3D morphometrics<ms> See geometric morphometrics. (10/25/11) Data analysis.

ACC<ms> Acronym for Antarctic circumpolar current. See Antarctic circumpolar current. (10/25/11) Paleoclimate: General.

adaptability<ms>=(L. adaptare=to fit) The ability to change in response to environmental challenges. For example, the ability to respond physiologically to different altitudes is an example of adaptability, but the acquisition of that adaptability was an adaptation. Weiss and Bigham (2007) provide a useful discussion of the differences between adaptability and adaptation in the context of acclimatization. They stress that both have a genetic component. See also adaptation. (7/28/11) Biology.

Aiello, Leslie Crum (1946 –)<ms> Leslie Aiello was born in Pasadena, California and studied Anthropology (BA and MA) at The University of California, Los Angeles where she specialized in Upper Paleolithic Archaeology working with James Sackett, Lewis and Sally Binford, and Bernard Campbell. However, her interests tended toward human evolution and in 1975 she moved to London to pursue a PhD with Michael Day who was then at St. Thomas’s Hospital Medical School, The University of London. Her thesis on the allometry of long bones in higher primates (1982) provided the analytical foundation for her subsequent work in the evolution of human adaptation including broader issues of evolutionary theory, life history, energetics, and the evolution of the brain and diet within the hominin clade. She spent the majority of her academic career (1976-2005) at University College London where she was Professor of Biological Anthropology (1995-2005), Head of the Anthropology Department (1996-2002) and Head of the Graduate School (2002 to 2005). She also served as the co-managing editor of the Journal of Human Evolution (1993-1999) and was a visiting Professor at Yale University (1986-87). She is best known for her work on comparative energetics, especially the expensive tissue hypothesis that suggested the metabolic requirements of one relatively large organ made of a metabolically expensive tissue, the brain, are offset by an equivalent reduction in size of another metabolically expensive tissue, the gut (Aiello and Wheeler, 1995) and for her co-authorship with Christopher Dean of the influential textbook Human Evolutionary Anatomy. In 2005, she returned to the US to become President of the Wenner-Gren Foundation of Anthropological Research. She was the 2006 Royal Anthropological Society Huxley Memorial Medalist and Lecturer and gave the Jane Hart Distinguished Lecture at George Washington University in 2007 and the Peabody Museum Founder’s Lecture (Harvard University) in 2008. She is Professor Emerita (Biological Anthropology) and an Honorary Fellow of University College London. See also expensive tissue hypothesis, Human Evolutionary Anatomy. (11/7/11) History: Biographies.

Alayla<ms> One of the collecting areas within the Western Margin, a major fossiliferous subregion within the Middle Awash study area, Ethiopia. See Ardipithecus kadabba, Middle Awash study area. (8/2/11) Paleontology: Sites – Africa, Horn


assimilation hypothesis See assimilation model. (8/2/11) Paleoanthropology: Hypotheses and models.


Baba, Hisao (1945-) Hisao Baba was born in Tokyo and in 1959 he entered the University of Tokyo and earned his BSc in 1968 and MSc in 1970 for research on the relationship between postcranial bone morphology and sitting postures. In 1983, he was awarded a Doctorate of Medical Science from the University of Tokyo for research on the postcranial skeleton of the anatomically-modern humans sampled at the site of Minatogawa in the Ryukyu Islands. Hisao Baba’s first academic post was in the Department of Anatomy at Chiba University (1971-1973), but he later moved to the Department of Anatomy at Dokkyo Medical College (1973-1988). He then moved to the...
Department of Anthropology at the National Museum of Nature and Science in Tokyo, first as Chief Researcher (1988-1997) and then as its Director (1997-2009); during the latter period he also held the title of Professor of Evolution and Biodiversity at the Graduate School of The University of Tokyo. Hisao Baba’s early research focused on the late Pleistocene and Holocene Homo sapiens on the Japanese archipelago. In collaboration with Banri Endo he examined the four postcranial skeletons found at Minatogawa in the Ryukyu Islands and as a result suggested that the Late Pleistocene Minatogawa people had several unique physical characteristics that may have developed as adaptations to the island environment. Since 1988 most of Hisao Baba’s research has been focused on sites in Java, Indonesia (e.g., Sambungmacan, Sangiran, Ngandong, and Trinil) and on the evidence for Homo erectus found at those sites. The results of these research efforts, much of it in collaboration with Yousuke Kaifu, Fachroel Aziz and Teuku Jacob, led Baba to stress the morphological continuity between early and later Javanese H. erectus and conclude that because of their relative isolation the Early to Middle Pleistocene hominins from Java did not contribute significantly to the overall evolution of modern humans. Hisao Baba, who served as the President of Anthropological Society of Nippon (2005-2008), is currently an associate member of the Science Council of Japan, a member of Investigative Commissioner for Preservation and Utilization of Cultural Properties with the Agency of Cultural Affairs Japan, and an Emeritus Researcher at the National Museum of Nature and Science in Tokyo. (11/7/11) History: Biographies.

Bayes’ theorem. See Bayesian methods. (10/25/11) Data analysis.

Bpg 2001.04 Site Bapang. Sangiran Dome, Indonesia. Locality UTM Zone 49 483990E and 9174670N. Surface/in situ “eroding from a carbonate-cemented, pebbly channel sand” (Zaim et al. 2011, p. 365). Date of discovery April 22nd, 2001. Finder Samingam. Unit Cemented zone in a fluvial channel. Horizon “Upper meter of the channel sand approximately 20 cm above the contact with the Sangiran Formation” (Zaim et al. 2011, p. 365). Bed/member Grenzbank Zone/Cycle 1. Formation Bapang Formation. Group N/A. Nearest overlying dated horizon 2 m below a lens of reworked tuff containing “epiclastic pumice” with an age of 1.51±0.08 Ma (Ciochon et al. 2005). Nearest underlying dated horizon Tephra in the uppermost Sangiran Formation. Geological age >1.51±0.08 Ma. Developmental age Adult. Presumed sex N/A. Brief anatomical description Part of the left maxilla including the well-preserved crowns of P3-M2 and the zygomatic process. Endocranial volume N/A. Announcement Zaim et al. 2011. Initial description Zaim et al. 2011. Photographs/line drawings and metrical data Zaim et al. 2011. Detailed anatomical description Zaim et al. 2011. Initial taxonomic allocation Homo erectus. Current conventional taxonomic allocation As above. Informal taxonomic category Pre-modern Homo. Significance This, the fifth maxilla recovered from sites within the Sangiran Dome (the others are S4, S17, S27, and Tjg 1993.05), reinforces the proposition that there are consistent dental differences between the part of the H. erectus hypodigm that comes from Sangiran and other sites in Java and the part of the hypodigm that comes from Zhoukoudian. Zaim et al. 2011 even suggest that the two populations may have had separate origins. Location of original Institute of Technology Bandung (ITB). (11/7/11) Paleoanthropology: Sites and individual fossils – East Asia.

Brown, Peter James (1954- ) Born in Sydney, Australia, Peter Brown attended the Australian National University where he received his BA Honors in Biological Anthropology in 1978. Brown worked as a part time Technical Officer at the Australian National University for several years during which time he participated in archeological and paleontological excavations in western Tasmania, southwestern Victoria (McEacherns cave pit-trap) and in the Willandra Lakes (Lake Mungo). In 1979 Brown enrolled as a graduate student at the Australian National University under the supervision of Alan Thorne and Jack Golson and received his PhD in 1981 for his thesis on the hominin remains from Coobool Creek; it was later published as a monograph (Brown 1989). The nine female crania and 24 male crania described by Brown are the best preserved of the 126 hominin individuals found at the site. One of Brown’s important conclusions was that some of the distinctive features of the Coobool Creek crania (and probably morphologically similar crania from other sites) were due to the cultural practice of head binding. In 1981, Brown moved to The University of New England where he now holds the Chair of Paleoanthropology. Since 1981, Brown has participated in field research in China, India, Japan, Indonesia, and Australia focusing primarily on late-Pleistocene and Holocene sites; he has also conducted museum research on collections of modern humans, non-human primates and Pleistocene hominins in Australia, China, Japan, Indonesia, and elsewhere. In 2003, Brown was invited to join the team working on the hominins being excavated at Liang Bua cave on the island of Flores, Indonesia and was the lead author of the paper that called for the recognition of a new species, Homo floresiensis, for the hominins recovered (Brown et al. 2004). Brown serves as a consultant for government agencies, law enforcement, and developers primarily focusing on Australian Aboriginal skeletal remains. See also Coobool Creek, Homo floresiensis, Liang Bua (11/7/11) History: Biographies.


Cerling, Thure Edward (1949-)<ms> Thure Cerling spent his childhood in Illinois and Iowa. Cerling began at Iowa State University by majoring in engineering, but he switched his interests and his undergraduate degrees from Iowa State University were in geology and chemistry. He first went to Africa as an undergraduate in 1971 where he assisted Bruce Bowen map the strata near Ileret at Koobi Fora, Kenya in the Turkana Basin. He became interested in lake chemistry and pursued a PhD at UC Berkeley using the chemistry of modern African lakes as an analogy to understand the chemistry of fossil lake sediments in the Turkana Basin. While at Berkeley he became involved in the dating of the KBS Tuff with Garniss Curtis and showed that tuffs in the basin had distinctive chemistry that could be used for correlation. He began collaborating with Frank Brown in 1976 and they developed a basin-wide tephra-stratigraphy that linked the Koobi Fora Formation with the Shungura Formation. He worked at Oak Ridge National Lab from 1977-1979 and since 1979 he has been at the University of Utah where he is now Distinguished Professor of Biology and Distinguished Professor of Geology and Geophysics. Following his interest in soil, he worked on stable isotopes in soil, showing how they can be used to reconstruct aspects of vegetation, especially the fraction of tropical grasses (C<sub>4</sub> plants) in local ecosystems; most significantly these studies led to the recognition in the 1990s of a global expansion of tropical grasses that took place in the late Miocene (between c.6 and 9 Ma) (Cerling et al. 1997). The isotope studies also had applications diet reconstruction, for tropical grasses have carbon isotope ratios that are distinct from those of most shrubs and trees, hence one can distinguish between grazing and browsing mammals. Studies of mammalian diets have shown that some mammals adapted to the new food resource (the C<sub>4</sub> tropical grasses) that appeared in the late Miocene and some mammal groups underwent significant morphological change along with the diet switch (e.g., suids). Taken together, the isotope studies provide independent tests of various dietary theories, including the diets of fossil hominids (e.g., Cerling et al. 2010). Cerling was elected a member of the National Academy of Science in 2001.

Climate cycles<ms> See glacial cycles, Oxygen Isotope Stages. (10/25/11)
Paleoenvironment/Paleoclimate: General.

Chimpanzee insectivory<ms> At many long-term chimpanzee research sites, insects compose a greater proportion of the diet than vertebrate prey (Pruetz 2006), but according to Kay’s threshold (Kay and Simons 1980) solitary insects as prey are energetically too costly to harvest to be a viable preferred food option for large-bodied primates. However, the balance of the energetic equation changes if A) the insects are social, sedentary and live in large colonies (e.g., >10<sup>6</sup> individuals) (McGrew 1983) and B) they can be harvested using tools that enable large numbers of insects (e.g., ants and termites) or substantial amounts of insect products (e.g., honey) to be harvested efficiently. Furthermore, insects harvested on this scale provide an organism with significant amounts of important (and in some cases essential) proteins, amino acids, vitamins, and minerals (Hladik 1977, DeFoliart 1992, Deblauwe and Janssens 2008). Despite insects’ much smaller size compared to vertebrates on a gram-for-gram basis the energetic and macronutritional value of insects can be comparable or superior to meat (DeFoliart 1992). For example, chimpanzees consume army ants (Dorylus sp.) using tools at 14 study sites...
across Africa (Schöning et al. 2008) and termite fishing, generally for *Macrotermes* species, has been reported at nine chimpanzee communities (Bogart & Pruetz 2008). Insects generally compose a small proportion of the dietary items at most chimpanzee sites, but researchers have reported a large proportion of insects in fecal analyses at some sites (e.g., La Belgique in Cameroon [Deblauwe and Janssens 2008], Ndoki and Lossi Forests in Congo [Suzuki et al. 1995, Bermejo and Illera, 1999], Gashasha in Nigeria [Fowler and Sommer 2007; Schöning et al. 2007] and Lope in Gabon [Tutin and Fernandez 1992]). Direct observations at Fongoli in Senegal have shown that insects make up nearly a quarter (c.24%) of the yearly feeding budget and during some times of the year the chimpanzees at Fongoli spend more time consuming termites than any other food resource (Bogart & Pruetz 2011). Across Africa the most common insect prey for chimpanzees include honey-making bees (*Apis mellifera* and the stingless Meliponini), mound-building termites (*Macrotermitinae*, particularly *Macrotermes* spp.) and ants (*Camponotus* spp., *Crematogaster* spp., *Dorylus* spp. and *Oecophylla longinoda*) (McGrew 1992). As in modern humans, insectivory by chimpanzees is often associated with tool-use and biased by sex, with females consuming insects more often and for longer periods than males (McGrew 1992, 2001). Tool-assisted predation on ants and termites by chimpanzees are learned behaviors requiring several years to master, and skill acquisition by juveniles benefits from exposure to skilled models (Humle et al. 2009; Lonsdorf 2005, 2006). Predation frequency, acquisition techniques, and tool characteristics are also influenced by prey availability, behavior, and local environmental conditions (McBeath and McGrew 1982; Schoning et al. 2008). In contrast to chimpanzees, the evidence for habitual insectivory by wild bonobos (*Pan paniscus*) is limited (McGrew et al. 2007). Early hominins that lived in highly seasonal environments would have faced periods when protein, both animal and plant, was in short supply and they may have been reliant on invertebrate protein. The significance of insects and honey in the diet of extant humans, chimpanzees and other apes suggests that hominins and early Homo might have exploited such resources as well (McGrew 1992, 2001). Some have suggested that larger vertebrates may not have been a significant source of protein until relatively late in hominin evolution (Pickering and Dominguez-Rodrigo 2006; Bogart & Pruetz 2011). See also diet reconstruction, termites. (11/7/11) Behavior: Diet.

