5TH ANNUAL MEETING OF THE

European Society for the study of Human Evolution

10–12 SEPTEMBER 2015
LONDON / UK

ESHE

European Society for the study of Human Evolution (ESHE)

5th Annual Meeting

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Proceedings of the European Society for the study of Human Evolution 4

Cover image: Artefact and skull fragment from the site of Swanscombe, UK.

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Dear Participants of the 5th annual meeting of the *European Society for the study of Human Evolution,*

Welcome to London!

We are very pleased to welcome you to London, a world cultural capital and the town of major universities. Once the heart of an empire, London is the world's most-visited city and its attractions are innumerable. Historically, the town played a critical role in the development of Palaeolithic archeology and human palaeontology. After seeing the collections of stone artefacts discovered by Boucher de Perthes in the terraces of the River Somme, the British palaeontologist Hugh Falconer encouraged Joseph Prestwich and John Evans to visit the French amateur and his sites in 1859. The report written in the *Proceedings of the Royal Society* by Prestwich after his trip to France can be considered as the birth date of Palaeolithic archeology. London has always been seminal throughout the progression of human evolutionary studies and and while the British Museum holds some of the world's most famous cultural relics, the *Natural History Museum* curates some of the most spectacular fossil hominin specimens. Both welcome scientists from all over the world coming to study their collections.

This year's excursion will reconnect us with the illustrious past of the discipline with the visit to *Down House*, where Charles Darwin wrote "On the Origin of Species" and the visit to the Acheulean site of *Swanscombe* that yielded three fragments of an early Neandertal skull in 1935, 1936 and 1955.

At the time of our 5th annual meeting, the society's membership includes more than 420 individuals and the number of submissions for presentations at our annual meetings continues to grow, which imposes on us a strict selection process and requires difficult choices in terms of scheduling. This year the ESHE conference will take place at the *British Museum*, Great Russell Street, London. The closing party on Saturday evening will be hosted at the *Natural History Museum*, Cromwell Road, London.

In order to support the participation of students presenting posters or papers, the society has offered 11 travel grants to the London meeting. In addition, for the third year in a row, the society will offer a poster prize to the most outstanding poster or posters presented by a student.

During our general assembly an important issue will be to vote for the renewal of the board. As per the statutes of the society, the ESHE board must be re-elected every two years. All members of the society are able to vote.

We are very grateful to our 2015 local organizers in London, Nick Ashton, Louise Humphrey, Chris Stringer and Josephine Mills, who have very efficiently organized the logistics of the meeting, closing party and the wonderful excursion.

The 2015 ESHE meeting is sponsored by the *British Museum* and the *Natural History Museum* as well as the journals *PLoS ONE*, *Journal of Human Evolution, Science Translational Medicine* and *Science*, in addition to *Beta Analytic* and the *Human Origins Research Fund*.

The preparation of the meeting and the publication of our abstract volume have been made possible by the endless work of the ESHE Board Officers and Board Members and in particular by Alyson Reid, Philipp Gunz, Shannon McPherron, Wil Roebroeks, Marie Soressi and Thomas Terberger.

In 2016, the meeting of the European Society for the study of Human Evolution will take place in Alcalá de Henares, near Madrid, a hotspot of European palaeoanthropological studies.

With best wishes,
Jean-Jacques Hublin
President, *European Society for the study of Human Evolution*

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The British Museum

The British Museum was founded by Act of Parliament on 7 June 1753 based on the collections of the physician, naturalist and collector, Sir Hans Sloane (1660–1753). Sloane had collected more than 71,000 objects which he bequeathed to King George II for the nation in return for a payment of £20,000 to his heirs. The collections consisted of books, manuscripts and natural specimens with some antiquities and ethnographic material. To this was added the 'Old Royal Library' and with it the privilege of copyright receipt.

When the British Museum opened its doors to the public on 15 January 1759 it was the first national public museum in the world. It was initially housed in Montagu House, a seventeenth-century mansion, formerly belonging to the Dukes of Bedford. Entry was free and given to 'all studious and curious persons'. With the exception of the World Wars, the Museum has remained open ever since, gradually increasing its attendance of 5,000 per year to nearly 6 million visitors today.

Montague House

The first years of the 19th century saw some significant additions to the collections, including the Rosetta Stone in 1802, the Townley collection of classical sculpture in 1805 and the Parthenon sculptures in 1816. With the gift by George IV of the King's Library in 1823, a new building was designed by Sir Robert Smirke (1780–1867) which forms the museum that we know today. By 1857, both the quadrangular building and the round Reading Room had been constructed, the latter designed by his brother Sydney. The Reading Room, which housed many of the books of the British Library, has had many famous readers including Karl Marx, Vladimir Lenin, George Orwell and Mahatma Ghandi.

