

Required readings - Journal abstracts and synopses

Unit 1 - Earlier Prehistory: a brief overview

Plio-Pleistocene early hominids and early archaeological traces of stone technology

Diet of *Australopithecus* and *Paranthropus*

1. van der Merwe, N.J., J. F. Thackeray, J. A. Lee-Thorp and J. Luyt
2003 The carbon isotope ecology and diet of *Australopithecus africanus* at Sterkfontein, South Africa. *Journal of Human Evolution* 44 :581-597.

Abstract: The stable carbon isotope ratio of fossil tooth enamel carbonate is determined by the photosynthetic systems of plants at the base of the animal's foodweb. In subtropical Africa, grasses and many sedges have C4 photosynthesis and transmit their characteristically enriched ¹³C/¹²C ratios (more positive ¹³C values) along the foodchain to consumers. We report here a carbon isotope study of ten specimens of *Australopithecus africanus* from Member 4, Sterkfontein (ca. 2.5 to 2.0 Ma), compared with other fossil mammals from the same deposit. This is the most extensive isotopic study of an early hominin species that has been achieved so far. The results show that this hominin was intensively engaged with the savanna foodweb and that the dietary variation between individuals was more pronounced than for any other early hominin or non-human primate species on record. Suggestions that more than one species have been included in this taxon are not supported by the isotopic evidence. We conclude that *Australopithecus africanus* was highly opportunistic and adaptable in its feeding habits.

2. Lee-Thorp, Julia A., van der Merwe, N.J. and C.K. Brain
1994 Diet of *Australopithecus robustus* at Swartkrans from stable carbon isotopic analysis. *Journal of Human Evolution* 27:361-372.

Abstract: Dietary adaptations of early hominids are generally understood to have played a crucial role in hominid evolution. The dietary habits of *Australopithecus robustus* are of special interest because the robust masticatory apparatus and characteristic dental features point to a distinctive dietary niche. Suggestions have ranged anywhere between carnivory and specialist herbivory, but current consensus has focused mainly on small hard items within the context of a vegetarian diet, and more particularly, frugivory. Few studies have challenged this perspective, although the results of a recent Sr/Ca study of *A. robustus* at Swartkrans were found to be inconsistent with herbivory. ----- Results for *A. robustus*, compared with other fauna from Swartkrans, show a mixed diet including both C3 and C4 foods. Since the C4 contribution must derive from consumption of grass or grazing animals, the data do not support either a specialist frugivorous or graminivorous niche for *A. robustus*, rather, they suggest a more generalized or omnivorous diet.

Early stone tools as a measure of cognitive and motor skills

3. Roche, Helene., A. Delagnes, J-P. Brugal, C. Feibel, M. Kibunjia, V. Mourrek & P-J. Texier
1999 Early hominid stone tool production and technical skill 2.34 Myr ago in West Turkana, Kenya. *Nature* 399:57-60.

Abstract: Well-documented Pliocene archaeological sites are exceptional. At present they are known only in East Africa, in the Hadar and Shungura formations of Ethiopia and in the Nachukui formation of Kenya. Intensive archeological survey and a series of test excavations conducted in the Nachukui formation since 1987 have led to the discovery of more than 25 archaeological sites whose ages range from 2.34 to 0.7 million years before present (Myr) and to the extensive excavation of two 2.34-Myr sites, Lokalalei 1 in 1991 and Lokalalei 2C in

1997. Lokalalei 2C yielded nearly 3,000 archaeological finds from a context of such good preservation that it was possible to reconstitute more than 60 sets of complementary matching stone artefacts. These refits, predating the Koobi Fora refits by 500Kyr, are the oldest ever studied. Here we describe a technological analysis of the core reduction sequences, based on these refits, which allows unprecedented accuracy in the understanding of flake production processes. We can thus demonstrate greater cognitive capacity and motor skill than previously assumed for early hominids, and highlight the diversity of Pliocene technical behaviour.