**Chuandong**<ms>(穿洞</ms>)(Location 26°16′30″N, 105°43′10″E in southwestern China; etym. named after the local cave) History and general description A cave site located c.4 km southwest of Puding County and c.23 km west of Anshun City, Guizhou Province. Prof. Yu Jin Biao of Nanjing University and colleagues from the Guizhou Provincial Museum prospected at the site in 1976. In 1979 hominin fossils and artifacts were excavated by Biao and colleagues and in 1982 by a team from the Institute of Vertebrate Paleontology and Paleoanthropology. Temporal span and How dated? Nine stratigraphic horizons have been defined. Radiocarbon dates are as follow: c.16 ka BP (layer 9), 9,610 BP (layer 6), 8,540 BP (layer 5), 8,670 BP (layer 4), 8,080 BP (layer 2). The position(s) of the fossils within the deposits is/are unclear but they are inferred to correspond to around the time of the Pleistocene-Holocene boundary. Hominins found at the site A calotte (Skull I) from an older male consisting of a frontal bone with adjoining nasals, most of both parietals and part of the occipital were discovered in 1979 and a right maxillary fragment with I1-C are thought to belong to the same individual. Near the
entrance and 1.2 m below a disturbed cave deposit, an isolated right I\(^1\), a mandibular fragment with three attached molars and another isolated lower molar were also found. In 1982, a calotte (Skull II), assessed as being that of a young female, was discovered. Archeological evidence found at the site Stone artifacts (mostly scrapers), bone artifacts (e.g., spades and awls with blunt points and a long apex) made from antlers, burnt bones, and ash have been found. Repository Guizhou Provincial Museum (original), Guiyang; Institute of Vertebrate Paleontology and Paleoanthropology (cast of the 1979 calotte), Beijing. Key references: Geology and dating Wu RK et al. 1989; Hominins Huang 1989, Wu ML 1989, Wu XZ and Poirier 1995, Wu RK et al. 1999; Archeology Wu XZ and Poirier 1995; Wu RK et al. 1999. (7/24/11) Paleoanthropology: Sites – East Asia and Pacific - China.

continuity with hybridization See multiregional hypothesis, Wu Xinzhi (吴新智) (1928–) (6/7/11) Paleoanthropology: Hypotheses and models.


cross-striation periodicity See periodicity. (10/24/11) Teeth: Microstructure.

Cueva Negra del Estrecho del Río Quípar (Location 39\(^0\)02'5"N 1\(^\circ\)48'10"W, Spain, Murcia; etym. The black cave on the Quípar River Gorge) A rock-shelter in the valley of the river Quípar that drains into the Segura River and thence into the Mediterranean Sea. Cursory archeological exploration was undertaken in 1981. Since 1990 annual systematic excavation of the at least 5m depth of late Early Pleistocene sediments in the rock-shelter has uncovered an early biface (in 2003) and early evidence of fire (in 2011). Temporal span and How dated? The rock shelter contains 5m of late Early Pleistocene sediment all showing reversed polarity and containing a mammalian fauna pointing to a time later than the Jaramillo normal polarity event but before the Matuyama-Brunhes boundary (i.e., 990-780 ka). Pollen analysis implies interglacial conditions (Oxygen Isotope Stage 21 or 25). The absence of Middle or Upper Pleistocene remains refutes the Middle Pleistocene age assigned to the site in earlier publications. Hominins found at the site The dental remains, which are comparable to those of Homo neanderthalensis, have been interpreted as belonging to Homo heidelbergensis. Archeology found at the site Palaeolithic artifacts include a bifacially-flaked “Acheulian” hand-axe on a flat limestone cobble and chert and limestone flakes struck by centripetal knapping of small discoidal (“Levallois”) cores, sometimes showing abrupt edge-retouch with “Mousteroid” forms such as side-and end-scrapers, awls, denticulates and gravers; knapping spalls are common. Large and small mammal remains are typical of Spanish late Early Pleistocene faunal assemblages e.g., Mimomys savini, Megaloceros sp. nov., Equus (cf. altidens? sussenbornensis?), Stephanorhinus (cf. eiruscus?), Dama sp., Macaca sp.. Key references: Geology, dating, and paleoenvironment Carrión et al. 2003, Walker et al. 2006, Scott and Gibert 2009; Hominins Walker et al. 1998, 2006; Archeology Walker et al. 2006, Walker 2011. (2/29/12) Paleoanthropology: Sites – Europe.


enamel hypoplasia See hypoplasia. (10/24/11) Anatomy: Teeth - Development.


Falk, Dean (1944-) Born in Seattle, Dean Falk obtained a BA and an MA (1972) in Anthropology from the University of Illinois in Chicago. She then transferred to The University of Michigan to work with C. Loring Brace and she was awarded a PhD in physical anthropology in 1976 for her thesis entitled External neuroanatomy of the Cercopithecoida. Falk taught briefly at Southern Illinois University and at Boston University and from 1980-1986 she was a faculty member at the University of Puerto Rico, School of Medicine. She then spent two years at Purdue University as an Associate Professor (1986-1988) before moving in 1988 to the University at Albany, State University of New York as Professor of Anthropology. In 2001 Falk moved to Florida State University where in 2003 she was named Hale G. Smith Professor of Anthropology. In 2010 she was appointed Senior Scholar at the School for Advanced Research, Santa Fe, New Mexico. Among Falk’s early papers were studies of brain evolution in Old World monkeys, but she is best known for her interpretations of the endocranial morphology of early hominins, proposals about the functional implications (the radiator theory) of the pattern of cranial venous drainage in early hominins and for her involvement (together with Glenn Conroy, Charles Hildebolt and Michael Vannier) in the exploitation of modern imaging modalities as a means of capturing otherwise unavailable information about the endocranial morphology of fossil hominins. She has also investigated the size and morphology of the endocranial cavity of LB1 and she has contributed to discussions about the taxonomy of the Homo floresiensis hominin fossils recovered from Liang Bua, Flores. But Falk is perhaps best known for a long-running dispute with Ralph Holloway about the location of the lunate sulcus in early hominins, especially its location in Taung 1. The natural endocast of Taung 1 preserves some
endocranial morphology in exquisite detail, but frustratingly the area where the lunate sulcus is most likely located is poorly preserved. Whereas Holloway was convinced the lunate sulcus is situated in a posterior, more modern human-like, position, Falk was just as strongly convinced the lunate sulcus is located more anteriorly as it is in the extant great apes. On balance the evidence favors Holloway’s interpretation. Falk has published several popular books that explore the evolution of the human brain (e.g., *Braindance Revised and Expanded* [2004], *Finding Our Tongues: Mothers, Infants & the Origins of Language* [2009] and *The Fossil Chronicles: How Two Controversial Discoveries Changed Our View of Human Evolution* [2011]). (11/10/11) History: Biographies.


FBBs<ms>Acronym for fallback foods (which see). (7/5/11) Genetics and molecular biology.

filler foods<ms>Marshall and Wrangham (2007) divide fallback foods into ‘staple’ and ‘filler’ foods. Filler foods are fallback foods (e.g., cambium for orangutans and foliage for chimpanzees) that are relatively uniformly distributed and which never make up 100% of an animal’s diet. See also fallback foods, staple foods. (7/28/11) Behavior: Diet – Terms.


forefoot<ms> See foot. (7/5/11) Anatomy: Regional – Lower limb and limb girdle.

Generalized Procrustes analysis<ms> See Procrustes analysis. (10/25/11) Data analysis.


Global Boundary Stratotype Section and Point<ms> See Plio-Pleistocene boundary. (8/2/11) Earth Sciences: Terms.

GM<ms> Acronym for geometric mean and geometric morphometrics. (10/25/11) Data analysis.


green-light-stimulated luminescence (or GLSL)\textlangle m\rangle See luminescence dating. (7/28/11) Earth Sciences: Dating – terms.

GSSP\textlangle m\rangle ABBreviation of Global Boundary Stratotype Section and Point. See Pliop- 


HARs\textlangle m\rangle Acronym for human accelerated regions (which see). (7/5/11) Genetics and molecular biology.

Hérault\textlangle m\rangle A Département in France that includes several archeological sites, including Hortus and Lézignan-la-Cèbe. (7/1/11) Paleoanthropology: Sites – Europe.

high quality foods\textlangle m\rangle Marshall and Wrangham (2007) define high quality foods as “low-fiber, high-energy, few antifeedants” (ibid, p. 1226) foods and they make the point that these properties mean that such foods can be processed by animals with short, unspecialized, guts. See also fallback foods. (7/28/11) Behavior: Diet – Terms.

hindfoot\textlangle m\rangle See foot. (7/5/11) Anatomy: Regional – Lower limb and limb girdle.

hourglass\textlangle m\rangle See bottleneck. (10/25/11) Genetics and Molecular Biology.

Hovers, Erella (1956-)\textlangle m\rangle Erella Hovers, who was born in Haifa, Israel, claims that her interest in archeology developed because she was surrounded by archeology as she grew up. She received her undergraduate degree in Archeology and Geography from the Hebrew University in Jerusalem in 1979. She then spent two years away from archeology before returning to The Hebrew University to obtain both her Master’s (1988) and PhD (1998) in Prehistoric Archeology. Her doctoral thesis focused on the Qafzeh Cave as a case study for testing ideas about lithic variability in the Levantine Middle Paleolithic. After post-doctoral work with Ofer Bar-Yosef at Harvard University (1998-1999) on the Middle Paleolithic of the Levant in 1999 she was appointed a Lecturer at the Institute of Archaeology, The Hebrew University of Jerusalem, where she is currently a Professor. Between 1977-1985 Erella Hovers worked under the direction of Ofer Bar-Yosef, Isaac Gilead, Nigel Goring-Morris and Naama Goren-Inbar at various Paleolithic and Neolithic sites in Israel and Sinai including Quneitra, Kebara Cave, Gesher Benot Ya’aqov and Netiv Hagdud. Hovers began her independent field and laboratory research at the Epi-Paleolithic site of Urkan e-Rub where she excavated in 1986 and 1988. In 1991 she began work co-directing (together with Yoel Rak and William Kimbel) excavations at Amud Cave, Israel. She participated in the discovery and subsequent excavation of Amud 7 a 10-month old Neanderthal baby and since 1991 she has been solely responsible for the direction and coordination of research at Amud Cave. In 1993 Hovers accepted an invitation to join the Hadar Research Project where she has been involved with excavations at AL 333 (the “first family site”) and directed excavations at AL 1101, AL 666-1 (1999-2000 and 2011) and at AL 894 (2000-2002). Since 1999 Hovers has directed and coordinated the analysis of the archeological remains from Hadar. Beginning in 2005 she has co-directed (together with Ariel Malinsky-Buller and Ravid Ekshtain) excavations at the open-air Middle Paleolithic site of ‘Ein Qashish on eastern Mount...
Carmel. In addition to these field projects Hovers has research interests in the evolution of symbolism and art, lithic technology, the land-use strategies of pre-modern hominins, and in archeological theory. Hovers’ monograph *The lithic assemblages of Qafzeh Cave* was published in 2009. See also Amud, Qafzeh (7/24/11) History: Biographies.

Hrdlicka’s Neanderthal phase of Man <ms> See Neanderthal phase hypothesis. (10/26/11) Paleoanthropology: Hypotheses and models.


Huanglong (黄龙)<ms>(Location 35°33’49”N, 109°53’51”E in northwestern China; etym. “hill with graves of Xu’s family”) History and general description: An open site located on the southern slope of Xujiafenshan just north of Yaomen River Dam and about 6 km southeast of Huanglong County, Shaanxi Province. A farmer discovered the hominin fossil in 1975 during water reservoir construction. In 1980 a team from the Institute of Vertebrate Paleontology and Paleoanthropology conducted a geological survey at the site. Huanglong, which is located about 80 km north of Dali, should not be confused with Huanglongdong (i.e., Huanglong Cave), a site in Hubei Province where five modern human teeth have been found. Temporal span and How dated? Late Pleistocene or Early Holocene based on biostratigraphy. Hominins found at the site: A male calotte (PA 842) consists of large part of the frontal squama, the lateral half of the superior part of the left orbit and the anterior two thirds of both parietal bones. Archeological evidence found at the site: None. Repository: Institute of Vertebrate Paleontology and Paleoanthropology, Beijing. Key references: Geology and dating Wang LH and Li Y 1983; Hominins Wang LH and Li Y 1983; Wang LH and Braüer 1984, Wu XZ and Poirier 1995; Archeology: None. (7/24/11) Paleoanthropology: Sites – East Asia and Pacific - China.


immunodiffusion<ms> See albumin, immunochemistry. (10/25/11) Genetics and Molecular Biology.


infrared-stimulated luminescence (or IRSL)<m> See luminescence dating. (7/28/11) Earth Sciences: Dating – terms.

isotropy<ms> See anisotropy. (10/25/11) Functional Morphology.

Ivane Valley site complex<ms>(Location 8°27’14”S, 147°12’36”E, Papua New Guinea; etym. Named after the river valley in which the sites are located) History and general description: A complex of sites in a c.2000 m high valley in the east of Papua New Guinea. Prospecting and excavations in the 1960s confirmed the presence of artifacts at
Kosipe Mission (AER - the Papua New Guinea National Museum site codes are given in squared parentheses), a site of a hill overlooking a swamp. Further prospecting and excavations in 2005 confirmed the presence of artifacts at seven other sites (Airport Mound [AAXD], Joe’s Garden [AAXC], Kerapa [AAXG], Nineve [AAXI], Piari’s Ditch [AAXH], South Kov [AAXE] and Vilakuav [AAXF]). All of the sites have five occupation layers. The youngest layer (Layer 1) is a dark brown topsoil, then come a brown-orange clay (Layer 2), a black-brown soil (Layer 3, but at most sites Layers 3a and 3b are distinguishable), and a gray soil (Layer 4) all of which overlie a consistently sterile orange clay (Layer 5). The site is one of the oldest in the region and it is evidence of the adaptability of Homo sapiens for the climate in the Ivane Valley would have been much cooler than that experienced at sites close to the coast. 

**Temporal span and How dated?**

Calibrated AMS radiocarbon dates on a layer of charcoal in Layer 4 suggest that the earliest occupations (c.49-43 ka) were at Vilakuav; Layer 3b is 40-30 ka; Layer 3a is 30-26 ka and Layer 2 is 8-4 ka (all are AMS dates). 

