish (consistently available regardless of the season), the possibility for year-round occupation of the site exists. Preliminary analysis of the avifauna, however, supports the biseasonal occupation pattern. Of the 58 species of birds identified thus far, only 6 are present in Israel year-round. The remaining 52 species are passage migrants, currently present in this region only in the Spring and Autumn months. The birds themselves are quite diverse, representing 17 families and 38 genera. As might be expected from a lakeshore site, the remains of waterfowl abound. The most diversity within a family occurs among the Anatidae (ducks, geese, swans) with 8 genera and 17 species; the most frequently occurring birds in the assemblage are those of the family Podicipidae, grebes. Species common to a variety of other environments are found in significant numbers as well (namely the Accipitridae, or diurnal birds of prey), indicating the concentrated hunting of certain species perhaps for purposes other than subsistence. The regular migration pattern of birds today broadly indicates that the site was occupied during the months of September-November (Europe-Africa migration) and late February-April (Africa-Europe migration). A biseasonal occupation pattern at Ohalo II seems to support a shift away from the generalized foraging economy of hunter-gatherers, indicate the onset of planned intensive collecting, and foreshadow the initial steps toward sedentism.

**Was there an Acheulian occupation at Yabroud Shelter I**  
**Rose L. Solecki & Ralph S. Solecki**  
Texas A&M University

Rust suggested that 11 out of his 25 cultural layers at Yabroud Shelter I had Acheulian affiliations, either as part of mixed industries or representative of traditional Acheulian ones. This paper deals only with those pre-Mousterian (below cultural layer 10) assemblages that Rust assigned to the Acheulian: end Acheulian-pre-Mousterian; Acheuleo-Yabrudian; Late Acheulian; Micoquian; and late Middle Acheulian. A restudy of Rust's collections suggests that all of these industries can be placed within the Acheuleo-Yabrudian of the Mugharan Tradition and that Upper Acheulian (e.g., Layer F Tabun) or Middle Acheulian assemblages are not represented at Yabroud Shelter I.

**Middle Paleolithic hunting in the Near East: the view from Kebara Cave (Israel)**  
**John D. Speth**  
Museum of Anthropology, University of Michigan, Ann Arbor

Excavations at Kebara Cave (Israel) by M. Stekelis in the 1940s and 1950s, and renewed work at the site in the 1980s by a joint French-Israeli team under the direction of O. Bar-Yosef and B. Vandermeersch, produced an extremely large, well-preserved, and well-documented collection of faunal remains that date to the last ca. 20,000 years of the Levantine Middle Paleolithic. This paper examines a sample of more than 20,000 ungulate bones from the site, mostly cervids and gazelle, in order to

better understand the procurement strategies employed by Middle Paleolithic hominids. Taphonomic studies indicate that most of the faunal remains were transported to the cave by humans, not hyenas. Mortality profiles, skeletal element frequencies, and other data suggest that most ungulates, including very large species like Bos, were acquired by Middle Paleolithic hominids (Neanderthals) at Kebara by hunting, not by scavenging.

**Species trends in Pleistocene archaeofaunas of Hayonim Cave:  
climate versus behavior change**

**Mary C. Stiner**

University of Arizona, Tucson

The deep faunal sequence of Hayonim Cave fills a crucial gap in our knowledge about the Pleistocene of Israel, spanning more than 200,000 years of foraging activities by Paleolithic peoples (Natufian through Mousterian periods). Most of the faunal remains other than rodents were collected in the cave by humans. These archaeofaunas are dominated by ungulate species--primarily Gazella and Dama--temporal variation in the proportions of which is best explained by climate change. There is also considerable evidence of small game exploitation at Hayonim Cave. The small prey species emphasized by human foragers changed a great deal over time, a trend that in not accounted for by climate effects. The shifts in small game types instead appears to reflect evolutionary shifts in humans' foraging adaptations. For example, tortoises (Testudo graeca) were especially important in the Mousterian diet despite their slow development and reproductive rates. In the Kebaran and Natufian periods, birds and lagomorphs became much more important, prey characterized by both quick escape mechanisms and the capacity for rapid population increase. Controlling for the effects of in situ bone decomposition, the rates of bone and artifact accumulation in the Mousterian appear to have been relatively low per unit time in Hayonim Cave; the large faunal assemblages recovered thus far instead owe their appreciable sizes to the long time frame represented and large sediment volume excavated. The findings argue for both low prey harvesting rates and very low human population densities during the Mousterian, especially the earlier Mousterian, raising the question of what kinds of selective constraints might favor intensification in harvesting strategies in the first place.

**Later Pleistocene evolutionary relationships in Central Europe  
and the Mladec postcranial remains**

**T. C. Stockton**

Northern Illinois University, Dekalb

Hominid remains from the site of Mladec in the Czech Republic comprise perhaps the earliest known sample of anatomically modern Europeans. Several analyses of cranial morphology have emphasized the presence of unique anatomical links between the Mladec sample and preceding Central European Neanderthals and , consequently, have been used to support the argument for continuity across the archaic (Neanderthal)/early modern boundary in this region of the world. The postcranial remains from Mladec, however, all clearly within the modern human range of variability, but exhibit considerable hypertrophy of joint surfaces in a male innominate, a juvenile proximal radius and ulna, and a talus. Additionally, the presence of a proximal femoral flange on both of the Mladec femora have been used in support of the continuity hypothesis.