With the new building the Museum expanded enormously with excavations abroad bringing back new large collections. A key figure during this period was Sir Augustus Wollaston Franks (1826–97). Appointed to the Museum in 1851, he expanded the collection in new directions, with British and medieval antiquities, prehistoric, ethnographic and archaeological material from Europe and beyond as well as oriental objects and art.

To make more room for the increasing collections held by the Museum, the natural history collections were moved to a new building in South Kensington in the 1880s, which became the Natural History Museum.

The 20th century saw an expansion in the Museum's public service through lectures, improved galleries and a series of guides on the collections and by the 1970s there was an education service and dedicated publishing company. In 1973 the library became part of a new organisation, the British Library, which remained at the Museum until 1997, when the books left Bloomsbury for a new building at St Pancras.

The Great Court, designed by Sir Norman Foster, was built in the space vacated by the library with the restored Reading Room at its centre. Being two acres in size, it is the largest covered public space in Europe. Until recently it was used for special exhibitions. The latest development is the World Conservation and Exhibition Centre in the north-west corner of the Museum, providing large underground storage areas, dedicated conservation laboratories and a 1000 m2 exhibition area, which opened in 2014.

Rosetta Stone

The British Museum Palaeolithic Collections

The British Museum houses one of the world's most important Palaeolithic collections with several million objects from Africa, Asia, Europe and the Americas. The British collections illustrate the birth of the subject from the 1850s with historically important material from many of the earliest collectors. Amongst these the Grays Inn Road handaxe was found in 1690 by John Conyers, an apothecary, in association with elephant bones attributed to the Roman invasion by Claudius. A more remarkable insight was provided by John Frere at Hoxne, who in 1797 described a series of handaxes in a letter to the Society of Antiquaries as '...weapons of war, fabricated and used by a people who had not the use of metals... the situation in which these weapons were found may tempt us to refer them to a very remote period indeed; even beyond that of the present world'.

Hoxne handaxe

Olduvai Gorge handaxe (Leakey Collection)

To the many British sites were added collections from the earliest work in France, particularly from the Somme Valley and the caves of the Dordogne. Foremost amongst these was the donation in 1868 of the Christy Collection from the work of Edouard Lartet and Henry Christy from sites such as Le Moustier, Laugerie Basse and La Madeleine. Together with the stone, bone and antler tools, their sites also produced Upper Palaeolithic mobile art. The art was also donated, which together with the collections of the Vicomte de Lastic Saint-Jal from Courbet in 1864 and those from Peccadeau de l'Isle from Montastruc in 1887, forms one of the most important collections around the globe.

Beyond Europe, the African collections include the early assemblage of Louis Leakey from Olduvai Gorge and sites such as Gambles Cave (Kenya), Kalambo Falls (Zambia) and Bambata Cave (Zimbabwe). Excavated assemblages such as Tabun cave (Israel), Ksar Akil (Lebanon) and Azraq (Jordan) are held in the Near Eastern section.

In more recent years new collections have been added from British fieldwork, including the excavations by John Waechter at Swanscombe, John Wymer at Hoxne and the English Heritage-funded work at Boxgrove. The Museum has also led its own excavations at High Lodge, Barnham and Elveden. Over the last 15 years the Museum has been a key partner with the Natural History Museum, Queen Mary University of London, UCL and many other institutions in the Ancient Human Occupation of Britain project, funded by the Leverhulme Trust, and in the last few years the Pathways to Ancient Britain project funded by the Calleva Foundation. These projects have involved fieldwork at the sites of Lynford, Pakefield and Happisburgh.

Swimming reindeer. Courbet, France

The Natural History Museum

in South Kensington is home to more than 80 million life and earth science specimens within five main collections: botany, entomology and zoology (in the Department of Life Sciences) and mineralogy and palaeontology (in the Department of Earth Sciences). The Museum is a world-renowned centre of research specialising in taxonomy, identification and conservation. Given the age of the institution, many of the collections have great historical as well as scientific value, such as specimens collected by Charles Darwin. The Museum is particularly famous for its exhibition of dinosaur skeletons and ornate architecture—sometimes dubbed a cathedral of nature—both exemplified by the large *Diplodocus* cast which dominates the vaulted central hall (now called the Hintze Hall).