**Archaeology found at the site**

Evidence of in situ manufacture of stone (“waisted”) axes, “axe-like bifacially flaked implements” (Summerhayes et al. 2010, p. 79), charred Pandanus nuts, starch grains from Dioscorea (yams) and burned bone. Key references: Geology, dating, and paleoenvironment Summerhayes et al. 2010; Hominins N/A; Archaeology O’Connell & Allen 2004, Summerhayes et al. 2010. (11/10/11) 

Paleoanthropology: Sites – East Asia and Pacific.

**jackknife<ms>** See resampling. (10/25/11) Data analysis.

**Jebel Faya<ms>** (Location 25°11’9"N 55°84’7"E, United Arab Emirates; etym. The name of the 10 km-long limestone mountain at the base of the peninsular that separates the Persian Gulf from the Gulf of Oman) 

**History and general description**

The site (FAY-NE1) is a rock-shelter at the northeastern end of the Jebel Faya that was excavated in 2003 and 2010. The excavation, which covers >150m², began at the rear wall of the rock-shelter with the excavators working towards the entrance exposing a section c.25m wide and up to 5m deep; test pits were also dug within and in front of the shelter. The researchers recognize three Paleolithic assemblages. The uppermost, A, is separated from the Holocene layers above and from the layers containing assemblages B and C beneath by archaeologically sterile sediments. Assemblages B and C are not always easily distinguishable. 

**Temporal span and How dated?** Single-grain optically stimulated luminescence dating was used to generate ages for assemblages C and A; the ages for assemblage C range from 127±16 to 95±13 ka and the age of assemblage C is c.40 ka. 

Hominins found at the site None. Archeological evidence found at the site Assemblage C consists of hand axes, end scrapers, side scrapers and denticulate and foliate points; some of the artifacts were made using the Levallois technique. Assemblage B consists of flakes and a few blades, but unlike Assemblage C there was no evidence that bifacial reduction or the Levallois technique had been used to make the Assemblage B artifacts. Assemblage A includes burins, end scrapers, side scrapers, denticulate points and retouched pieces; blades are rare and as for Assemblage B there is no evidence that bifacial reduction or the Levallois technique had been used to make the Assemblage A artifacts. The researchers claim that the nature of the artifacts at the site is consistent with them being made by anatomically-modern humans leaving Africa and bringing their

Kay’s threshold See chimpanzee insectivory. (7/24/11) Behavior: Diet.

KBS Tuff Volcanic tuff exposed in the Koobi Fora Formation named after the tuff exposed at the Kay Behrensmeyer Site. Its age is 1.87±0.02 Ma (McDougall and Brown 2006) and its lateral equivalents include the H-2 Tuff in the Shungura Formation and the Turoha Tuff in the Konso Formation (Katoh et al. 2000). Controversy over the nature and the age of the KBS Tuff in the 1960s-1980s proved a fundamental testing ground for the development and refinement of radiometric and other dating methods, with original potassium-argon estimates of 2.26 Ma in conflict with biostratigraphic evidence (particularly from the suids). Subsequent concordant K-Ar, argon-argon, fission-track and paleomagnetic analyses supported the biostratigraphic estimates of 1.9 Ma. See also KBS Tuff dating controversy (10/30/11) Earth Sciences: Stratigraphy – terms (WC: 98)

KBS Tuff controversy The KBS Tuff forms the lower boundary of the KBS Member of the Koobi Fora Formation. There are many tuffs throughout the section at Koobi Fora but the KBS Tuff and its age were important for two reasons. First, the tuff was named after the Kay Behrensmeyer site, or KBS, one of two sites where Oldowan artifacts had been found in situ within tuffaceous sediments that were subsequently given the same name as the site (Isaac et al. 1971). Second, the KBS Tuff was identified above the horizon where fragments of a hominin cranium, KNM-ER 1470, had been recovered from Area 131 in 1972. The cranium was particularly significant because when the cranial fragments were reassembled it was clear that its estimated endocranial volume (c. 752 cm³, Holloway 1983c) was substantially larger than that of archaic hominins. The first attempts to date the KBS Tuff used both conventional potassium-argon and argon-argon dating. The majority of the ages using the former method were between 2.4-2.5 Ma; one of 3.76±2.1 Ma was rejected as an anomaly. The particular argon-argon method used involved heating the sample in increments (hence it was called step, or incremental, heating) and it resulted in several ages. Frank Fitch and Jack Miller interpreted the younger ages (including one of c. 1.8 Ma) as artifacts due to a phenomenon they referred to as “overprinting” and they suggested that the older ages were due to contamination from older rocks, thus they opted for 2.68±0.26 Ma as the age of the KBS Tuff. Cooke and Maglio (1972) pointed out that such an old age for the tuff was inconsistent with the biochronological framework being developed by the researchers working in the Shungura Formation and elsewhere and they suggested that the taxa found in what are now known as the Burgi and KBS Members at Koobi Fora were equivalent to those found in strata in the Shungura Formation dated to c.2 Ma and with those found in strata dated to less than 2 Ma at Olduvai Gorge. The discrepancies between the ages determined using biochronology and those based on absolute methods were a cause of friction between the researchers working in the International Omo Research...
Expedition and those involved in what was then called the East Rudolf Research Project. As those who attended will attest, the pros and cons of the two methods were debated vigorously at conferences and meetings held around this time, especially the Earliest Man and Environments in the Lake Rudolf Basin conference sponsored by the Wenner-Gren Foundation held in Nairobi in 1973 (Coppens et al. 1976) and the Geological Background to Fossil Man: Recent Research in the Gregory Rift Valley, East Africa meeting sponsored by the Geological Society of London and held at the Society’s rooms in London in 1975 (Bishop 1978). Meanwhile absolute dates were being obtained for tephra above and below the KBS Tuff (Fitch et al. 1974, Fitch and Miller 1975); these ages and later estimates were to become important factors that eventually constrained the options for the age of the tuff. Andrew Brock was invited to Koobi Fora to see if magnetostratigraphy could resolve the controversy but the normal direction of the magnetic field in samples of the KBS Tuff was consistent with both a 2.6 or a 1.8 Ma age, but for various reasons he opted for the older age (Brock and Isaac 1974). However, for this assessment to be consistent with the other geomagnetic dating results from the Koobi Fora sediments and with the proposed ages of the other tephra in the region it required there to be a substantial amount of “missing” time (c.0.7 Ma) in the section above the KBS Tuff. But once the initial Koobi Fora stratigraphy (Findlater 1978) was revised (Brown and Feibel 1986) it was clear that there was an unconformity, but it was below the KBS Tuff and not above it, which is where the 2.6 Ma age for the tuff required it to be. In the following year Curtis et al. (1975) published new potassium-argon ages for the KBS Tuff. These researchers used both feldspar and glass for their analyses and their results were disconcerting for one set of samples suggested an age of 1.85 Ma and a second set an age of 1.6 Ma. Were the samples of the “KBS Tuff” from different locations at Koobi Fora really sampling the same horizon at the different locations or were the samples coming from two different tephra? Curtis et al. (1975) also demonstrated that detrital contamination of young volcanic feldspars by much older plutonic feldspars was a potential problem: this was especially the case using the large sample sizes (c.1 gram of feldspar separate) required by the total fusion of feldspars using an induction furnace (laser fusion of single crystals was still considerably in the future).

In the meantime Thure Cerling, a student of Richard Hay, was coming to the end of his graduate thesis research that was using unique chemical signals in the tephra to check whether tuffs that had been linked in the exposures on the basis of their gross and microscopic appearance were actually the same tephra (i.e., the product of the same eruption). This technique, now called tephrostratigraphy or “tuff fingerprinting,” showed conclusively that the KBS Tuff as mapped did consist of two distinct tephra and it also showed that other tuffs at Koobi Fora that had been given different names (e.g., the Chari and Karari Tuffs) were actually the product of the same eruption and that some other tuffs (e.g., the Tulu Bor Tuff as mapped in 1977) were actually several different tuffs (Cerling 1977). Cerling et al. (1979) subsequently confirmed that the “real” KBS Tuff in Area 105 was the same tephra as Tuff H-2 from the Shungura Formation that had been securely dated to c.1.8 Ma. It was also around this time that Hillhouse et al. (1977) were unable to reconcile their new paleomagnetic data with the existing Koobi Fora stratigraphy and this also pointed to the need for the former to be overhauled. The age of the ‘real’ KBS Tuff in Area 105 was finally resolved in 1980. First came the publication of potassium-argon dates of feldspar and glass (Drake et al. 1980) that suggested an age
of c.1.8 Ma. Later in the same year Gleadow (1980) published the results of a fission-track dating study that used zircon from pumice in the KBS Tuff. This gave an age of 1.87±0.04 Ma and in the paper Gleadow suggested that the older (e.g., c.2.4 Ma) ages were the result of detrital contamination. In the same issue of Nature McDougall et al. (1980) reported the results of potassium-argon dating of anorthoclase feldspars from the KBS Tuff that gave an age of 1.89±0.01 Ma and a later paper confirmed the age of the tuff (McDougall et al. 1985). The controversy over the age of the KBS Tuff is important for several reasons. First, the resolution of the age of the tuff illustrated the crucial importance of having a sound stratigraphy for a complex site such as Koobi Fora. Second, it demonstrated how tephrostratigraphy can precisely correlate tephra not only within site complexes such as Koobi Fora, but also among site complexes within the same sedimentary basin, among sites in more than one sedimentary basin and between deep sea cores in the Gulf of Aden and terrestrial sediments as far inland as the Albertine Rift. Third, it is worth remembering that the controversy took place at a time when many of what we now regard as routine dating methods were still being developed and several of the preliminary dates from the Shungura Formation were subsequently revised, but none to the same extent as the age of the KBS Tuff. Fourth, it reminds us that sophisticated methods need to be used with discretion and their results interpreted with particular care. Lastly, with hindsight it was unwise to disregard Occam’s razor and resort to an exotic explanation for data (e.g., overprinting) instead of persevering with the implications of simpler explanations. As Samuel Johnson wrote in 1751 “we frequently fall into error and folly, not because the true principles of action are not known, but because, for a time, they are not remembered.” For a general recounting of the KBS Tuff controversy see Roger Lewin’s Bones of Contention (Lewin 1987); a useful non-technical summary was provided by Richard Hay (1980). Brown (1994) wrote in more technical detail about the controversy and Oldroyd (1987) looked at it from the point of view of a historian of science. See also argon-argon dating. Koobi Fora Formation, potassium-argon dating. (10/30/11) Earth Sciences: Dating.

A ‘keystone’ is a wedge-shaped stone in the center of an arch that locks the other stones of the arch in place. A keystone resource is one that if lost would have an impact on more than one member of a community and that impact would be out of proportion to its abundance. A keystone resource for a community may also be a fallback food for a single taxon (Marshall and Wrangham 2007). See also fallback foods. (7/28/11) Behavior: Diet – Terms.

Klein, Richard G. (1941-)<ms>Richard Klein was born in Chicago in 1941 where his interest in prehistory in general and in Neanderthals in particular was stimulated by visits to Chicago’s Field Museum. In 1958 he attended The University of Michigan intending to study Russian and physics, but he soon switched to Anthropology. His professor Frank B. Livingstone’s work on hemoglobin variability encouraged Klein to pursue a graduate education in paleoanthropology and in 1962 he joined The University of Chicago to study with Clark Howell. For his graduate studies Klein decided to combine his interests in Russia and archeology by focusing his graduate research on the Russian Paleolithic. His graduate studies included a period at The University of Bordeaux where he looked more closely at Neanderthal tool use under the tutelage of Francois Bordes. After completing
his PhD at The University of Chicago in 1966 at the suggestion of Desmond Clark, Klein began to focus on African prehistory and this is the work for which he is best known. Early in his career Klein developed an interest in how the careful investigation of the faunal assemblages from sites can inform and improve our knowledge of the behavior of fossil hominins. His pioneering studies of ungulate mortality profiles, changes in tortoise and mollusk size and other zooarchaeological indicators of hominin behavior resulted in the publication, together with Kathryn Cruz-Uribe, of the widely used book *The analysis of animal bones from archaeological sites* (1984). These techniques were developed while investigating the faunal assemblages from several southern African sites including those from Klasies River, Nelson Bay Cave, Die Kelders, Elandsfontein, Duinefontein and Ysterfontein; Klein was responsible for conducting the excavations at Nelson Bay Cave, Duinefontein and Ysterfontein. It was during this work that he developed his ideas, first formulated in his doctoral research on the Middle and Upper Paleolithic, about the contrasts in behavior between Middle Stone Age and Later Stone Age hominins. In addition to his work in southern Africa, Klein also worked on a number of Spanish sites, such as Torralba, Ambrosa and El Juyo. Klein is perhaps best known for his espousal of the hypothesis that c.50 ka ago there was a quantum shift in the cognitive and language abilities of modern humans and that it was this that explains the most recent Out-of-Africa migration by modern humans. This has since been challenged by the countervailing hypothesis that claims the origins of modern human behavior can be traced back to more than 300 ka ago in Africa. This latter hypothesis also suggests that modern human behavior evolved incrementally (e.g., McBrearty and Brooks 2000). Klein is also well known as the sole author of the influential advanced textbook *The Human Career* (1989, 1999, 2009). Klein has taught at The University of Wisconsin-Milwaukee and Northwestern University, The University of Washington, The University of Chicago and at Stanford University where presently he is the Anne T. and Robert M. Bass Professor of the School of Humanities and Sciences and Professor of Anthropology and Biology. Klein’s contributions were recognized by his 2003 election to the National Academy of Science.

(10/3/11) History: Biographies.

**KNM-BK 67**

taxon and may belong to *Homo rhodesiensis*. It is considered to be conspecific with another mandible from the Kapturin Formation, **KNM-BK 8518**. Location of Original National Museums of Kenya, Nairobi, Kenya. (6/24/11) Paleoanthropology: Sites and individual fossils – Africa, East.


Brief anatomical description A mandibular corpus with heavily and asymmetrically worn teeth affected by post-mortem distortion, plus a fragment of the left ramus, a heavily damaged fragment of the left P4 and a damaged right lower canine. Endocranial volume N/A. Announcement Van Noten and Wood 1985. Initial description Wood and Van Noten 1986. Photographs/line drawings and metrical data Wood and Van Noten 1986, Wood 1991. Detailed anatomical description Wood and Van Noten 1986. Initial taxonomic allocation *Homo sp.* (aff. erectus) Current conventional taxonomic allocation *Homo erectus*. Informal taxonomic category Pre-modern *Homo*. Significance This mandible is consistently more primitive (e.g., more robust corpus, more complex symphyseal buttressing, premolar root form and molar size order) than **KNM-BK 67**, but the differences between the two mandibles are still more consistent with intra- rather than inter-specific variation. The features listed above are consistent with an allocation to *H. erectus*, but in the absence of any mandibular evidence from Bodo or Kabwe, allocation to *Homo rhodesiensis* cannot be ruled out. Location of original National Museums of Kenya, Nairobi, Kenya. (7/24/11) Paleoanthropology: Sites and individual fossils – Africa, East.