Early bone tools and evidence of diet

4. Backwell, Lucinda R. and F. d'Errico
 2001 Evidence of termite foraging by Swartkrans early hominids.
Proc. Natl. Acad. Sci. USA 98(4):1358-1363. (February 13, 2001)

Abstract: Previous studies have suggested that modified bones from the Lower Paleolithic sites of Swartkrans and Sterkfontein in South Africa represent the oldest known bone tools and that they were used by *Australopithecus robustus* to dig up tubers. Macroscopic and microscopic analysis of the wear patterns on the purported bone tools, pseudo bone tools produced naturally by known taphonomic processes, and experimentally used bone tools confirm the anthropic origin of the modifications. However, our analysis suggests that these tools were used to dig into termite mounds, rather than to dig for tubers. This result indicates that early hominids from southern Africa maintained a behavioral pattern involving a bone tool material culture that may have persisted for a long period and strongly supports the role of insectivory in the early hominid diet.

Importance of cooking in human biological and cultural evolution

5. Wrangham, R. and N.L. Conklin-Brittain
 2003 Cooking as a biological trait.
Comparative Biochemistry and Physiology Part A 136: 35-46.

Abstract: No human foragers have been recorded as living without cooking, and people who choose a 'raw-foodist' life-style experience low energy and impaired reproductive function. This suggests that cooking may be obligatory for humans. The possibility that cooking is obligatory is supported by calculations suggesting that a diet of raw food could not supply sufficient calories for a normal hunter-gatherer lifestyle. In particular, many plant foods are too fiber-rich when raw, while most raw meat appears too tough to allow easy chewing. If cooking is indeed obligatory for humans but not for other apes, this means that human biology must have adapted to the ingestion of cooked food (i.e. food that is tender and low in fiber) in ways that no longer allow efficient processing of raw foods. Cooking has been practiced for ample time to allow the evolution of such adaptations. Digestive adaptations have not been investigated in detail but may include small teeth, small hind-guts, large small intestines, a fast gut passage rate, and possibly reduced ability to detoxify. The adoption of cooking can also be expected to have had far-reaching effects on such aspects of human biology as life-history, social behavior, and evolutionary psychology. Since dietary adaptations are central to understanding species evolution, cooking appears to have been a key feature of the environment of human evolutionary adaptedness. Further investigation is therefore needed of the ways in which human digestive physiology is constrained by the need for food of relatively high caloric density compared to other great apes.

Plio-Pleistocene Overview - optional supplemental reading

The reading listed below provides an excellent overview of issues in Plio-Pleistocene hominid and archaeological research in Africa, from about 5 to 1.5 million years ago.

6. Toth, N. and K. Schick
 2005 African Origins. In *The Human Past: world prehistory and the development of human societies*, ed. C. Scarre. Thames and Hudson, pp. 55-83.

Middle Pleistocene and Upper Pleistocene evidence of diet and technology

7. Goren-Inbar, Nama, G. Sharon., Y. Melamed, and M. Kislev
2002 Nuts, nut cracking, and pitted stones at Gesher Benot Ya'aqov, Israel.
Proceedings of the National Academy of Sciences, USA 99(4):2455-2460.

Abstract: The Acheulian site of Gesher Benot Ya'aqov (Israel) has revealed a unique association of edible nuts with pitted hammers and anvils. Located in the Dead Sea rift, on the boundary between the Arabian and African plates, the site dates to the Early-Middle Pleistocene, oxygen isotope stage 19. In a series of strata, seven species of nuts, most of which can be cracked open only by a hard hammer, were uncovered. Five of the species are extant terrestrial nuts, and two are aquatic nuts now extinct in the Levant. In addition, the site yielded an assemblage of pitted hammers and anvils similar in pit morphology to those used by chimpanzees and contemporary hunter-gatherers. This is the first time, to our knowledge, that a site has offered both paleobotanical and lithic evidence of plant foods eaten by early hominins and technologies used for processing these foods. The evidence also sheds light on the structure of the community: ethnographic analogies suggest that mixed gender groups may have been active on the shores of paleo-Lake Hula.