Hintze Hall, The Natural History Museum, London

The Natural History Museum (NHM) houses collections of global importance for which its stated purpose is both 'to conserve, curate and enhance national collections... [and] to further research the collections'. What are now the NHM collections began life as part of the collections of Hans Sloane. Sloane was one of the leading physicians of his day and served as president of both the College of Physicians and the Royal Society; he was also a passionate and prolific collector, particularly of natural history specimens. After Sloane's death in 1753, his collection was bought for the nation by Parliament for a then enormous sum, which was raised by public lottery. The Sloane collection formed the majority of the founding collection of the British Museum, which was established by an Act of Parliament in 1753. The British Museum opened first in Montagu House, near Bloomsbury Square, and then moved to the current (British Museum) site from 1827.

Arriving at the British Museum in 1856, the new Superintendent of Natural History, Richard Owen, was dismayed by the conditions in which the collections were housed and he began a campaign to set up a separate museum to house the natural history specimens. He was eventually successful and the British Museum (Natural History) [henceforth BM(NH)] became physically independent from the British Museum proper when the natural history collections were moved to the current South Kensington site. Building work in South Kensington started in 1873 and Alfred Waterhouse's new building opened in 1881; it is the oldest and most famous part of the current NHM. The palaeontology (including anthropology) collections are housed in an additional building opened in 1977. The two Darwin Centre buildings are further additions, partly designed as modern facilities for storing and exhibiting the valuable collections. The BM(NH) only became formally independent of the British Museum in 1963, when it was declared so by an Act of Parliament (BM(NH), 1977) and, having been referred to colloquially as the Natural History Museum for many years, in 1992 this name was finally made official.

The spectacular Hintze Hall of the Museum will host the ESHE closing party. With its cathedral-like structure, frescoes and sculptures, Hintze Hall forms a fantastic backdrop to some of the highlights of the Museum's collection including a *Diplodocus* replica skeleton and a 1,300-year-old giant sequoia. Charles Darwin's famous statue sits at the top of the hall's grand staircase, with the recently-added Alfred Russel Wallace portrait nearby.

Science at the Natural History Museum

The Natural History Museum, London

The Natural History Museum has been generating and sharing knowledge about the natural world for more than 250 years and is a world leader in research on the burning issues facing humans and the natural world. Through its collections and scientific expertise, the Museum is working with many organisations to inspire an understanding of the natural world and to conserve its extraordinary richness and diversity, with ground-breaking projects in 70 countries.

Natural History Museum science explores natural diversity, the Earth itself, what organisms exist and how they interact, where they are and how diversity changes and develops. More than 300 scientists work at the Museum, tackling a diverse range of global problems that threaten the Earth's biodiversity, such as the maintenance of delicate ecosystems and the impacts of environmental pollution and tackling human diseases. At the heart of its research is the description and classification of organisms and natural objects and the study of their interrelationships. This international collection of more than 80 million specimens – from meteorites and dinosaur fossils to Darwin's finches and the Thames whale – is vital to this research and is growing constantly.

The Museum is an internationally renowned scientific infrastructure used by 5,000 scientists from all over the world. Scientists are able to use both our collections and our facilities to deliver research that has a global impact:

Collections – the Museum cares for one of the world's most important natural history collections, totalling over 80 million specimens from almost all known groups of animals, plants, minerals and fossils. They represent the natural variation within and between groups and are a window to both the past and the future. They can tell us how the world might have looked millions of years ago, and can help us understand the changing environment and its effect on the planet. The collections include a particularly high number of type specimens, the gold standard for species that were the first specimens to earn the species name. When new questions are asked about a species, scientists will refer to the type for answers.

Facilities – the Museum has comprehensive analytical, imaging and DNA-sequencing facilities that are used by both staff and visiting scientists. New purpose-built laboratories are well equipped with a wide range of modern, state-of-the-art instruments and are run by specialists experienced in preparing, analysing and interpreting a broad range of biological, mineralogical and material specimens. The Natural History Museum Library contains extensive books, journals, manuscripts and artwork collections linked to the work and research of the scientific departments.

Science in action

Museum scientists publish more than 500 research papers each year, reporting their findings from fieldwork and the laboratory, pushing forward the boundaries of human knowledge. They are involved in hundreds of projects in 70 countries around the world and are internationally renowned for their specialist expertise. Identification and information services are available for scientists and the public on a worldwide range of animals, plants, minerals and fossils. Our experts are consulted by government and a broad range of clients from mining companies and health authorities to customs officers and police forensic teams.