Given the significance of the Mladec sample in determining evolutionary relationships in Central Europe, morphological and statistical comparisons with archaic and early modern European populations were conducted. Results indicate that certain morphological features are reminiscent of the Neanderthal pattern (e.g., proximal femur morphology, talar dimensions), but the evidence for continuity based on the Mladec postcranial sample is less convincing than that of the crania.

**The Magdalenian "community": from Belgium to Portugal**  
**Lawrence G. Straus**

University of New Mexico, Albuquerque

Beginning at the close of the Upper Pleniglacial (c.16 kya) the human geography of Europe began to change once again, gradually taking on its present form, as people, first falteringly, then inexorably re-expanded their range northward into trans-Loire France, England, Belgium, Germany and Netherlands. These frontierlands were sparsely and unevenly utilized by the colonizing bands and ties seem to have been maintained over long distances to their "homelands", while the new environments were learned and settled into, sometimes only temporarily, under the highly fluctuating conditions of the Tardiglacial. At the same time, in the southern refugia of the Iberian Peninsula precocious "Mesolithic-like" adaptations were being consolidated, with growing emphasis on the exploitation of marine resources and r-selected species in general, in both Atlantic and Mediterranean zones. In between, in the "promised land" of southern France, a variety of strategies (including both "anachronistic" specialized and more "post-glacial-like" diversified ones) were utilized by human groups both across time and among regions (such as the Western Pyrenees, Perigord, Provence and Languedoc). This paper will examine evidence for significant variability in territorial scale, mobility patterns and subsistence strategies during the Magdalenian, especially focusing of the last 3-4 millennia of the Last Glacial. However, it will also consider the meaning of striking similarities in art styles over broad areas of Europe, particularly in light of indications for widespread "circulation" of exotic fossils, marine shells, non-local flints, etc. This discussion will also include consideration of the less tangible evidence for widespread similarities in technological "style" that suggest broad commonalities at the level of an inter-band "community" of ideas or standards, possibly explainable with reference to the "expansionary" nature of human settlement in Magdalenian times. The Magdalenian presents an excellent case study for the analysis of both ecological and social determinants of formal similarities in the archeological record at a continental scale. The paper will be based on data from the research of the author and many colleagues, especially in Belgium, southern France, Spain and Portugal.

**Toward a revised geochronology for the Hominid-bearing strata of Java, Indonesia**  
**Carl C. Swisher III**

Berkeley Geochronology Center, Berkeley CA

An ongoing America-Indonesian field program is revealing significant problems with the currently held geochronologic framework of the hominid-bearing strata of Java. The results of detailed thermal and of demagnetization of oriented rock samples from the hominid-bearing strata of the Sangiran and Perring areas, coupled with new  $^{40}\text{Ar}/^{39}\text{Ar}$  dates on interbedded volcanic horizons are contrasted with previously published chronologies. The removal of stubborn normal geomagnetic overprints in the Sangiran section brings into question previous attempts at correlation with the geomagnetic polarity timescale. Previously recognized normal geomagnetic polarity intervals in the Sangiran area correlated with the Olduvai and Jaramillo subchrons and the Bruhnes-Matuyama boundary are now considered the result of the inability of demagnetization techniques to remove a present day normal polarity residing in goethite. The removal of these normal polarities and the recognition of reversed polarity rocks near the top of the Kabuh formation (as recognized in the Sangiran section) brings into question the stratigraphic location of the Jaramillo and Bruhnes-Matuyama boundary at Sangiran. If substantiated, the paleomagnetism would indicate that all hominids in the Sangiran area as well as their associated vertebrate faunas are older than 780 Ka. The results of this study in conjunction with new  $^{40}\text{Ar}/^{39}\text{Ar}$  dates is contrasted with a new paleomagnetic stratigraphy and geochronology for the Perring section and with revised ages for the hominid site of Ngandong.

**Upper limb versus lower limb robusticity  
in Near Eastern Middle Paleolithic Hominids**  
**Erik Trinkaus<sup>1</sup>, Christopher B. Ruff<sup>2</sup> & Steven E. Churchill<sup>3</sup>**  
<sup>1</sup>University of New Mexico, Universite de Bordeaux;  
<sup>2</sup>Johns Hopkins University Medical School; <sup>3</sup>Duke University

Human remains from the Near Eastern Middle Paleolithic can be divided into two lineages, one of late archaic humans from Amud, Dederiyeh, Kebara, Shanidar and Tabun, and one of early modern humans from Qafzeh and Skhul. Functional anatomical considerations of their skeletal morphology and dental attrition have substantiated that there were significant differences between these samples in aspects of their biologies reflecting differential loads on their anatomies from contrasting behavioral levels and patterns. However, when the full range of functionally relevant (especially developmentally and degeneratively plastic) aspects of their remains are considered, a complex mosaic of similarities and differences emerges.