8. Goren-Inbar, Nama, N. Alperson, M E. Kislev, O. Simchoni, Y. Melamed, A. Ben-Nun and E. Werker
2004 Evidence of Hominin Control of Fire at Gesher Benot Ya'aqov, Israel.
Science 304: 725-727.

Abstract: The presence of burned seeds, wood, and flint at the Acheulian site of Gesher Benot Ya'aqov in Israel is suggestive of the control of fire by humans nearly 790,000 years ago. The distribution of the site's small burned flint fragments suggests that burning occurred in specific spots, possibly indicating hearth locations. Wood of six taxa was burned at the site, at least three of which are edible-olive, wild barley, and wild grape.

9. Thieme, H.

1997 Lower Palaeolithic hunting spears from Germany. *Nature* 395:807-810.

Abstract: Little is known about the organic component of Lower and Middle Palaeolithic technologies, particular with respect to wooden tools. Here I describe some wooden throwing spears about 400,000 years old that were discovered in 1995 at the Pleistocene site of Schöningen, Germany. They are thought to be the oldest complete hunting weapons so far discovered to have been used by humans. Found in association with stone tools and the butchered remains of more than ten horses, the spears strongly suggest that systematic hunting, involving foresight, planning and the use of appropriate technology, was part of the behavioural repertoire of pre-modern hominids. The use of sophisticated spears as early as the Middle Pleistocene may mean that many current theories on early human behaviour and culture must be revised.

Figure 5 from this paper (photo of wooden spear) removed due to copyright restrictions.

Neandertals and early modern humans

Neandertal diet ??

10. Richards, M.P., P.B. Pettitt, E. Trinkaus, F.H. Smith, M. Paunovic and I. Karavanic
2000 Neanderthal diet at Vindija and Neanderthal predation: The evidence from stable isotopes. *Proceedings of the National Academy of Sciences, USA* 97(13):7663–7666 (June 20, 2000)

Abstract: Archeological analysis of faunal remains and of lithic and bone tools has suggested that hunting of medium to large mammals was a major element of Neanderthal subsistence. Plant foods are almost invisible in the archeological record, and it is impossible to estimate accurately their dietary importance. However, stable isotope ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) analysis of mammal bone collagen provides a direct measure of diet and has been applied to two Neanderthals and various faunal species from Vindija Cave, Croatia. The isotope evidence overwhelmingly points to the Neanderthals behaving as top-level carnivores, obtaining almost all of their dietary protein from animal sources. Earlier Neanderthals in France and Belgium have yielded similar results, and a pattern of European Neanderthal adaptation as carnivores is emerging. These data reinforce current taphonomic assessments of associated faunal elements and make it unlikely that the Neanderthals were acquiring animal protein principally through scavenging. Instead, these findings portray them as effective predators.

11. Defleur, A., T. White, P. Valensi, L. Slimak, E. Crégut-Bonnoure
1999 Neanderthal Cannibalism at Moula-Guercy, Ardèche, France. *Science* 286:128-31. (1 October 1999)

Abstract: The cave site of Moula-Guercy, 80 meters above the modern Rhone River, was occupied by Neanderthals approximately 100,000 years ago. Excavations since 1991 have yielded rich paleontological, paleobotanical, and archaeological assemblages, including parts of six Neanderthals. The Neanderthals are contemporary with stone tools and faunal remains in the same tightly controlled stratigraphic and spatial contexts. The inference of Neanderthal cannibalism at Moula-Guercy is based on comparative analysis of hominid and ungulate bone spatial distributions, modifications by stone tools, and skeletal part representations.

Patterns of land use and group mobility

12. Lieberman, D. and Shea, J.J.
1994 Behavioral differences between archaic and modern humans in the Levantine Mousterian. *American Anthropologist* 96(2):300-332.

Abstract: Early modern and archaic humans are associated with similar lithic industries in the Middle Paleolithic of the southern Levant, but new data suggest that they used the environment in different ways. Evidence from analyses of seasonally deposited increments of the teeth of the animals they hunted suggests that modern humans primarily practiced a strategy of circulating seasonal mobility, while archaic humans in the same region 30,000 years later were more residentially mobile. Analyses of their lithic hunting technology further suggest that archaic humans hunted more frequently than did modern humans. We argue that this greater hunting intensity may have been a strategy for coping with the consequences of resource biodepletion resulting from long-term multiseasonal occupation of sites. These behavioral contrasts may be related to some of the morphological differences between early modern and archaic humans.