Human Origins

A number of Museum research projects concern human evolution and major changes in behaviour from the Pliocene through to the Holocene. This work is centred in the Human Origins Research Group within the Department of Earth Sciences, with research staff and associated workers such as Chris Stringer, Louise Humphrey, Silvia Bello, Mark Lewis, Ali Freyne, Simon Parfitt, Ros Wallduck, Brenna Hassett and Tim Compton. The related collections are looked after by Robert Kruszynski and Heather Bonney. Museum and Museum-based scientists have made important contributions to the *Ancient Human Occupation of Britain* and *Pathways to Ancient Britain* projects, which bring together archaeologists, palaeontologists and other earth scientists to build a calendar of the early human colonisations of Britain and continental Europe over the last million years. This work featured in the successful *Britain: one million years of the human story* exhibition at the Museum in 2014.

Following the Second World War, a consensus was reached among many British teaching establishments that a national museum was the best place to store human skeletal remains, which would be of more use as a single collection. This led to the donation to the NHM of thousands of anthropological and palaeoanthropological specimens from institutions such as the Royal College of Surgeons (RCS) and the University of Oxford. By the 1960s these donations necessitated new housing for the Anthropology collections and in 1977 the new sub-Department of Anthropology (previously created under the Deputy Keeper, Kenneth Oakley) was moved to the new East Wing extension of the Museum.

The importance of fossils in the NHM collections goes right back to Sloane's founding specimens, but the first fossil hominins to come to the NHM were probably the Upper Palaeolithic *H. sapiens* remains from Bruniquel, which were purchased on behalf of the Museum by Richard Owen in 1864. This was to be the beginning of a collection which has continued to expand into this century. Fossil hominins in the collection have been acquired in a variety of ways. Several of the NHM's most important hominin fossils (e.g. the Tabun Neanderthal remains, Skhul 9, and Forbes' Quarry) have come to the Museum from the RCS, while others were donations, such as the Broken Hill material, given by the owners of the mine where it was discovered in 1921. The most recent additions to the fossil collections are from excavations and surveys by Museum scientists and colleagues at sites such as Boxgrove and Gough's Cave. *Pathways to Ancient Britain* fieldwork at Happisburgh in Norfolk recently uncovered evidence of stone tools and the earliest known human footprints outside of Africa, dating to about 900,000 years ago.

There have been successive descriptions of the hominin fossil collections at the NHM over their long history. For example, the *Guide to the Department of Geology and Palaeontology* in the British Museum (Natural History), published by the Museum in 1890, described the display of fossil (or subfossil) human remains, including those from Kent's Cavern and Bruniquel. A little later the Museum published a more specific pamphlet, *A guide to the fossil remains of Man in the Department of Geology and Palaeontology* in the British Museum (Natural History), due to increased public interest in human fossils generated by the 'discovery' of the Piltdown remains. NHM specimens have also been covered by important international works on hominin fossils; the *Catalogue des Hommes Fossiles* by Vallois and Movius (1953) was the first comprehensive account of the fossils known at that time. In the catalogue, remains are divided by country and described by experts in each region. In the early 1970s, a team based at the NHM set out to revise the *Catalogue des Hommes Fossiles.* Oakley et al. produced the *Catalogue of Fossil Hominids* in three parts (I: Africa, II: Europe, III: Asia and the Americas, followed by a second African edition). Following Vallois and Movius' lead, for each fossil there is a summary of its discovery, anatomical description, geological deposit and stratigraphic information, age of the fossil, archaeological context, palaeontological context, bibliography and institution holding the fossils. Again, each geographical section was compiled by an expert, or experts, working in that region. This is still the most comprehensive and wide-ranging account of fossil hominin remains available. Although a global revision of the *Catalogue of Fossil Hominids* has not yet been attempted, smaller scale overviews for different groups of fossil hominins and updates for particular regions have been published, and more comprehensive works have included coverage of many of the NHM's specimens, of course.

This information was adapted from Natural History Museum sources, Wikipedia and Buck LT, Stringer CB (2015) A rich locality in South Kensington: the fossil hominin collection of the Natural History Museum, London. *Geological Journal*, doi: 10.1002/gj.2657, which contains a full bibliography.

Excursion Schedule

Coach departure is from Montague Place (North side of the British Museum)

The excursion will be split into two groups, the first visiting Swanscombe in the morning and Down House in the afternoon, and the second visiting Down House in the morning and Swanscombe in the afternoon. Expected arrival in London is 17:00 but there may be delays due to heavy traffic, so please do not rely on this arrival time for onward travel.