**KRP**<ms> Prefix for fossil hominins from Krapina. (10/26/11) Paleoanthropology: Site prefixes.

**La Solana del Zamborino**<ms> See Solana del Zamborino. (1/3/11)
Paleoanthropology: Sites – Europe.

**lag surface**<ms> See lag deposit. (10/26/11) Earth Sciences: Terms.

**lake basin**<ms> See basin, closed basin lakes. (10/26/11) Earth Sciences: Terms.

**landmark-based morphometric methods**<ms> See geometric morphometrics. (10/25/11) Data analysis.

**Lanpo, Jia (1908-2001)**<ms>Jia Lanpo was born in 1908 in a mountain village in Yutian County, Hebei Province, China. He spent his early years with his grandparents, but when he was old enough for school he moved to Beijing to be with his father. Jia Lanpo excelled at Beijing Huiwen Middle School, graduating in 1929. His parents could not afford to send him to college, but in the spring of 1931 the Cenozoic Research
Laboratory of the Geological Survey of China was hiring trainees and Lanpo’s excellent exam results resulted in his admission into the training program. He was assigned to assist Pei Wenzhong [裴文中] at the excavations at what was then called Chou’koutien (now Zhoukoudian) and such was his progress that Lanpo was appointed successively Assistant Research Professor, Research Professor and then Academician at the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP). In 1935 Lanpo was asked to take over as the head of the excavations at Chou’koutien (now Zhoukoudian) and he worked there from 1935 to 1949. During that time period c.45 hominin fossils were recovered from Chou’koutien and Lanpo worked alongside Pierre Teilhard de Chardin, Henri Breuil, Davidson Black and Franz Weidenreich as well as his life-long friend Bian Meinian. Lanpo argued that the microlithic tools and blades found at Chou’koutien were consistent with the use and control of fire and he interpreted the faunal evidence found at the cave as suggesting that region of China underwent successive shifts in climate with alternating warm and cold periods. After 1949 Lanpo devoted most of his time to projects in Shaanxi Province where he led excavations at Dingcun (1954) and at Kehe (1959). Lanpo was part of the team who discovered the first in situ Gigantopithecus teeth in China at Heidong (Black Cave) in Daixin county, Guangxi (1956). Jia Lanpo’s investigations at Lantian (1964) recovered hominin fossils that he interpreted as more primitive than the homins recovered from Chou’koutien. In 1976 Jia Lanpo joined with Wei Qi to work at Hsuchiayao (Xujiayao). Beginning in the 1980s Jia Lanpo was actively engaged in encouraging foreign archeologists to visit China and to become involved in archeological research in China. In 1990 Lanpo co-directed a Chinese-American excavation in the Nihewan basin of northern China with Desmond Clark. Jia Lanpo was a mentor to many Chinese archeologists and he was a committed popularizer of prehistory (e.g., Early Man in China, The Story of Peking Man, Chinese Homo erectus). Jia Lanpo was an Academician of the Archaeological Institute of the Chinese Academy of Social Sciences and a member of the Geological Bureau of the Biological Section of the Chinese Academy of Natural Sciences. He also served as Assistant Director of the Quaternary Geology and Glaciology Sections of the Chinese Geologic Association, Assistant Chairperson of the Board of Directors of the Chinese Archaeological Association, Assistant Director and Secretary of the Chinese Pacific History Association, and Member of the Cultural Bureau of the Chinese State Council. Jia Lanpo was arguably the preeminent Chinese paleoanthropologist of his time.

Lézignan-la-Cèbe<ms>(Location 43°29'N, 3°25'E, France; etym. after the nearby town) History and general description Discovered during quarrying, this site was excavated by Jean-Yves Crochet in 2008. Along with Chilhac in France and Barranco Leon, the Orce region, and Sima del Elefante in Spain, it is one of the few early western European sites with both fauna and lithic artifacts. Temporal span and How dated? Argon-argon dating of lava overlying the archeological remains provides a date of c.1.57 Ma. Hominins found at the site None. Archeological evidence found at the site The large faunal assemblage included species that are consistent with the late Early Pleistocene (Upper Villafranchian). Twenty stone artifacts, including both flakes and pebble tools, were recovered. Key references: Geology, dating, and paleoenvironment Crochet et al. 2009;
Lijiang (丽江)<ms>(Location 26°46'42"N, 100°16'35"E in southwestern China; etym. named after the nearby city) History and general description The Lijiang hominin was discovered by local farmers during the construction of an irrigation canal in c.1964. The exact location of the find is unknown, but it was reportedly found in a riverbed near Mujiaqiao village about 12 km southeast of Lijiang City, northern Yunnan Province. Temporal span and How dated? Late Pleistocene based on lithostratigraphic correlation of the coarse, yellow sand adhering to the cranium and the excavated horizons along both banks of the irrigation canal. Hominins found at the site A small, gracile, and almost complete cranium (Cat. # Limu 01) with a right M2 (PA 89); it is presumed to be a young female individual. The specimen is poorly known in the English literature and has not received much attention since the late 1970s. Archeological evidence found at the site: A small number of stone artifacts including cores, flakes, scrapers, choppers, and possible bolas stones have been reported. Repository Yunnan Provincial Museum (original), Kunming; Institute of Vertebrate Paleontology and Paleoanthropology (cast), Beijing. Key references: Geology and dating Ms. in Yunnan Provincial Museum 1977, Wu XZ and Poirier 1995; Hominins Ms. in Yunnan Provincial Museum 1977, Wu RK and Olsen 1985, Wu XZ and Poirier 1995, Archeology Wu XZ and Poirier 1995. (5/12/11) Paleoanthropology: Sites – East Asia and Pacific - China.

Liujiang (柳江)<ms>(Location 24°11'04"N, 109°26'25"E in southern China; etym. named after the local county) History and general description The limestone cave site at Tongtianyan is located about 16 km southeast of Liuzhou City, Guangxi Zhuang Autonomous Region. Local farm workers recovered the hominin fossils in the winter of 1958. Temporal span and How dated? The provenance of Liujiang is unknown. Accounts of the discovery suggest that the hominin fossils were found near the cave entrance where a complete skull of a giant panda was also discovered and uranium-series dating of the second travertine flowstone layer c.1 m above the Ailuropoda skull and five other mammalian teeth produce age estimates of 67±6/5ka and >100+ka, respectively. Recently, Shen Guan Jun and colleagues have suggested that the fossils may in fact come from an intrusive Refilling Breccia Unit previously misidentified as the Middle Unit. Their TIMS uranium-series analyses produce a minimum age range of 139-111 ka. Hominins found at the site Liujiang is a partial male skeleton consisting of an almost complete and well-preserved cranium (PA 89), an axial skeleton (PA 90) with four lower thoracic and five lumbar vertebrae, the sacrum, and four rib fragments, a left femoral shaft (PA 91), a right femoral shaft (PA 92) and a right os coxa (PA 93). Because of its state of preservation and relative completeness, Liujiang is one of the best known Chinese Homo sapiens specimens and the cranium has been compared to the fossils from

Paleoanthropology: Sites – East Asia and Pacific - China.


**LOD score** See linkage analysis. (6/7/11) Genetics and Molecular Biology.

**Lower Pubu** See Bubing Basin. (6/7/11) Paleoanthropology: Sites – South and Central - China.

**Luangwa Valley** Situated in eastern Zambia, the Luangwa Valley is a spur off the western branch of the East African Rift System. The Luangwa River is a tributary of the Zambezi River that rises in the east and flows for c.700 km in a southwesterly direction cutting through the high central plateau of Zambia to reach the Zambezi at the eastern end of the Mupata Gorge. The Luangwa Valley is a half-graben; it does not have the structure or characteristics of a rift valley. There are secondary archeological and paleontological deposits in the current floodplain and in the past there have been reports of surface finds of Sangoan and possibly Lower Paleolithic artifacts (Macrea and Lancaster 1937, Clark 1954). Excavations began in 2002 and Mode 1 artifacts and a fossilized Theropithecus femur were reported (Elton et al. 2003). Barham and colleagues began a five-year program of survey and excavation in the South Luangwa National Park and in the adjacent Nchindeni Hills and it was in gravel deposits exposed by the Manzi River close to where it joins the Luangwa River that in 2003 Barham and colleagues recovered Mode 1 and Mode 3 artifacts. Cosmogenic nuclide dating was unsuccessful, but geomagnetic dating results suggest the artifacts in unit CL6 may be c.1 Ma. (Barham et al. 2011). See also Manzi River. (7/25/11) Paleoanthropology: Sites – Southern Africa; Zambia.

**Luna** See Bubing Basin. (7/5/11) Paleoanthropology: Sites – South and Central - China.

**Luonan Basin** The first basin through which the South Luo River flows in its eastward course from its source in the mountains east of Lantian, China, to where it joins the Huang (or Yellow) River. The Luonan Basin, which is known for many surface occurrences of artifacts (Wang 2005, Lu et al. 2011) and for an abundance of artifacts found in Longyadong (Longya Cave), extends from 34° to 34.3°N and from 110° to 110.6°E. See also Longyadong and South Luo River. (7/25/11) Paleoanthropology: Sites – East Asia and Pacific: China.

**Lushi Basin** The second basin through which the South Luo River flows in its eastward course from its source in the mountains east of Lantian, China to where it joins
the Huang (or Yellow) River. The Lushi Basin, which centers on the intersection of 34°N and 111°E, is known for many surface occurrences of artifacts (Wang et al. 2008, Lu et al. 2011) and for the in situ artifact occurrence at Qiaojiayao (Lu et al. 2011). See also Qiaojiayao and South Luo River. (7/25/11) Paleoanthropology: Sites – East Asia and Pacific: China.


Malakunanja II<ms>(Location 37°21'09"S, 146°85'77"E; Australia, etym. local name for the rock shelter) History and general description: A shallow rock shelter located in Arnhem Land about 200km east of Darwin just south of Malanganerr, near Ngarradji Warde Djobkeng and Ja Ja Billabong. Jo Kamminga and Harry Allen initially excavated the rock shelter in 1973 and it was subsequently investigated by Roberts et al. in the 1980s; no formal site report has yet been published. Temporal span and How dated? Luminescence dates initially suggested an occupation as early as 61-52 ka, but their relationship with evidence for hominin activity is now seen as uncertain. The site may not have been used until much later. Hominins found at the site None. Archeological evidence found at site The earliest evidence of hominin occupation (flaked stone tools) at the site is 2.6 m below the present ground surface; overlying deposits contain a broader array of materials, including ochre and grinding and pounding tools. Some rock art is also present. Key references: Geology and dating O’Connell & Allen 1998, 2004; Roberts et al. 1990, 1998; Hominins N/A; Archeology As above. (7/25/11) Paleoanthropology: Sites – East Asia and Pacific.

malaria, recent evolutionary history of modern human<ms> Malaria (It. mala aria = literally “bad air”) is a mosquito-borne parasitic infection of the blood that has been, and still is, a major cause of morbidity and mortality (c.1 million deaths per year) in modern humans. The various malaria parasite species affecting modern humans all belong in the genus Plasmodium but one of them, Plasmodium falciparum (L. falciparum = from falciform = crescent- or sickle-shaped and parum = birth; P. falciparum is the only Plasmodium species that has crescent-shaped gametocytes) is responsible for c.85% of the cases and for most of the morbidity and mortality. This is why infection with P. falciparum is called “malignant malaria.” For a long time little was known about Plasmodium infections in the extant great apes. In the 1920s Eduard Reichenow claimed that chimpanzees were capable of being infected with P. falciparum, but all attempts to infect modern humans using the Plasmodium recovered from a chimpanzee met with failure. Researchers concluded that the chimpanzee Plasmodium belonged to a separate species, which they named Plasmodium reichenowi in honor of its discoverer. In 2009 researchers amplified three gene fragments from 94 chimpanzees and identified five isolates from 84 chimpanzees from Cameroon and three from 10 chimpanzees from Côte d’Ivoire (Rich et al. 2009). They suggested that P. reichenowi and P. falciparum were sister taxa (it was proposed they should share their own genus, Laverinia), that P. reichenowi is a much more polymorphic species than P. falciparum and that P. falciparum in modern humans originated from what was most likely a single host transfer from P. reichenowi, an event that was estimated to have occurred between 3 and 2
million years ago (Rich et al. 2009). The researchers further suggested that the cross species transmission to the hominin lineage around that time was facilitated by the loss in that lineage of the Neu5Gc form of **sialic acid**. Researchers showed that *P. falciparum* preferentially recognizes the Neu5Ac form of sialic acid that is present in large amounts on the surface of modern human erythrocytes. A year later the authors of a more extensive comparative study (Liu et al. 2010) came to a different conclusion. Liu et al. used polymerase chain reaction-based methods to amplify a 956-base-pair fragment of *Plasmodium* cytochrome b sequences from DNA recovered from samples of feces of extant African great apes. This new method enabled them to screen many more individuals (1,827 chimpanzees, 805 gorillas and 107 bonobos) from 71 field sites (but they were unable to sample western chimpanzees [*Pan troglodytes verus*] or eastern gorillas [i.e., Cross River (*Gorilla beringei diehli*) and mountain (*Gorilla beringei beringei*) gorillas]). *Plasmodium* infections were found to be endemic (prevalence rates ranged from 32% to 48%) in chimpanzees from Nigeria and western Cameroon (*Pan troglodytes ellioti*), central Cameroon (*Pan troglodytes troglodytes*) and eastern Cameroon (*Pan troglodytes schweinfurthii*) and in western lowland gorillas (*Gorilla gorilla graueri*) (N = 146) and bonobos (*Pan paniscus*) (N = 120). The observation that all of the then available modern human *Plasmodium* sequences nested within one of the western lowland gorilla *Plasmodium* clades suggests that *P. falciparum* infections in modern humans are due to cross-species transmission from western lowland gorillas and not from chimpanzees. But it is unclear when, where and under what circumstances that transmission occurred. (7/25/11)

**Evolution: Malaria.**

**Manzi River**<ms>(Location 13°11′59″S, 31°41′2″E, eastern Zambia; etym. after the river that exposed the fluvial sequence) History and general description** The site consists of fluvial sediments (covering Karoo Group deposits) that have been exposed by the Manzi River within a kilometer of where it joins the Luangwa River. The sequence consists of a series of 15-20 cm-thick gravel lenses that are probably the remains of gravel bars deposited in the paleo-river system. Six of these cobble lenses have been recognized; CL1 is the youngest and CL6 the oldest. An unconformity consisting of a silty-clay (CL4) divides the Manzi River fluvial gravels subequally into two sequences; CL1-3 are above and CL5-6 are below. **Temporal span and How dated?** Contrary to preliminary age estimates (Phillips et al. 2005, Colton 2009) the results of subsequent research (Barham et al. 2011) have cast doubt on the reliability of the cosmogenic nuclide ages because of uncertainties about the history of exposure of the sediments containing the artifacts. Eight samples from CL2-5 were taken for geomagnetic dating. Units CL1-2 are believed to be late Pleistocene (c.78 ka), unit CL3 may sample the Matuyama-Brunhes boundary and the magnetic signal in CL6 suggests that it corresponds to either the end of the Jaramillo (c.0.98 Ma) or the end of the Cobb Mountain (c.1.17 Ma). Hominins found at the site None. Archeological evidence found at the site Units CL1 and CL2 had the greatest concentration of artifacts, but their overall frequency is low in all
six of the cobble lenses. Flakes make up the biggest component; angular chunks, cores, and shatter make up most of the rest. The only possible evidence of retouch is in units CL5-6. The researchers have concluded that the artifacts recovered from above CL4 (i.e., from CL1-3) are Mode 3, whereas those from CL4-6 are Mode 1. Key references: Geology, dating, and paleoenvironment Phillips et al. 2005, Colton 2009, Barham et al. 2011; Hominins N/A; Archeology Barham et al. 2011. See also Lungwa Valley.