13. d'Errico, F., C. Henshilwood, M. Vanhaeren and K. van Niekerk
2005 *Nassarius kraussianus* shell beads from Blombos Cave: evidence for symbolic behaviour in the Middle Stone Age. *Journal of Human Evolution* 48:3-24.

Abstract: Since 1991, excavations at Blombos Cave have yielded a well-preserved sample of faunal and cultural

material in Middle Stone Age (MSA) levels. The uppermost MSA phase, M1, is dated to c. 75 ka by optically stimulated luminescence (OSL) and thermoluminescence, and the middle M2 phase to a provisional c. 78 ka. Artefacts unusual in a MSA context from these phases include bifacial points, bone tools, engraved ochre and engraved bone. In this paper, we describe forty-one marine tick shell beads recovered from these MSA phases and tick shell beads from Later Stone Age (LSA) levels at Blombos Cave and the Die Kelders site. Thirty-nine shell beads come from the upper M1 phase and two from M2. Morphometric, taphonomic and microscopic analysis of modern assemblages of living and dead tick shell demonstrate that the presence of perforated *Nassarius kraussianus* shells in the Blombos MSA levels cannot be due to natural processes or accidental transport by humans. The types of perforation seen on the MSA shells are absent on modern accumulations of dead shells and not attributable to post-depositional damage. Their location, size, and microscopic features are similar to those obtained experimentally by piercing the shell wall, through the aperture, with a sharp bone point. Use-wear, recorded on the perforation edge, the outer lip, and the parietal wall of the aperture indicates the shells having being strung and worn. MSA shell beads differ significantly in size, perforation type, wear pattern and shade compared to LSA beads and this eliminates the possibility of mixing across respective levels.

On the rate of the emergence of modern cultural traits

In palaeoanthropology today there are two markedly opposing views about the timing and the nature of the first appearance of fully modern human behavior. By fully modern we often mean the appearance of the following features - blade technology, bone tools, increased geographic range, specialized hunting, the use of aquatic resources, long distance trade, systematic processing and use of pigment, and art and decoration. The proponents of these two opposing views are archaeologists Richard Klein on the one hand and Sally McBrearty and Alison Brooks on the other. An abstract and excerpts from two of their recent papers are presented below to give you a feeling for the nature of the controversy.

14. Klein, Richard G.

2000 Archeology and the evolution of human behavior. *Evolutionary Anthropology* 9(1):17-36.

"...it is surely reasonable to propose that the shift to a fully modern behavioral mode and the geographic expansion of modern humans were also coproducts of a selectively advantageous genetic mutation."(p. 17)

"In my view, however, we can say that fully modern behavior appeared only 50–40 ky ago. Prior to that time, geographically far-flung populations progressively anticipated living people in their behavior, but they remained uniformly nonmodern in many important, detectable respects, including their relatively unstandardized (informal) artifacts, the remarkable uniformity of their artifact assemblages through time and space, their failure to produce unequivocal art or ornaments, the simplicity of their burials, their failure to build structures that retain archeological visibility, and their relatively limited ability to hunt and gather. All people before 11 ky ago lived primarily by hunting and gathering, but only archeological residues postdating 40 ky ago routinely imply the technological ingenuity, social formations, and ideological complexity of historic hunter-gatherers. Limited evidence suggests that fully modern behavior appeared first in Africa roughly 50 ky ago."(p.17)

"...credible claims for art or other modern human behavioral markers before 50 ky ago must involve relatively large numbers of highly patterned objects from deeply stratified, sealed contexts." (p. 28)

15. McBrearty, Sally and Alison S. Brooks

2000 The revolution that wasn't: a new interpretation of the origin of modern human behavior. *Journal of Human Evolution* 39, 453–563.