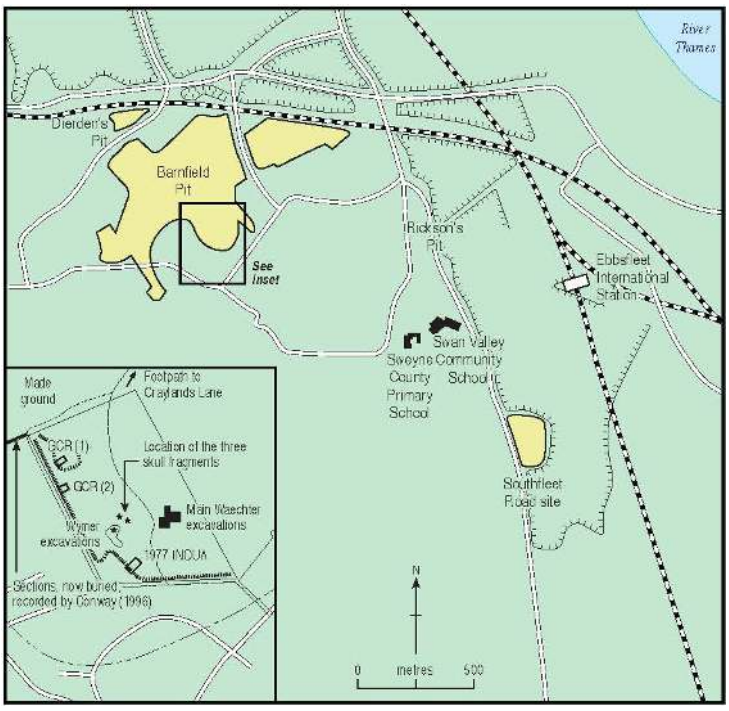
Group 1	
9:00 - 10:00	Travel from London to Swanscombe
10:00 - 12:00	Tour of Swanscombe
12:00 - 13:00	Lunch at George and Dragon Pub
13:00 - 14:00	Travel to Down House
14:00 - 16:00	Visit Down House
16:00 - 17:00	Travel back to London

Group 2	
9:00 - 10:00	Travel from London to Down House
10:00 - 12:00	Visit Down House
12:00 - 13:00	Travel to Swanscombe
13:00 - 14:00	Lunch at George and Dragon Pub
14:00 - 16:00	Tour of Swanscombe
16:00 - 17:00	Travel back to London

Barnfield Pit, Swanscombe, UK

Nick Ashton[1], David Bridgland[2] & Chris Stringer[3]

[1] Department of Britain, Europe & Prehistory, British Museum, London
[2] Department of Geography, Durham University, Durham,
[3] Department of Earth Sciences, Natural History Museum, London



Swanscombe Map

The sand and gravel pits at Swanscombe have attracted archaeological and geological research since the 19th century. Many of the pits were subsequently deepened and obliterated as a result of chalk extraction for the cement industry. The area is mapped as Boyn Hill Gravel and in the Swanscombe area consists of a deep series of gravels, sands and silts. The Boyn Hill Gravel has been attributed to MIS 12-10, with the fossiliferous deposits at Swanscombe assigned to the Hoxnian Interglacial of MIS 11 [1, 2].

The most important of the sites was Barnfield Pit which has been the subject of various excavations, from Smith & Dewey in 1911-12 to those of the Wymers in the 1950s, and by Waechter from 1968-72 [3-6]. Other sites have also contributed to our understanding of the area, including Dierden's Pit, which lies about 500m to the north-west of Barnfield Pit and has an unparalleled palaeoecological and biostratigraphical record [7-8]. More recently, as part of the development for the high-speed railway to the Channel Tunnel, an elephant butchery site was discovered and excavated at Southfleet Road, c. 1 km to the south-east, associated with a non-handaxe assemblage [9].

Geology

The deposits at Barnfield Pit can be divided into three phases. Phase I sediments occur within a palaeochannel and consist primarily of the Lower Gravel and the Lower Loam. The Lower Gravel is a bedded sandy medium–coarse gravel, fining upwards to shelly sands and fine gravels. The Lower Loam, which is the infilling of a narrower channel cut into the top of the Lower Gravel, comprises horizontally bedded clayey sands with thin lenses of shelly sand and evidence for channel cuts and fills. Vertical changes in the lithology, together with knapping scatters and surfaces with animal footprints, suggest intermittent sedimentation and drying out, perhaps in keeping with interpretation as an overbank deposit. It is the Phase I deposits that have produced the non-handaxe or 'Clactonian' industry.

The Lower Middle Gravel and Upper Middle Gravel of Phase II are considerably more widespread than the Phase I deposits. The Lower Middle Gravel consists of up to 2.5 m of medium–coarse sandy gravel, with a coarser lag deposit at the base, whereas the more variable Upper Middle Gravel is generally much finer, typically consisting of cross-bedded and ripple-laminated sands with thin gravels and silty clays. The Middle Gravels as a whole can perhaps be interpreted as a typical upward-fining fluvial sequence, although an erosional contact has been observed between the two members [5]. Phase II deposits have produced the very large handaxe assemblage together with the Swanscombe skull.