McHenry, Henry M. (1944-) Henry McHenry was born in Los Angeles, USA. He attended The University of California at Davis where he received his BA degree in 1966 and his MA degree in 1967, both in Anthropology. In 1969 he began his PhD studies with William Howells at Harvard University, where he used multivariate methods to explore the affinities of isolated fossil hominin postcranial remains in the context of large samples to capture variation in modern humans and extant apes. The results of his 1972 thesis, The postcranial skeleton of Early Pleistocene hominids, were developed in an influential review article (McHenry 1975) about the functional morphology of the hominin postcranium. McHenry joined the Anthropology department at the University of California, Davis in 1971 where, in addition to pursuing his interest in the hominin postcranial skeleton, he explored the relationship between skeletal size and body size in modern humans and extant apes. This eventually led him to develop estimates of the body size of individual early hominins and thereby estimates for early hominin species (McHenry 1992). This interest in body size led McHenry to develop the megadontia quotient, a quantitative measure of the relative size of postcanine tooth crowns. In collaboration with Peter Rodman, McHenry developed the efficiency hypothesis to explain the origins of hominin bipedalism. Rodman and McHenry (1980) suggest that bipedalism would have been favored over quadrupedalism because it would have allowed the earliest hominins to more effectively compete for arboreal resources by adopting a more efficient form of travel between forest patches. McHenry was also an early advocate of applying cladistic reasoning to hominin evolution (Corruccini and McHenry 1978) and together with a student he undertook a phylogenetic analysis of early hominins (Skelton and McHenry 1992); he was also one of the first researchers to suggest that homoplasy was pervasive in hominin evolution (McHenry 1996). McHenry spent his career in the Anthropology Department at the University of California, Davis becoming Professor Emeritus in 2009. (7/25/11) History: Biographies.

Mengzi (蒙自) (Location 23°20’N, 103°24’E in southwestern China; etym. “hill of Huang’s family”) History and general description The fossil site is located in Maludong (i.e., Malu Cave) at the foothill of Huangjiashan, c.7 km south of Mengzi County, southern Yunnan Province. This site, which was excavated by a team from the Yunnan Provincial Museum in 1989, is relatively unknown in the English literature. Temporal
span and How dated? Late Pleistocene or Early Holocene based on biochronology.
Hominins found at the site Adult cranial remains (Skull I-IV), adult and juvenile mandibular remains (Mandible I and II, respectively), teeth, a right partial femur and a left partial tibia belonging to at least five individuals have been found at the site. Skull I (male), which consists of the frontal and adjoining parietals, shows evidence of postmortem cultural modification in the form of two symmetrically-positioned holes that have been drilled into the left and right margins of the frontal bone. Skull II, which consists of parts of both parietals shows black and brown discoloration consistent with burning; the other two crania are more fragmentary. Archeological evidence found at the site A sizeable quantity of stone and bone artifacts have been recovered. Other traces of hominin activity include hearths, carbon particles, burnt bones and stones and red burnt clay. Repository: Yunnan Provincial Museum (original), Kunming. Key references: Geology and dating Wu XZ and Poirier 1995; Hominins As above; Archeology As above. (7/25/11) Paleoanthropology: Sites – East Asia and Pacific - China.

midfoot<ms> See foot. (7/5/11) Anatomy: Regional – Lower limb and limb girdle.


Mohui<ms> See Bubing Basin. (6/7/11) Paleoanthropology: Sites – South and Central - China.

Monte Poggiolo<ms> (Location 44°12′06″N, 11°57′00″E; Italy, etym. It. Ca’Belvedere di Monte Poggiolo = castle of Mount Poggiolo with a good view) History and general description More than 4000 chipped flints and other Oldowan or “pebble” industry artifacts were found by Alberto Antoniazzi in open air sand/gravel deposits at this site near Forli. Temporal span and How dated? The absence of faunal remains limits the dating methods that can be used, but the results of geomagnetic dating suggest that local geological sequences show reversed polarity, pointing to an age of >780 ka for the deposit and perhaps for the artifacts. Electron spin resonance spectroscopy dating applied to bleached quartz grains from various archeological levels at the site suggest a mean age of 1065±165 ka. Hominins found at the site None. Archeological evidence found at the site The artifacts, which were fashioned from flint pebbles, are said to include cores, flakes, choppers and chopping-tools. Flake-scars on some of the refits suggest that the pebbles were minimally worked. Key references: Geology, dating, and paleoenvironment Falguères 2003, Antoniazzi et al. 1996, Gagnepain et al. 1996; Hominins N/A; Archeology Milliken and Peretto 1996. (7/25/11) Paleoanthropology: Sites – Europe.

mtDNA<ms> Abbreviation of mitochondrial DNA. See mitochondrial DNA. (10/25/11) Genetics and Molecular Biology.


Nauwalabila<ms>(Location 36°06′25″S, 133°01′23″E, Arnhem Land, Australia; etym. the Gagadju (Arnhem Land Aboriginal) word for the site formerly known as “Lindner Site” after David Lindner, a long-time local resident) History and general description
This small rock shelter formed by a large inclined sandstone boulder is in the southern part of Deaf Adder Gorge in Kakadu National Park, Australia. Johan Kamminga and Harry Allen first formally recorded it in 1972 and Rhys Jones and Ian Johnson excavated it in 1981. The sedimentary sequence consists of c.2.5 m of grayish-yellow sand sitting above c.40 cm of sandstone rubble. Temporal span and How dated? Charcoal in the top 1.75 m of the deposit initially yielded 16 radiocarbon dates in the modern-27 ka BP range (uncalibrated), all in roughly appropriate stratigraphic order. Dates for deeper deposits, originally thought to have contained no datable charcoal, have been controversial. Roberts et al. (1994) reported two luminescence dates (53 ka BP and 60 ka BP, respectively) in association with stone tools in the rubble layer. These appeared to confirm purported archeological dates of similar age from another Arnhem Land site, Malakunanja, and all were all significantly older than the then generally accepted date of 45-50 ka BP for the initial human colonization of Australia. O’Connell and Allen (1998) argued that the basal rubble layer, including all associated dates and artifacts, was a secondary deposit, created by termite activity, which had shifted clasts of various sizes (including artifacts) downward relative to their initial points of deposition, making them appear older than they really were. Bird et al. (2002) reported >30 additional radiocarbon dates on microscopic charcoal. They interpreted these as confirming the initial Roberts-Jones dates for the rubble layer, but Allen & O’Connell (2003) showed that some of these new dates were based on chemically-altered charcoal and hence were unreliable. Dates on the remaining well preserved, newly reported charcoal samples were consistent with the proposition that the lower levels of the site had been disturbed by termite activity (see also O’Connell and Allen 2004). The maximum age of the deposit remains unclear, but it is probably less than 40 ka BP. Hominins found at the site None. Archeological evidence found at the site A large number of artifacts (c.30k), nearly all lithic, have been recovered from excavations at this site. They are most frequent at a depth of c.40 cm below modern ground surface. Specific types include dolerite flakes with evidence of edge grinding, igneous cobbles shaped for use as axe heads and pieces of red and yellow ochre. Faded pictographs are also present but they are presently un-dateable. Key references: Geology, dating, and paleoenvironment Allen and O’Connell 2003; Bird et al. 2002; O’Connell and Allen 1998, 2004; Roberts et al. 1994. Hominins N/A. Archeology Jones and Johnson 1985; Kamminga and Allen 1973. (7/28/11) Paleoanthropology: Sites – East Asia and Pacific.


Neanderthal phase of Man<ms> See Neanderthal phase hypothesis. (10/26/11) Paleoanthropology: Hypotheses and models.


Os peroneum (L. os = bone, as in osseus = bone or bone-like and Gk. perone = many-pointed object) The os peroneum is a sesamoid bone in the foot that forms within the tendon of the fibularis longus muscle (the old name of this muscle was peroneus longus, hence the name os peroneum) as it passes on the plantar aspect of the cuboid bone of the midfoot. Monkeys, gibbons, and modern humans (the incidence of an os peroneum in modern humans is c.95%; c.20% of them are ossified) usually have a large enough os peroneum for a facet to form on the lateral side of the plantar aspect of the cuboid, just proximal and lateral to the peroneal groove (for the tendon of fibularis longus) that marks the distal part of the plantar surface of the cuboid. It has been suggested that the os peroneum serves to lift the tendon of the peroneus longus out of the peroneal groove, thus changing its direction from one that passes parallel to the tarsometatarsal joint to one that crosses this joint. The extant great apes generally do not have an os peroneum and they maintain midfoot mobility by having the peroneus longus tendon running parallel to the tarsometatarsal joints. However, in other extant primates including modern humans, midfoot rigidity is achieved by having the peroneus longus tendon cross the tarsometatarsal joints, thus the contraction of peroneus longus and tension in the tendon helps to make these joints rigid during the stance phase of walking. It has been suggested that evidence of an os peroneum and/or the corresponding facet may be used as a proxy for the type of midfoot rigidity that is important during the propulsive phase of bipedal walking in hominins. This otherwise obscure pedal sesamoid bone has received attention recently with the discovery that the cuboid of ARA-VP-6/500, the holotype of Ardipithecus ramidus, has a facet for an os peroneum and researchers have proposed that it provides evidence of midfoot rigidity in that taxon (Lovejoy et al. 2009c). See also Ardipithecus ramidus, foot function (11/15/11) Anatomy: Lower limb – foot.


Paleosol (n.) (Gk palaios = ancient and L. solum = ground) A layered deposit consisting of ancient soils. Soils are not confined to sedimentary rocks; they can form from the deterioration of any type of bedrock (e.g., metamorphic, sedimentary, and igneous). Paleosols result from various soil-forming processes such as leaching and precipitation, oxidation and reduction, etc. that occurred at the time the soil was exposed on the Earth's surface. However, the conditions under which the soil formed could be very different from the modern conditions at that locality. The distinctive horizontal layers in paleosols (called soil horizons) are distinguished by one or more of the
following: soil structure, color, mineral content, and chemistry. The characteristics of a paleosol (e.g., color, horizon thickness, carbonate content) reflect the relative influence of various factors that can affect soil formation (e.g., climate, vegetation, relief, parent material, and time). Thus, the characteristics of paleosols can be used to reconstruct paleohabitats and even paleoclimates. For example, investigations of the physical features (e.g., color and grain size) and stable isotopic values (e.g., carbon and oxygen) of c. 4 Ma paleosols at Kanapoi, Kenya (Wynn 2000) have been used to reconstruct the paleohabitat of Australopithecus anamensis. See also soil, stable isotope. (7/25/11)

Earth Sciences: Terms.


Payre. (Location 44°44'12"N, 4°44'23"E, France; etym. Payre is the name of the locality; it is a toponymic term or in Fr. a "lieu-dit") History and general description. The site, which is a rock shelter formed from a collapsed cave, is located on the edge of a limestone plateau on the western bank of the Middle Rhône Valley in south-eastern France. It was discovered and first explored in the late 1940s and it has been systematically excavated since 1990 by a team led by M-H. Moncel. The opening of the karstic complex faces towards the south-east and is 60 m above the Payre River. The >5m thick stratigraphic sequence is divided into five main units (G at the bottom, F, E, D–C and B–A at the top), each of which is divided into sub-layers. The sequence lies on a stalagmitic floor (unit H) that has been dated to Oxygen Isotope Stage 8. Eight occupation levels were identified in units G, F, E and D–C. The abundance of the remains of Ursus speleus suggest that the animals most likely died during hibernation. Paleoenvironmental evidence suggests the main occupation levels (G, F, and D) were occupied during a temperate and humid interstadial phase. The faunal remains are consistent with the hunting of cervids, equids, and bovids; rhinoceros and elephants were more likely scavenged. Dispersed charcoals in each level and an ashy lens at the top of Unit Ga are consistent with the controlled use of fire. Temporal span and How dated? Uranium series, electron spin resonance and thermoluminescence dating suggest the sequence spans the period between c.300-140 ka (i.e., between OIS 8 and 5). Most of the hominin remains come from occupation levels in units G and F that are dated to the end of OIS 8 or beginning of OIS 7; the last occupation by hominins in unit D was either at the end of OIS 6 or at the beginning of OIS 5. Hominins found at the site. The fifteen hominin fossils (13 isolated teeth, and parietal and mandibular fragments) recovered between 1994 and 2010, most of them from unit G, have been assigned to Homo neanderthalensis. Archeology found at the site. The lithic assemblages from the site are consistent with the early Middle Palaeolithic. Most of the flint, which is the main raw material, comes from sources on the southern plateau that are 10-5 km away, but other sources are c.60 km to the south. Other raw materials include quartzite, quartz, basalt, and limestone. Discoids, which are common, were used as the source of flakes and large discoids were evidently used as bifacial tools. The main small flake tools are scrapers and points; thin retouch has not modified the shape of the flakes. Use-wear analysis suggests the points were used for scraping, piercing, and cutting; there is no evidence they were hafted. Key references: Geology, dating, and paleoenvironment. Moncel 2008, Valladas et
plafond (Fr. plafond = a ceiling or vaulted structure) This term has been co-opted by some in the orthopedic and paleoanthropological community to refer to the domed nature of the distal articular surface of the tibia that articulates with the superior surface of the body of the talus. The term plafond apparently has not been used to describe any other domed articular surface and the term tibial plafond does not appear in the Terminologia Anatomica. (6/5/12) Anatomy: Terminology.