To address this issue further, the robusticity (strength scaled to size) and shapes of the shafts of their primary upper limb and lower limb long bones were analyzed using quantifications of their cross-sectional geometries, in particular second moments of area which measure both the quantity of cortical bone and its distribution relative to the mechanical neutral axis of the shaft. This was done for humeral mid-distal shaft and for femoral and tibial midshafts. The comparisons indicate: 1) similar levels of modest humeral asymmetry, 2) a consistent contrast in humeral diaphyseal robusticity with the late archaic humans being more robust than the early modern ones despite a general gracility in the smaller individuals in both samples, 3) markedly greater late archaic human femoral and tibial robusticity when their midshaft strengths are compared to bone length, but 4) no significant difference in femoral and tibial robusticity once body breadth (for the femur and tibia) and relative limb segment lengths (for the tibia) are taken into account, 5) significant differences in femoral midshaft antero-posterior to medio-lateral absolute strengths, but 6) no significant difference in femoral midshaft antero-posterior and medio-lateral strengths relative to body size, and 7) no significant differences in tibial midshaft antero-posterior to medio-lateral strengths.

These analyses therefore indicate that these samples consistently contrasted in their relative arm strengths, implying differences in load levels during manipulative activities despite similar technologies. In contrast, there is little difference in their lower limb strengths relative to inferred body mass, implying similar levels of locomotor activity.

**Reptile lipid storage and utilization patterns:  
Significance for early Hominids at Olduvai Gorge, Tanzania**  
**Jolee A. West**  
University of Illinois, UC

Recent investigations of the taphonomy of aquatic reptiles at Olduvai Gorge Bed I and II archaeological and palaeontological sites indicate that crocodile (Crocodylus) and turtle (Pelusios) remains are best represented in archaeological levels and present in numbers comparable to mammalian remains at these same sites (Crocodylus teeth excluded). The significance of this patterning lies in the fact that reptile lipid storage and utilization patterns differ dramatically from those of tropical ungulates, particularly with regard to seasonal changes in precipitation. Seasonal cycling of lipid storage in many tropical reptiles is the opposite of the average ungulate cycle, with stored lipids increasing throughout the dry season, and reaching a peak at the beginning of the wet season. The aquatic reptiles found at the Olduvai Gorge archaeological sites, therefore may have served as a predictably located dry season fat resource in the closed habitats frequented by early Homo (Plummer and Bishop 1994; Sikes 1995). The progressive drying of paleolake Olduvai, and the loss of this critical source of fat, thus may have had profound implications for the evolution of Homo erectus.

### **Modification of Hominid bones at the Vindija Neanderthal site, Croatia**

**Tim D. White**

Laboratory for Human Evolutionary Studies, University of California, Berkeley

In 1986 N. Toth and T. White initiated a study on modifications to the Neanderthal fossils and associated fauna from the Krapina shelter in Croatia. These modifications had been attributed by various authors to cannibalism, rockfall, carnivore activity, and/or mortuary practices. Parallel analysis of the Vindija Neanderthal remains, also housed in Zagreb, demonstrated similarity in patterns of modification, despite preservational differences, between these fossils and the more ancient remains from Krapina. Hominid modification was evident on both assemblages, but the sample from Vindija was dominantly craniodental. This observation was combined with others from similarly modified assemblages from the American Southwest. This synthesis generated a prediction that additional (especially postcranial) hominid fossils lay unrecognized among the 'nonhuman' faunal remains extracted from the 'hominid unit' G3 at Vindija. A 1994 survey of the Vindija nonhominid faunal collection in the Institute for Paleontology and Quaternary Geology in Zagreb confirmed that a minimum of 10 previously unrecognized hominid specimens were present. Among the remains identified were both cranial and postcranial specimens, including an os coxae fragment. These fossils and their implications will be illustrated and discussed in the context of the total Vindija sample.

### **Paleolithic rock art and Paleolithic archaeology of the Coa Valley (Portugal)**

**Joao Zilhao**

Instituto de Arqueologia, Faculdade de Letras de Lisboa

The Coa and its tributaries represent the largest known cluster of Paleolithic open air rock art sites presently known. In spite of doubts raised by unreliable and poorly applied direct dating techniques, the Paleolithic chronology of this art is unquestionable. The clustered distribution of the several localities raises several issues of interpretation and taphonomy. Some of those localities are closer to sites that may have been used as camps, others are completely off-habitation areas. Together with smaller finds made since the early 1980s in Portugal and Spain, the Coa complex indicates that the interior of the Iberian Peninsula knew an important Upper Paleolithic occupation, contrary to what was hitherto generally admitted. The Douro basin in particular seems to have been an important focus, and it is predictable that new finds of open air art sites will be made in the future, transforming what is now a spotty distribution pattern into the continuous pattern of a past landscape anthropized through art.