The Phase III deposits consist of the solifluction of the Upper Sand, deposited under cold conditions. The Upper Loam, in contrast, has been likened, from its sedimentological characteristics, to an estuarine deposit, which would imply a warm climate and high sea level. Unfortunately it and the uppermost Swanscombe sediments in general, are oxidized and decalcified and have therefore produced no faunal evidence to corroborate or deny the sedimentological interpretation. The final widespread deposit at Swanscombe, the Upper Gravel, is interpreted as soliflucted overburden, consisting of fine–medium gravel in a sandy clay matrix. A highly localized 'Higher Loam' has also been recorded to the south-west part of the site, which is a horizontally bedded clayey sand with scattered pebbles, perhaps a slopewash deposit.

Palaeontology

The various exposures at Swanscombe have yielded a variety of important fossil assemblages, notably vertebrates, molluscs and ostracods. These have been central to the development of biostratigraphical schemes and the correlation of the Swanscombe sequence with other Hoxnian localities, especially given that pollen is so poorly preserved at Swanscombe.

The most recent palaeontological research at Swanscombe has focused on non-marine mollusc and ostracod successions from Dierden's Pit. New analysis of samples taken in 1975 has helped correlate the site with the Barnfield Pit sequence, but also establish the pattern of fluctuating sea level during the interglacial [8,10]. Of particular note is the succession of new taxa from Europe called the 'Rhenish' fauna with species such as Theodoxus danubialis, Belgrandia marginata and Pisidium clessini, some of which first appear at the top of the Lower Loam. This must indicate a confluence of the Thames and Rhine at this time. The temperate-nature of the molluscs is at apparent odds with a lower sea level. However, a land-link could be established through only slight lowering because the floor of the North Sea Basin was much higher than it is today and has since progressively subsided [11]. The first appearance of brackish-water molluscs and ostracods at the top of the Lower Middle Gravel suggests a rise in sea-level at this stage. In the Upper Middle Gravel there is a suggestion of cooling climate, presumably reflecting a lowering of sea level. Taken as a whole, the molluscan succession at Swanscombe forms an important means of correlating with other Hoxnian sites, in particular Clacton.

The vertebrate fauna was found predominantly in the Phase I and II deposits. Phase I includes fallow deer (*Dama dama*), beaver (*Castor fiber*), wild boar (*Sus scrofa*) and macaque (*Macaca sylvana*) suggesting temperate woodland, although horse (*Equus ferus*) and rabbit (*Oryctolagus cuniculus*) reflect more open conditions. Merck's rhinoceros (*Stephanorhinus kirchbergensis*), narrow-nosed rhinoceros (*Stephanorhinus hemitoechus*) and straight-tusked elephant (*Palaeoloxodon antiquus*) are also represented [2,12]. Although many of these taxa are present in the Middle Gravels, there is a suggested change to more open conditions with the decrease in the numbers of fallow deer, but increase in horse. In the Upper Middle Gravel, this might be taken as evidence of cooling as suggested by the molluscs [10].

Table 1. The Pleistocene sequence at Barnfield Pit, Swanscombe, showing the beds, depositional environment, archaeology and human fossil material. The attribution to pollen zones and the marine isotope sub-stages is based on White et al. [8].

Phase	Bed	Deposition	Environment	Archaeology	Humans	Pollen Zone	MIS
III	Higher Loam	Colluvium					
	Upper Gravel	Solifluction	Cold				
	Upper Loam	Estuarine ?	Temperate ?	Twisted ovate handaxes			11a
	Upper Sand	Solifluction	Cold				11b
II	Upper Middle Gravel	Fluvial	Temperate, more open	Pointed handaxes	Skull	Ho IIIb	
	Lower Middle Gravel	Fluvial	Temperate, more open	Pointed handaxes		Ho IIIa	
I	Lower Loam	Floodplain	Temperate, open woodland	Flake industry 'Clactonian'		Ho II	IIc
	Lower Gravel	Fluvial	Temperate, open woodland	Flake industry 'Clactonian		Ho I-II	

Chronology

The geological position of Swanscombe on the Boyn Hill Terrace suggests an age between late MIS 12 and early MIS 10. This age bracket has been supported by amino acid geochronology [13,14]. The mammals also help constrain the age of the Phase I and II deposits. Merck's rhinoceros is unknown before MIS 11, but rabbit, an extinct mole (*Talpa minor*) and European pine vole (Microtus (Terricola) cf. subterraneus) appear to be absent from Britain after MIS 11. The site can be correlated using the molluscan evidence with Clacton, which itself can be correlated with Marks Tey and Hoxne using pollen [8,15]. It has been suggested that all these Hoxnian interglacial sequences can be attributed to sub-stage MIS 11c, prior to the onset of the less stable climate during MIS 11b and 11a.