Plasmodium See malaria, recent evolutionary history of modern human. (7/25/11) Evolution: Malaria.


Plasmodium reichenowi See malaria, recent evolutionary history of modern human. (7/25/11) Evolution: Malaria.

Pongidae In a paper entitled “Mr. Gray on Mammalia” J.E. Gray of the British Museum undertook some taxonomic housekeeping within the order Mammalia. (Gray, 1825). He made the point that the Orders introduced by Linnaeus were “merely a paraphrase of those proposed by Ray” (ibid, p. 337) and suggested the ways each mammalian order could be divided at the level of family, tribe, and subtribe. As part of this rationalization he introduced the family Pongidae. The family Pongidae always includes the three non-human great ape genera (i.e., Pongo, Gorilla and Pan) and it may also include the gibbons and siamangs. Morris Goodman (1963) was the first to suggest, on the basis of his study of serum albumin, that the evidence for gorillas and chimpanzees (Gorilla and Pan) being more closely related to modern humans than to orangutans (Pongo) was so convincing that gorillas and chimpanzees ought to join modern humans in the family Hominidae, thus leaving just the orangutan in Pongidae. Subsequently Groves (1986) suggested that Pongo should also be included in the Hominidae. Because...
most researchers now accept that it is desirable for taxa (at least above the species level) to coincide with monophyletic lineages or clades it is fast becoming conventional to include all of the great apes in the family Hominidae. (2/1/12) Paleoanthropology: Taxa.

Pont-de-Lavaud<ms>(Location 46°26'30"N and 1°36'9"E; France; etym. Fr. pont = bridge, so the literal translation of the site is Lavaud’s Bridge) History and general description The site is located beneath a terrace c.90-110 m above the present-day river Creuse (a tributary of the Loire) in the Eguzon-Chantôme commune in the Indre department in Central France. Pont-de-Lavaud, which is divided into upper and lower levels, comprises a thin bed composed of quartz pebbles and debris with small, embedded sand lenses. This bed includes evidence of cryoturbation (e.g., sorted circles, polygons, and inclusions). Excavations conducted between 1983 and 1995 uncovered Mode 1 artifacts, but no hominin remains were discovered at the site. Bones are scarce due to the acidity of the sediments; the only two bones recovered belonged to a horse. Temporal span and How dated? Electron spin resonance (ESR) dating on ten bleached quartz samples from Terrace 90-110m from different alluvial remnants resulted in an average age of 1.054±0.054 Ma. Hominins found at the site None. Archeological evidence found at site More than five thousand Mode 1 quartz artifacts were recovered from the upper level. They included pebble tools, unifacial choppers, bifacial chopping tools, pebbles broken on anvil stones, and retouched flakes. Two ‘pavements’ unearthed in the upper level of the site were comprised of blocks of vein quartz and well-rounded quartz pebbles, and outlined with lined-up blocks. There are scattered artifacts in the lower level, similar to those from the upper level. The paloenvironmental data indicate that the site, which is above latitude 45°N, was occupied by hominins only during warm and wet climate conditions. Key references: Geology, dating, and paleoenvironment Despriée and Gageonnet 2003, Falguères 2003, Voinchet et al. 2010, Messager et al. 2011; Hominins N/A; Archeology Despriée et al. 2006, 2009, 2011. (7/25/11) Paleoanthropology: Sites – Europe.


precession-forced climate change<ms> Precession (the “wobble” of the Earth's axis of rotation) is one of the three “rhythms,” or “cycles” that affect climate. Prior to 13 Ma, c.23 ka-long precessional cycles were the dominant influence (or force) on global climate and they have continued to influence climate since 3 Ma. Joordens et al. (2011) used strontium isotope ratios of lacustrine fossils to resolve precession-forced climate change in the Omo-Turkana Basin, thus significantly improving the age control of the hominin fossil occurrences within the basin. See also astronomical time scale, climate forcing. (11/10/11) Paleoclimate/Paleoenvironment: Reconstruction.

preferred foods<ms>Foods which organisms use in preference to other foods. Preferred foods are also usually selected and consumed out of proportion to their availability in the habitat (Marshall and Wrangham 2007). See also fallback foods. (7/28/11) Behavior: Diet – Terms.
**pressure flaking**<ms> One of the techniques used by knappers to **retouch** a stone artifact. It involves using another tool to concentrate pressure close to the edge of an artifact. For a long time the earliest evidence of pressure flaking was believed to have been the **Solutrean** technocomplex of the European Upper Paleolithic, but Mourre et al. (2010) suggest that it was used in the manufacture of c.74 ka-old bifacial points made from heat-treated silcrete that form part of the **Still Bay** technocomplex preserved at **Blombos Cave**, South Africa. See also **pyrotechnology**. (7/25/11) Archeology: Stone tools – Manufacturing techniques and terms.

**primate insectivory**<ms> Insects are consumed incidentally by many extant primates in the course of folivory or frugivory in addition to being targeted as prey by some primate taxa. The small body size and skeletal and dental morphology of the earliest primates suggest that they were insectivoruous, and the detection and capture of invertebrates and small vertebrates may have been selective pressures for the evolution of such basal primate characteristics as grasping hands and binocular vision (Cartmill 1992). Primates favor insects that are large-bodied, highly concentrated in time and space, or both; these typically include prey from the insect Orders Coleoptera (beetles and grubs), Isoptera (termites), Hymenoptera (ants, bees and wasps), Lepidoptera (butterflies and moths), and Orthoptera (grasshoppers and locusts) (McGrew 2001). Like other animal-source foods, insects can be high in protein and fat and provide a number of essential minerals and vitamins that are limited or absent in wild plants (Defoliart 1992, Hladik 1977). Many extant hominoid taxa including **Homo** (Bodenheimer 1951), **Pan** (McGrew 1992), **Gorilla** (Tutin and Fernandez 1992, Deblauwe et al. 2003), **Pongo** (Fox et al. 1999), and some Hyllobatidae (Elder 2009) practice insectivory. Chimpanzees and some orangutan populations employ tools such as chisels, probes, and wands to acquire social insects and honey (McGrew 1992, Sanz and Morgan 2009, Stanford et al. 2000, van Schaik et al. 2003). Insects and honey probably made some contribution to the diet of extinct hominins (McGrew 2001), particularly those living in seasonal mosaic or savanna environments with pronounced periods of food scarcity (Bogart and Pruetz 2011). Direct evidence for extinct hominin insectivory is limited to Backwell and d’Errico (2001, 2008) identifying wear patterns on 2.0-1.0 Ma bone and horn tools from southern African hominin sites that are consistent with being used to dig into termite mound soil. Consumption of termites or other insects may contribute to (but cannot fully account for) the strong C₄ signature detected in the remains of the southern African archaic hominins (Sponheimer et al. 2005, 2006) and of **Paranthropus boisei** (Cerling et al. 2011). See also **chimpanzee insectivory**, **digging sticks**. (2/29/12) Behavior: Diet.

**principal strain**<ms> See **strain gage**. (10/23/11) Functional morphology: Terms.

**protoconid cingulum**<ms> See **cingulum**, **protoconid**. (7/28/11) Teeth: Macrostructure.

**PT**<ms> Acronym for planum temporale. See **planum temporale**. (10/17/11) Nervous system – Terms.
Qiaojiayao (Location 33°59'34"N, 110°59'34"E, central China; etym. after the name of a local village) History and general description The site, 5 km southwest of Lushi township, is a quarry where local farmers extract loess-paleosol for brick manufacture. A team of researchers led by Huayu Lu recognized artifacts at this site in 2006 and more were recovered at the base of the exposed section in 2008. The 20 m thick deposit contains six loess units and five paleosols numbered from S1 at the top to S5 at the base; the artifacts are in situ in S5. Temporal span and How dated? Optically stimulated luminescence dating and magnetostratigraphy suggest that the loess deposit spans the interval between c.650 ka to 60 ka. The maximum and minimum ages for ten samples from the upper part of the sequence (down to S3) determined by optically stimulated luminescence dating are c.125 ka and c.62 ka, respectively. There is no evidence of the Matuyama-Brunhes boundary (i.e., c.0.78 Ma) in the loess-paleosol sequence and the researchers suggest the age of the artifacts in S5 is c.650-600 ka. Hominins found at the site None. Archeological evidence found at the site Several trenches were excavated and 880 quartzite artifacts were recovered. Of these more than 700 are either flake debris or broken flakes, c.100 are flakes and 18 are cores; there are also five manuports, one hammerstone and 11 retouched pieces (six scrapers, three choppers and a burin); the artifacts have been compared to those from Zhoukoudian Locality 1. Key references: Geology, dating, and paleoenvironment Lu et al. 1999, 2011; Hominins N/A; Archeology Pei 1955, Wang 2005, Lu et al. 2011. (7/25/11) Paleoanthropology: Sites – East Asia and Pacific: China.


radiator theory A hypothesis put forward by Dean Falk suggesting that any increase in brain size in early hominins beyond that seen in chimpanzees was constrained by the ability to cool the enlarging brain. Falk (1990) suggested that for hydrostatic reasons venous blood from the brain in bipedal hominins was channeled to the ‘vertebral plexus’ instead of the internal jugular vein (Falk and Conroy 1983). Falk suggested that the, “Hadar early hominids and robust australopithecines partly achieved this reorientation with a dramatically enlarged occipital/marginal sinus system” (Falk 1990, p. 333), whereas, “the gracile australopithecine through Homo lineage” (Falk 1990, p. 333) achieved the same result by increasing the incidence of cranial emissary veins. The radiator theory was predicated on, “the belief that basal gracile and basal robust australopithecines occupied distinct niches, with the former living in savanna mosaic habitats that were subject to hot temperatures and intense solar radiation during the day”. Falk claimed that because emissary veins were a means of cooling the brain they provided a release from these thermal constraints and allowed brain size to increase in Homo. There are several reasons why the radiator theory never gained traction. First, if the habitat of the “basal robust australopithecines” was cooler, then excess heat would not have been a constraint on an increase in the size of their brains. Second, the evidence for cranial emissary veins playing a significant cooling role was not compelling. Third, much of the underlying physiology (e.g., of cranial venous drainage and the influence of the upright posture on venous drainage) was confused. Fourth, the underlying vascular anatomy was also confused. Fifth other researchers were less impressed by the
paleontological evidence about the emissary venous system (e.g., no raw data were provided): the percentages were limited to data for the mastoid and the parietal emissary foramina and there was just one datum for Australopithecus afarensis. All in all, the model had only modest evidential support and it did not take into account that large brains are metabolically expensive to develop and maintain. It is unlikely that even if there was just one constraint on increasing brain size that any from it would release by itself result in a larger brain. The substantial energetic and other costs would have to have been offset by a substantial increase in Darwinian fitness. (7/28/11) Paleoanthropology: Hypotheses and Models.


rift valley Large scale (i.e., tens to hundreds of kms) elongated depression on the Earth’s surface created when faults (e.g., normal or strike slip) extend (i.e., pull apart) the Earth’s crust. Rift valleys are oriented approximately perpendicular to the direction of stress (e.g., an E-W extension on the Earth’s crust creates a rift valley oriented N-S). During normal faulting, a block of the Earth’s crust moves down with respect to the adjacent crust. The crust that moves down (and creates the rift valley floor) is called a graben (after the German for ‘ditch’, whereas the crust to which it was originally attached is called a horst (after the German for ‘thicket’); the steeply inclined boundary between the horst and the graben is called the rift scarp. Rift valleys can also be formed at bends in strike-slip faults (where blocks of crust move horizontally past each other) where left-right motion on the fault pulls the bend in the fault apart to create a depression. During the extension that results in rift valleys the Earth’s crust thins and the mantle beneath it moves closer to the Earth's surface and this is why volcanism is often associated with rift valleys. Large volumes of water can collect in rift valleys and may accumulate as rift lakes, the size of which is determined by the relative amounts of inflow, outflow, and evaporation. When rifting progresses to the point that continents separate, seawater can inundate the rift valley to create a seaway (e.g., Red Sea). Sediments laid down in rift valleys include: clastic debris from the rift scarp (that can form alluvial fans), river (i.e., fluvial) deposits, lake (i.e., lacustrine) sediments and volcanic ash or lava flows. Modern rift valleys include the East African Rift System, the majority of which is formed by extension as the African Plate moves westward and the Indian Plate moves eastward. Numerous hominin sites are found within the confines of the East African Rift system (e.g., the Turkana basin, Olduvai Gorge etc.). See also East African Rift System, fault, volcanism. (7/25/11) Earth Sciences: Terms.

Rightmire, G. Philip (1942—)<ms>Philip Rightmire was born in Boston, Massachusetts. He entered Harvard College earning his Bachelor’s degree in Anthropology in 1964. During his time as an undergraduate, Rightmire had the opportunity to work as a research assistant to Raymond Dart for three months at Makapansgat Limeworks in South Africa. He then moved to The University of
Wisconsin, Madison, to study with John Robinson and it was there he earned his MS in Human Biology in 1966 and his PhD in Human Biology in 1969 for a thesis entitled *Recent and subfossil human crania from southern Africa: a re-assessment by multivariate statistical techniques*. Apart from time in Sweden in 1973 and a Visiting Lectureship at The University of Cape Town in 1975-6, Rightmire spent his academic career at what was then called The State University of New York at Binghamton and which is now Binghamton University (BU) from 1969 onwards, finishing his career there as Distinguished Professor of Anthropology. During the 1970s and 1980s, Rightmire collaborated with Mary Leakey on the remains of *Homo erectus* from Olduvai Gorge and with Richard Leakey on fossils from the Turkana Basin. Rightmire’s research focused on the identification, origin, and dispersal of *H. erectus* and on the taxon that many considered superseded it, *Homo heidelbergensis*. His book, *The Evolution of Homo erectus*, traces the evolution of *H. erectus* and explains its paleobiology (Rightmire 1990). Since 2001 Rightmire has been a member of the research team at Dmanisi, Georgia, describing and analyzing many of the hominin fossils found at the site. In addition to his position at BU, he has also been a Research Associate in the Department of Human Evolutionary Biology in the Peabody Museum at Harvard University since 2009. (7/25/11) History: Biographies.