Abstract: Proponents of the model known as the "human revolution" claim that modern human behaviors arose suddenly, and nearly simultaneously, throughout the Old World ca. 40–50 ka. This

fundamental behavioral shift is purported to signal a cognitive advance, a possible reorganization of the brain, and the origin of language. Because the earliest modern human fossils, *Homo sapiens sensu stricto*, are found in Africa and the adjacent region of the Levant at >100 ka, the “human revolution” model creates a time lag between the appearance of anatomical modernity and perceived behavioral modernity, and creates the impression that the earliest modern Africans were behaviorally primitive. This view of events stems from a profound Eurocentric bias and a failure to appreciate the depth and breadth of the African archaeological record. In fact, many of the components of the “human revolution” claimed to appear at 40–50 ka are found in the African Middle Stone Age tens of thousands of years earlier. These features include blade and microlithic technology, bone tools, increased geographic range, specialized hunting, the use of aquatic resources, long distance trade, systematic processing and use of pigment, and art and decoration. These items do not occur suddenly together as predicted by the “human revolution” model, but at sites that are widely separated in space and time. This suggests a gradual assembling of the package of modern human behaviors in Africa, and its later export to other regions of the Old World. The African Middle and early Late Pleistocene hominid fossil record is fairly continuous and in it can be recognized a number of probably distinct species that provide plausible ancestors for *H. sapiens*. The appearance of Middle Stone Age technology and the first signs of modern behavior coincide with the appearance of fossils that have been attributed to *H. helmei*, suggesting the behavior of *H. helmei* is distinct from that of earlier hominid species and quite similar to that of modern people. If on anatomical and behavioral grounds *H. helmei* is sunk into *H. sapiens*, the origin of our species is linked with the appearance of Middle Stone Age technology at 250–300 ka.

Modern humans and the advent of modern behaviors

On the “Broad Spectrum Revolution”

16. Stiner, Mary C.

2001 Thirty years on the “Broad Spectrum Revolution” and paleolithic demography
Proceedings of the National Academy of Sciences, USA 98(13):6993–6996.
(June 19, 2001)

(comment)

This paper surveys the evidence for the “broad spectrum revolution” during the later part of the Palaeolithic in the Mediterranean basin, based on faunal remains from numerous archaeological sites. It considers the evidence for the increasing use of small mammals, birds and reptiles as food sources near the end of the Pleistocene. It concludes that there is substantial evidence supporting an increase in dietary breadth during this time.

17. Weiss, E., W. Wetterstrom, D. Nadel and O. Bar-Yosef

2004 The broad spectrum revisited: evidence from plant remains.
Proceedings of the National Academy of Sciences, USA 101(26):9551–9555.
(June 29, 2004)

Abstract: The beginning of agriculture is one of the most important developments in human history, with enormous consequences that paved the way for settled life and complex society. Much of the research on the origins of agriculture over the last 40 years has been guided by Flannery’s [Flannery, K. V. (1969) in *The Domestication and Exploitation of Plants and Animals*, eds. Ucko, P. J. & Dimbleby, G. W. (Duckworth, London), pp. 73–100] “broad spectrum revolution” (BSR) hypothesis, which posits that the transition to farming in southwest Asia entailed a period during which foragers broadened their resource base to encompass a wide array of foods that were previously ignored in an attempt to overcome food shortages. Although these resources undoubtedly included plants, nearly all BSR hypothesis-inspired research has focused on animals because of a dearth of Upper Paleolithic archaeobotanical assemblages. Now, however, a collection of >90,000 plant remains, recently recovered from the Stone Age site Ohalo II (23,000 B.P.), Israel, offers insights into the

plant foods of the late Upper Paleolithic. The staple foods of this assemblage were wild grasses, pushing back the dietary shift to grains some 10,000 years earlier than previously recognized. Besides the cereals (wild wheat and barley), small-grained grasses made up a large component of the assemblage, indicating that the BSR in the Levant was even broader than originally conceived, encompassing what would have been low-ranked plant foods. Over the next 15,000 years small-grained grasses were gradually replaced by the cereals and ultimately disappeared from the Levantine diet.