Archaeology

The deposits at Swanscombe provide a critical sequence for understanding the repopulation of Britain after the Anglian Glaciation (MIS 12). The Phase I assemblages are best known from the excavations of Waechter from 1968-72 [16]. The industry consists of simple alternate platform and multiple platform cores, flakes and simple flake tools such as notches and a few scrapers. Despite the large assemblages of several thousand pieces, there is no evidence of handaxe manufacture. The assemblages form the strongest evidence for a non-handaxe or 'Clactonian' tradition in the early Hoxnian in Britain. The assemblages from the Lower Gravel, in particular, show that raw material was not a limiting factor for handaxe production. In addition, a distinction in site function cannot be argued because the artefacts are fluvially derived and reflect the variety of activities across a wide landscape. Within the Lower Loam a knapping floor with refitting artefacts was found in association with the skull and antlers of a fallow deer, providing one of the few examples of in situ archaeology. The Lower Loam is probably contemporary with the shallow pond at the Southfleet Road site, just over 1 km to the south-east. Here a straight-tusked elephant seems to have become mired and the association of flakes and flake tools suggests that it was the subject of human scavenging and butchery [9].

In contrast the Middle Gravels have provided one of the richest handaxe assemblages in Britain, mainly collected in the late 19th and early 20th centuries. The main excavations were undertaken in the 1950s by Bertram Wymer and his son John. The industry contains a similar core technology to the Phase I deposits, but is characterised by pointed, often small, handaxes that frequently retain cortex on the butt. Although the artefacts have been fluvially derived, most are still only moderately rolled. The Middle Gravels extend over a large area of Swanscombe and similar assemblages have been found in many of the other pits, but most recently from the development of a school site, c. 1 km to the east [17].

The Upper Loam also contained a handaxe industry, but this time in much smaller numbers and typified by twisted ovates. There have been no formal excavations of this unit, but a number of the handaxes were collected by Henry Stopes and reported on by Derek Roe (1981). Similar twisted ovates have been found at several nearby sites, including

Dierden's Pit and Rickson's Pit. It is has been suggested that they come from contemporary deposits at these sites [8].

The Swanscombe skull

The partial calvaria from Swanscombe consists of three cranial bones: the occipital and left parietal fragments were found by Marston in 1935 and 1936, respectively, and the right parietal was found by B. and J. Wymer and Gibson in 1955 [4,18,19]. The calvaria is now thought to be that of a female, based mainly on its moderate muscle markings and a fairly young adult due to the patency of the sutures. The parietal bones are short, flat and relatively thick. A broad, shallow suprainiac fossa is visible on the occipital, and the foramen magnum is oval in shape. It is inferred that, when complete, the neurocranium was low and relatively broad across the base. The internal surface of the bones is less weathered than the external. Because of this better preservation, the blood vessels and imprint of the brain are clearly visible; no obvious differences to *H. sapiens* brain organization can be determined.

Over time, attention has turned to the Neanderthal characteristics of the fossil, particularly in its occipital morphology. The occipital bone shows a suprainiac fossa, a possible Neanderthal apomorphy, and what remains of the basicranial morphology is Neanderthal-like, while the parietal bones are rather primitive in shape. In its combination of Neanderthal and more primitive features, Swanscombe resembles several other European fossils. Its similarity to the Steinheim cranium (Germany) has long been noted, and it is also analogous in some regards to the cranial material from Sima de los Huesos, Atapuerca (Spain), Reilingen (Germany) and Saccopastore 1 (Italy). In combination with the fossils mentioned above, Swanscombe may support the concept of a slow, non-linear, accretion of Neanderthal characteristics over time and space.

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Charles Darwin and Down House

Down House

Charles Darwin returned from his journey around the world on *HMS Beagle* in October 1836 after an absence of nearly 5 years. He married his first cousin, Emma Wedgwood in January 1839, and for the first few years of their marriage the couple lived on Gower Street in Bloomsbury, close to the British Museum on the site now occupied by UCL's Darwin Building. In 1842, Charles and Emma moved from central London to Down House in Kent shortly before the birth of their third child. Down House and garden provided an ideal location for study and experimentation, away from the noise and turmoil of central London, but close enough to major scientific institutions to maintain contact with friends and colleagues and keep abreast of scientific developments.