**saltation**<ms>See saltatory evolution. (6/7/11) Evolution: Terms.

**saltatory evolution**<ms>(L. saltare = to leap) Trends within evolution that proceed in leaps. Examples within hominin evolution are the apparent pulses of increase in endocranial volume that occur c.1.8 Ma and c.500 ka. See mode (7/25/11) Evolution: Terms.

**secondary altriciality**<ms> See altricial. (10/25/11) Growth and Development: Terms.

**sialic acid**<ms> See siglec. (10/25/11) Genetics and Molecular Biology.

**Sima de las Palomas del Cabezo Gordo**<ms>(Location 37°47'54"N 0°53'53"W, Spain, Murcia; etym. literally “Shaft of the Doves on the Large Hill”) The site, which is at the top of a 20 m deep karstic shaft in a marble massif overlooking the Mediterranean, comprises the remnants of sedimentary fill, most of which was removed by miners at the beginning of the 20th C. Annual excavations, which began in 1992, have uncovered three articulated hominin skeletons, two adults and one child, from about 2 m down in the sedimentary fill, as well as the remains of at least six other individuals plus faunal remains and artifacts. There are grounds for inferring that the hominins were covered with stones, perhaps to prevent scavenging by the hyenas and panthers represented among the fauna. Burnt horse and other bones are consistent with the consumption of roast meat. Temporal span and How dated? The results of uranium-series, optically stimulated luminescence, electron spin resonance and radiocarbon dating suggest the site was occupied between 60-40 ka. Hominins found at the site All of the hominins have been assigned to *Homo neanderthalensis*. The skeletons are the most complete Neanderthals to have been excavated in Europe since the 1970s; a female skeleton with an exceptionally well-preserved pelvis is 85% complete. Pollen analysis indicates more
humid environmental conditions than those of today. Deeper levels have been excavated recently in which porcupine mandibles have been found; optically stimulated luminescence sediment dating of these levels is underway. Archeology found at the site **Mousterian** artifacts. Key references: Geology, dating, and paleoenvironment Carrión et al. 2003, Walker et al. 2008, 2011; Hominins Walker et al. 2008, 2010, 2011a and b; Archeology Walker et al. 2008. (1/27/12) Paleoanthropology: Sites – Europe.

**Solana del Zamborino**<ms>(Location 37°39'N 3°11'W, Spain; etym. Sp. **solana** = solarium, so literally “Zamborino's solarium”) History and general description A fossil quarry located in the Guadix Basin part of the internally-drained Baza Basin near the town of Fonelas in Granada province. The >150 m stratigraphic sequence is dominated by fluvial sediments in the lower part and shallow lake margin sediments in the upper part. Excavations in the mid-1970s recovered many bones of large mammals plus several **bifaces** and other artifacts made of quartzite, quartz, and chert. The bifaces are among the oldest in Europe (after **Cueva Negra del Estrecho Rio Quipar**) and if the possible evidence of intentional burning is confirmed, it will be among the earliest evidence of fire in Europe. **Temporal span** and **How dated?** An age of 200 ka was assumed based on the quality of the Acheulean artifacts, but the first evidence of a paleolake in the Baza Basin is c.800 ka and sedimentation is estimated to have ceased at c.600 ka. Magnetostratigraphic evidence suggests that at Solana del Zamborino the Matuyama/Brunhes boundary is a few meters **below** the artifact horizon thus the age of the site is c.740 ka. The magnetostratigraphy at Cúllar Baza-1 a quarry 50 km to the east with similar micromammals (e.g., **Arvicola cantianus**) suggested that the Matuyama/Brunhes boundary was a few meters **above** the artifact horizon. **Hominins** found at the site None. **Archeology** found at the site Late Acheulean. Key references: Geology, dating, and paleoenvironment Botella et al. 1975, Scott and Gibert 2009; Hominins N/A; Archeology Botella et al. 1975. (7/25/11) Paleoanthropology: Sites – Europe.

**South Luo River**<ms>The South Luo River in central China rises in the mountains east of Lantian and flows eastward to where it joins the Huang (or Yellow) River. For the first c.250 km of its course it flows through several basins, from west to east they are the Luonan Basin, the Lushi Basin and Luoning Basin. Since 2006 field surveys in the first two basins have identified many clusters of Paleolithic artifacts on the surface (Wang 2005, Wang et al. 2008). In 2008 Lu and colleagues discovered an in **situ** source of artifacts within loess deposits in the second terrace of the South Luo River at Qiaojiayao in the Lushi Basin (Lu et al. 2011). See also **Luonan Basin**, **Lushi Basin** and **Qiaojiayao**. (7/25/11) Paleoanthropology: Sites – East Asia and Pacific: China.

**87Sr/86Sr**<ms> Strontium isotope ratios, which can be measured in rocks, animal apatite (bone and teeth) and carbonate (shells), soft tissue and plants, are direct indicators of the provenance of the material. Strontium has four isotopes; three of them, ⁸⁴Sr, ⁸⁶Sr and ⁸⁸Sr, are stable and one, ⁸⁷Sr, is a radiogenic isotope produced by decay of radioactive ⁸⁷Rb (rubidium). The ratio between two of the stable isotopes of strontium, ⁸⁷Sr and ⁸⁶Sr, is a characteristic of the rocks from which the strontium derives and the value of the ratio is determined by the concentration of ⁸⁷Rb and the age of the rocks. In general, old metamorphic bedrock has a high ⁸⁷Rb concentration and thus a high ⁸⁷Sr/⁸⁶Sr, while
young basaltic rocks have a low $^{87}$Rb concentration and thus a low $^{87}$Sr/$^{86}$Sr ratio. Rock weathering releases strontium into the water and soil, where it is incorporated into plants and animals and moves through the food web. In contrast to oxygen and carbon isotope ratios, strontium isotope ratios measured in plant and animal tissue are not subject to fractionation by temperature or by biological effects. Therefore, the $^{87}$Sr/$^{86}$Sr value measure in any of these tissues directly reflects the $^{87}$Sr/$^{86}$Sr value of the water or geological substrate where the organism lived at the time the tissue was being formed (for a review see Bentley 2006). A major application of strontium isotope ratios is strontium isotope stratigraphy in marine systems, where the well-documented temporal variation of seawater $^{87}$Sr/$^{86}$Sr ratios is used as a dating method (e.g., McArthur et al. 2001). Strontium isotope analysis is increasingly being applied in paleoanthropology to investigate diet, landscape use and migration patterns (e.g., Copeland et al. 2011) and to reconstruct paleosalinity of aquatic environments (e.g., Vonhof et al. 2003, Joordens et al. 2009). Strontium isotope ratios of lacustrine fossils have also been used to reconstruct high-resolution paleoclimate fluctuations related to rainfall distribution within the catchment area of large lake basins. Joordens et al. (2011) used this approach to resolve precession-forced climate change in the Omo-Turkana Basin, thus significantly improving the age control of the hominin fossil occurrences within the basin. Strontium isotope ratio analysis is more time-consuming and costly than stable isotope analysis, but its advantages, which include the absence of any temperature and biological isotope fractionation effects and its ability to reflect the provenance of an organism, make it a valuable tool in paleoanthropology. (11/10/11) Behavior: Diet - reconstruction.

**Staple foods**<ms> Marshall and Wrangham (2007) divide fallback foods into ‘staple’ and ‘filler’ foods. Staple foods refers to those fallback foods (e.g., foliage for gorillas) that are relatively patchily distributed yet they may make up 100% of an animal’s diet. See also fallback foods, filler foods. (7/28/11) Behavior: Diet – Terms.

**Step-heating**<ms> See KBS Tuff dating controversy. (10/24/11) Earth Sciences: Dating terms.

**Strontium/strontium ratios**<ms> See $^{87}$Sr/$^{86}$Sr. (11/10/11) Behavior: Diet - reconstruction.

**SWT**<ms> Abbreviation of Swartkrans (SW) and Transvaal Museum (T). It is the prefix used for fossils recovered from Swartkrans by the Swartkrans Paleanthropological Research Project. See Swartkrans; Swartkrans Paleanthropological Research Project. (6/6/12) Paleanthropology: Site prefixes.

**SWT/TC**<ms> Prefix for fossils recovered by the Swartkrans Paleanthropological Research Project from the Talus Cone Deposit (Sutton et al. 2009). See Swartkrans. (6/6/12) Paleanthropology: Site prefixes.

**SWT1/HR**<ms> Prefix for fossils recovered by the Swartkrans Paleanthropological Research Project from the Hanging Remnant part of Member 1 of the Swartkrans Formation (Pickering et al. 2012). See Swartkrans. (6/6/12) Paleanthropology: Site prefixes.
prefixes.


tectonic landscape model A landscape model that suggests there is a link between geomorphological processes (e.g., faulting and volcanism) and the suitability of the landscape for hominin occupation (King and Bailey 2006, Bailey et al. 2011, Reynolds et al. 2011). The tectonic landscape model (TLM) suggests that when underlying tectonic processes are continuously forming and rejuvenating normal and reversed faults this results in a suite of landscape features such as river terraces, uplifted flanks, down-dropped valleys with fertile sediments and wetlands, lava flows, cliffs, and river gorges. The landscape features and range of habitat conditions persist in close proximity for as long as the fault motion continues. These landscape features result in overall high levels of soil fertility, a rough topography that provides safety and tactical advantages for following game, and habitat heterogeneity (e.g., both wetter and drier zones that support different vegetation) all of which, the model posits, make the landscape attractive to occupation and use by hominins. According to the TLM the three basic habitat requirements for early hominins namely, a range of foods within foraging distance, relative safety from predation, and drinking water, are met by tectonically modified landscapes. The TLM provides an alternative to time-averaging as an explanation for the mosaic habitats seen at some sites (e.g., Middle Awash, Sterkfontein and Toros-Menalla) over longer timescales. The TLM also highlights physical topography as a selective agent in the evolution of hominin morphology and as major influence on the routes followed by hominins as they left Africa. (7/25/11) Paleoanthropology: Hypotheses and models.


tibial plafond plafond (which see). (7/25/11) Anatomy: Terminology.

Trinkaus, Erik (1948-) Erik Trinkaus was born in New Haven, CT and grew up in Stony Creek, CT. He attended the University of Wisconsin-Madison and received his BA in 1970 in Art History. Trinkaus attended the University of Pennsylvania from 1970 to 1975. He received his MA in Anthropology in 1973 with a thesis on the reconstruction and evolutionary significance of the Fontéchevade fossils and in 1975 Trinkaus was awarded his PhD for a thesis entitled A functional analysis of the Neandertal foot. In 1974 Trinkaus moved to Harvard University and then in 1983 he moved to The University of New Mexico where he remained until he moved to Washington University.
in 1997 where he is presently the Mary Tileston Hemenway Professor of Arts and Sciences. In 1986 and again in 1991 Trinkaus spent time teaching in France where he was the Professeur Associé du Centre National de la Recherche Scientifique in the Laboratoire d'Anthropologie, Université de Bordeaux I. Erik Trinkaus’ interest in the fossil evidence for the later phases of hominin evolution began during his doctoral thesis work on Neanderthal leg and foot remains, followed by his work with T. Dale Stewart on the remains of *Homo neanderthalensis* from Shanidar Cave, Iraq. Initially he focused on the foot, pelvis, and leg bones, but as part of his analysis of the Shanidar fossils he reviewed all of the hominin evidence from the Neanderthals; the fruits of his Shanidar-related research were summarized in *The Shanidar Neandertals* (1983). Other major research projects included the analysis of the *Lagar Velho 1* associated child’s skeleton found together with archeological evidence for the Upper Paleolithic in the Lapedo Gorge in Portugal, a large sample of early anatomically-modern human remains from Dolni Věstonice and Pavlov in southern Moravia, Czech Republic, and the early anatomically-modern human remains from Peštera cu Oase in Romania. Trinkaus’ more recent research has focused on fossil hominins from China (e.g., the early modern human *Tianyuandong* skeleton and the earlier remains from Zhirendong) and Spain (e.g., Neanderthals from the *Sima de las Palomas*). Trinkaus co-authored *The Neandertals: Changing the Image of Mankind* (1993). In 1996 he was elected a Member of the National Academy of Sciences.

*tuberculum dentale*<ms>(L. *tuberculum* = a small rounded projection and *dentale* from *dentales* = tooth) Christy Turner (Turner et al. 1991) and his students (Scott and Turner 1997) use the term *tuberculum dentale* for a bulge or cusp-like swelling (aka the lingual tuberculum at the base of the lingual surface of upper canine teeth. Central and lateral maxillary incisors also exhibit the trait in the form of a trefoil-shaped cusp situated on the lingual surface of the crown of maxillary or mandibular incisors. It replaces the prominence that is at the confluence of the marginal ridges and occurs at low frequencies in modern human populations (e.g., Stojanowski et al. 2011). Pedersen’s (1949) monograph on the dentition of the East Greenland Eskimo cites early German odontographies (Adloff 1908, de Terra 1905) as his source of information about the term and he remarks that de Terra (1905) provides a good review of the ‘older’ literature on the *tuberculum dentale*. In their summary review of dental morphology Türp and Alt (1998) suggest that maxillary canine variations from the norm most frequently concern the form of the lingual tuberculum (cingulum); they also cite Adloff (1908) and de Terra (1905). The *tuberculum dentale* is also known as the tuberculum molare or the talon cusp. A reduced expression of the *tuberculum dentale* in fossil hominins is referred to as a lingual basal tubercle (Kimbel and Delezene 2009).

*tuberculum molare*<ms> See *tuberculum dentale*. (7/28/11) Teeth: Macrostructure.

UC<ms>Prefix for fossils from the Upper Cave at Zhoukoudian (e.g., UC 101 and 103). See *Zhoukoudian Upper Cave*. (1/8/11) Paleoanthropology: Site prefixes.

Untermassfeld<ms>(Location 50°32’N, 10°25’E; Germany, etym. Ge. roughly translated as “the lower measured field”) History and general description Archeological site located
along the River Werra in the region of Thuringia, in central Germany. The site was discovered in 1978 and excavations were carried out annually until 1997 and recent analyses of the fluvial sediments at the site have confirmed that in addition to the faunal evidence there is evidence of hominin activity. **Hammerstones**, core-tools, and flakes made of **chert** show apparent **use-wear**. In addition to the archeological evidence the excavations resulted in an impressive quantity and diversity of fauna and there is evidence of direct percussion on some of the faunal remains. **Temporal span** and **How dated?** The faunal remains have been compared with those from better dated sites in the Werra Valley such as Heiligenberg and Donnersenberg. These results, plus the results of **geomagnetic** dating are consistent with the stratigraphic and archeological evidence suggesting the site was occupied c.1.07 Ma. **Hominins found at the site** None. **Archeological evidence found at the site** Cores, flakes, hammerstones, bone tools, and chopping tools dated to the Lower Pleistocene were found in the lower part of the Upper Fluviatile Sands of the Werra River Valley exposed at Untermassfeld. The chert used to manufacture these artifacts consisted of nodular chert from Lower Pleistocene and Pliocene gravels and tabular chert from the limestone rocks in the vicinity. There is evidence of flaking by continuous percussion, the sharp edges of flakes show use-wear traces and macro-edge wear and there is evidence of cut-marks. In addition, the smooth surface and visible luster on one pointed stone artifact are consistent with thermal alteration, which suggests direct interaction with either natural or controlled fire. Excavation of the Upper Fluviatile Sands recovered a rich fauna that samples 43 mammalian species; researchers have suggested that Untermassfeld may be evidence of either hunting or intensive scavenging. Untermassfeld provides further evidence that hominins were present for at least brief periods in northern Europe beginning in the Lower Pleistocene. Key references: Geology and dating Kahlke 2000; Hominins N/A; Archeology Landeck 2008. (7/28/11) Paleoanthropology: Sites – Europe.

**Upper Pubu**<ms>See Bubing Basin. (6/7/11) Paleoanthropology: Sites – East Asia and Pacific - China.

**Vallonet**<ms>(Location 45°09′N 6°05′E, France, Alpes Maritimes close to the Italian border; etym. Named after its location) **History and general description** This Early Pleistocene cave site on the Mediterranean coast of France is one of the few European sites older than 0.5 Ma that documents hominin activity. In the 1960s lithic artifacts associated with faunal remains were recovered from a level that was inferred to be within the Jaramillo normal subchron (i.e., c.1.0 Ma). The faunal remains include a very rich late Villafranchian assemblage with one of the latest records in Europe of the giant hyena *Pachyrcocuta brevirostris* and examples of a vole *Allophaiomys labocati* that is more evolved than *A. ruffoi*. **Temporal span** and **How dated?** Biochronology and magnetostratigraphy. **Hominins found at the site** None. **Archeological evidence found at the site** The artifacts are **Oldowan**; there are also remains of large mammals. Key references: Geology, dating, and paleoenvironment de Lumley et al. 1988, Moullé et al. 2004, 2005; Hominins N/A; Archeology de Lumley 2010. (7/28/11) Paleoanthropology: Sites – Europe.
Vallparadís (Location 41°56’59’’N, 2°01’90’’E, Spain; etym. Sp. *Vallparadís* = Paradise Valley – the name of a watercourse that crosses the city of Terrassa, located some 20 km north of Barcelona. It is one of the rivers that drains the waters of the Catalan pre-littoral mountain range into the Vallès area towards the Llobregat River to the south of the city of Barcelona) History and general description The presence of Pleistocene macrovertebrates in deposits along the banks of the Vallparadís River had been documented since the end of the 19th C. In 1997, during rescue excavations at Vallparadís, at least 100 m of section was exposed at the locality known as Cal Guardiola. The results of geomagnetic dating suggested that the stratigraphic sequence containing the paleontological evidence (see above) predates the Matuyama-Brunhes boundary (i.e., it is >0.78 Ma), a finding that was consistent with the biochronological evidence. Between 2005 and 2007 further rescue excavations were carried out by Joan García and Kenneth Martínez and these authors have continued to excavate at a locality on the left bank of the river across from the previously excavated Cal Guardiola, since 2007. These latter excavations have exposed a >20 m sequence that included 12 alluvial/colluvial stratigraphic units. Temporal span and How dated? Localities at Vallparadís correspond to the pre-Jaramillo subchron (i.e., >1.07-0.99 Ma) and the early Middle Pleistocene (i.e., c.0.78 Ma). The overall age of the sequences at the Vallparadís localities has been investigated using geomagnetic dating and biochronology based on micro- and macrofauna. The richest level excavated at the new locality on the left bank of the river is archeological level 10 (stratigraphic unit 7), and electron spin resonance and uranium-series dating of horse teeth and quartz grains suggest that archeological level 10 (stratigraphic unit 7) has a weighted mean age of 0.83+0.13 Ma. Hominins found at the site None. Archeological and paleontological evidence found at the site More than 24 thousand macrofaunal fossils and more than 30 thousand artifacts have been recovered from the excavations since 2005. The lithic evidence from level 10 has been described as Oldowan or Mode 1. The tools, which are mostly small and made of locally available raw materials (in particular quartz, but also lydite and flint), are predominantly made using bipolar knapping on an anvil and feature very little centripetal exploitation. There are abundant retouched and denticulate forms, notches and becs, in addition to the occasional large chopper. In addition, 12 of the non-human fossil bones (e.g., mandibles, vertebrae and upper limb bones of Hippopotamidae, Rhinocerontidae, Cervidae and Equidae) show evidence of deliberate fractures and cut-marks. Most of the macrofauna (e.g., Praemegaceros verticornis, Hippopotamites antiquus, Elephas antiquus, Panthera gombaszoegensis, Pachycrocuta brevirostris) and the microfauna (e.g., Mimomys savini, Ungaromys sp., Eliomys quercinus, Sciurus sp., and Iberomys huescarensis) come from the level dated to just above the Jaramillo subchron (1.07-0.99 Ma). There is a break in both the faunal and the archeological sequences above the Matuyama-Brunhes boundary. There is a change in the fauna (e.g., the appearance of Cervus elaphus, Equus cf. hydruntinus and Vulpes sp.) and the artifacts are more standardized and larger (there are more bifaces, but the collection still lacks the characteristics of an Acheulean assemblage). No artifacts were recovered from the Cal Guardiola locality. According to the geomagnetic and biochronological evidence the richest paleontological level (D2) at Cal Guardiola is between the Jaramillo subchron and the Matuyama-Brunhes boundary sequences (i.e., 1.07-0.99 to 0.78 Ma). Evidence about the paleoenvironment at Vallparadís-Cal Guardiola comes mainly from pollen recovered from level D2 at Cal
Guardiola and from unit 4 at Vallparadis. During D2 times the climate was subarid (e.g., *Chenopodiaceae*, *Lygeum*, and *Tamarix*) and warm (e.g., *Quercus* type *ilex-coccifera* and *Olea-Phillyrea*). Only 12% of the pollen was arboreal pollen, of which 1% was characteristic of riverbank tree species, which suggests a temperate, Mediterranean climate, with seasonal rainfall. The palynological analysis of unit 4 suggests that 60% of the pollen are arboreal; this indicates the climate at this time was cool and humid with the landscape dominated by coniferous (*Pinus*) and deciduous (*Quercus ilex-coccifera*) forest species. The evidence from Vallparadis-Cal Guardiola, which chronologically falls between the Fuente Nueva 3 and Barranco León 5 sites at Orce and the sites of Sima del Elefante and Gran Dolina TD6 at Atapuerca suggests that the Iberian peninsula was intermittently occupied by hominins from 1.4-1.3 Ma until c.0.78 Ma. However, the some of the interpretations of Martínez et al. (2010) and García et al. (2011) have been challenged by Madurell-Malapeira et al. (2012).


VENs<ms>Acronym for von Economo neurons (*which see*). (10/25/11) Nervous System: Microstructure.

voxel<ms> See computed tomography. (10/24/11) Morphometry: Data capture - terms.

vertebral profile<ms> See vertebral number. (6/7/11) Anatomy: Regional – axial skeleton.

Wuyun<ms>See Bubing Basin. (6/7/11) Paleoanthropology: Sites – East Asia and Pacific - China.


Zeeland Ridges hominin<ms>Site Zeeland Ridges. Date of discovery 2001. Finder The Zeeland Ridges hominin was recognized and recovered from a commercial sieving operation by Luc Anthonis. Circumstances The sieve is owned by an extraction company that dredges the North Sea for shells that are used for insulation or to make pavements. The dredgings that included the hominin came from the floor of the North Sea in the region of the Zeeland Ridges (i.e., <15 km from the coast of Zeeland in the Netherlands). Two Pleistocene faunas are known to come from the dredgings; it is surmised that the hominin came from the younger Late Pleistocene fauna that includes *Mammuthus primigenius*, *Coelodonta antiquitatis*, *Panthera leo*, and *Crocuta crocuta*. The sievings also contained small handaxes and Levallois flakes consistent with the Middle Paleolithic. Geological age Late Pleistocene. Developmental age Possibly young adult. Presumed sex Probably male based on its size. Brief anatomical description Approximately the lateral three-quarters of the right side of a frontal bone. The results of a comparative 3D geometric morphometric analysis are strongly suggestive that the Zeeland hominin samples *Homo neanderthalensis*. Announcement Hublin et al. 2009. Initial description, photographs/line drawings, metrical data and detailed anatomical

**Zhoukoudian Tianyuandong** (周口店田园洞) (Location 39°39'28"N, 115°52'17"E, 174.5 m above sea level, China, Fangshan, near Beijing; etym. Literally “Tianyuan Cave” in northern China; etym. ‘Tianyuan Cave’) History and general description Tianyuandong, or Locality 27, is located about 6 km southwest of Zhoukoudian Locality 1 and 50 km southwest of Beijing Municipality. This small (6 - 7 m wide and 6 m deep) karstic cave, which is close to the surface, was formed within Precambrian carbonatite; the karstic activity is ongoing. It was discovered in 2001 by the owners of the tree-farm on which it is situated. Faunal remains and part of a hominin skeleton were removed by the owners. Systematic excavations under the direction of Haowen Tong were carried out by the Institute of Vertebrate Paleontology and Paleoanthropology (or IVPP) in 2003 and 2004. The sediments vary in thickness within the cave. The hominin skeleton came from deep within the cave. Four layers, I to IV from top to bottom, were recognized. All of the hominin remains recovered in situ during the course of the excavation come from Layer III; the non-hominin fauna, which is dominated by deer, comes from Layers I and III. Temporal span and How dated? Uranium-series dates were inconclusive. AMS calibrated radiocarbon ages on the Layer III fauna point to an age spread of 44-34.5 ka, and a single AMS calibrated radiocarbon age from a fragment of the hominin skeleton is 40,328±816 cal BP (i.e., OIS 3). This makes Zhoukoudian Tianyuandong coeval with **Niah Cave** and the oldest securely-dated Homo sapiens site in mainland East Asia. Hominins found at the site The remains include a partial mandible with I₁-M₂, an upper molar, a right M₃, an axis (C₂), two sternal segments, both scapulae, both humeri, an ulna, a radius, three carpals, five manual phalanges, both femora and tibiae, a distal fibula, a talus, a calcaneus, four metatarsals, and two pedal phalanges. The exposure of dentine on all dental occlusal surfaces suggests an advanced age and recent stable isotopic analyses suggest the Zhoukoudian Tianyuandong hominins consumed freshwater fish. Sex is indeterminate. Archeological evidence found at the site No artifacts. There are abundant animal bone fragments in the cave, but it is not clear how they are related to the hominin skeletal remains. Repository Institute of Vertebrate Paleontology and Paleoanthropology, Beijing. Key references: Geology and dating Shang et al. 2007; Hominins Shang et al. 2007; Hu et al. 2009; Archeology None. (7/28/11) Paleoanthropology: Sites – East Asia and Pacific - China.

**Ziyang** (资阳) (Location 30°07'23"N, 104°38'15"E in southwestern China; etym. named after the nearby city) History and general description The site is located just west of Ziyang City, Sichuan Province. During the construction of a railway bridge across the Jiuquhe River in 1951 workers discovered a cache of mammalian fossils on the southern river bank. A team led by Pei Wen Zhong conducted test excavations and identified four stratigraphic layers; the hominin fossils were inferred to be from layer 3. Additional fossil and cultural evidence was recovered from a pit c.100 m west of the fossil site in 1981;
seven stratigraphic layers have been identified at this second locality. The original locality is now referred to as the Ziyang Man Locality and the second locality is called Locality B; lithostratigraphic evidence suggests both localities are situated on the same river terrace. Temporal span and How dated? The localities have been dated using **biostratigraphy** and conventional **radiocarbon dating**, but accuracy is limited by the lack of clear provenance data. Early radiocarbon dates on wood samples from the Ziyang Man Locality suggest a mean age well under 10,000 BP, which contradicts the biostratigraphic evidence that suggests a Late Pleistocene age. Wood samples collected from Locality B, however, produce dates of 37,400±3,000 BP and 39,300±2,500 BP. **Hominins found at the site** A presumed female the Ziyang hominin (PA 57) consists of a small calvaria with a nearly complete vault and most of the base on the left side (including the mastoid, the external auditory meatus, the petrous pyramid, the mandibular fossa, and the greater wing of the sphenoid) plus the lower part of the maxillae including the horizontal plate of the palatine bones. The only tooth preserved is the right P₄. The three molars on the left were lost antemortem; all the other upper teeth were lost after death. **Archeological evidence found at the site** A single bone awl was recovered from the Ziyang Man Locality. More than one hundred and fifty artifacts (choppers, scrapers, and a few points) were recovered from Locality B; most are large and crude and show evidence of retouch. **Repository** Institute of Vertebrate Paleontology and Paleoanthropology, Beijing. Key references: Monograph by Pei and Woo (1957); **Geology and dating** Woo 1958, Wu RK and Olsen 1985; **Hominins** Woo 1958, Wu RK and Olsen 1985, Wu XZ and Poirier 1995; **Archeology** Woo 1958, Li XM and Zhang SS 1984. (7/28/11) Paleoanthropology: Sites – East Asia and Pacific - China.