Darwin lived at Down House for nearly 40 years until his death, developing his scientific ideas and observations, corresponding widely and receiving specimens for study. Darwin kept a private study in the house and gradually converted the garden and its outhouses into a living laboratory. One of the first introductions was the "Sandwalk", a sandy path encircling a newly planted wood, where Darwin walked each day for exercise and reflection. Darwin kept a pile of stones beside the path and would push one stone aside each time he passed so that he could keep track of the number of circuits without interrupting his thoughts.

Another addition was the small heated greenhouse, crammed with plants in terracotta pots. These included insect-trapping plants, which Darwin treated with gases and fed with raw meat, but most of the space was taken up by orchids. Some of these were collected locally during family walks and other more exotic varieties were given to Darwin by his friend Joseph Hooker, who worked at the Royal Botanical Gardens at Kew.

Darwin took a keen interest in pigeon breeding and belonged to several societies of pigeon fanciers. At Down he established a pigeon loft and purchased numerous varieties of fancy pigeons to undertake his own breeding experiments. Once dead, the pigeons were boiled with caustic soda to clean the bones for further study and some of these now belong in the collections of the Natural History Museum.

Darwin's family life was integral to his scientific work. The children's contributions to his experiments included playing a range of musical instruments to test whether worms have a sense of hearing. On other occasions five or six children were strategically placed around the garden to report on the buzzing of bees. The integration of research and family life was not always harmonious. One night a pet cat belonging to Darwin's daughter Etty broke in to one of the pigeon cages and killed several important pigeons. Darwin was furious and had the cat destroyed. Etty then acquired a dog, Polly, who proved better suited to the dual role of family pet and scientific subject.

Darwin's family life was also haunted by illness and tragedy as three of the ten Darwin children died in early life. Darwin feared that his own ill health and a succession of close marriages within the Darwin and Wedgewood families had contributed to the poor health of his children. Darwin himself died in 1882, and was buried in Westminster Abbey. Emma Darwin continued to live at Down House until her death after which the house was first rented and then used as a school. Down House opened as a museum in 1929. The Old Study has been restored to its original state based on a photograph taken in the 1870s and the recollections of one of Darwin's sons, Leonard Darwin. The study contains much original furniture, together with scientific instruments, specimens and documents. The gardens have been gradually returned to their appearance in Charles Darwin's time, replicating the original layout and replacing plants with the varieties that Darwin grew and studied.

Photography is not allowed in the house but is permitted in the gardens. Please bring an umbrella in case of rain so that you can still enjoy the gardens and greenhouses.

http://www.english-heritage.org.uk/visit/places/home-of-charles-darwin-down-house/history/
Michael Boulter (2008) Darwin's Garden: Down House and The Origin of Species. Constable: London

Thursday, 10 September British Museum		
9:00-10:00	**Registration: Clore Centre - British Museum**	
10:00-10:20	**Opening Speech: Jean-Jacques Hublin: BP Lecture Theatre**	
	Session 1	
10:20	**Sonia Harmand et al.** Before the Oldowan: 3.3-million-year-old stone tools from West Turkana, Kenya	
10:40	**Henry Bunn** Prey Mortality Profiles and Two Million Years of Efficient Hominin Hunting	
11:00	**Fred Spoor** Early *Homo*: making sense of new fossils and new interpretations	
11:20	**Ignacio de la Torre et al.** Excavations in the EFHR complex (Olduvai Gorge, Tanzania). Implications for the emergence of the Acheulean in East Africa	
11:40	**Brian G. Richmond et al.** Hominin paleoecology and use of lake margin environments in the early Pleistocene	
12:00-13:00	**Lunch Break**	
	Session 2	
13:00	**Katerina Douka et al.** Radiocarbon chronology of the Denisova Cave (Russian Altai, Russia)	
13:20	**Nicholas Barton et al.** The MSA/LSA transition in North Africa: population continuity or not?	
13:40	**José María Bermúdez de Castro et al.** Virtual reconstruction of the mandible ATD6-96 (Gran Dolina-TD6, Sierra de Atapuerca, Spain) and the reassessment of the taxonomical signal of *Homo antecessor* mandibles	
14:00	**Matthias Meyer et al.** Nuclear DNA sequences from the hominin remains of Sima de los Huesos, Atapuerca, Spain	
14:20	**María Martinón-Torres et al.** On the variability of the Late Pleistocene hominins from continental Asia	
14:40-15:20	**Coffee Break**	
	Session 3 A	**Session 3 B**
15:20	**Markus Bastir et al.** The 3D structure of thoracic vertebrae and their significance for size and shape of the ribcage in Neandertals	**Viola C. Schmid et al.** Bifacial serrated technology in the southern African Still Bay: new data from Sibudu Cave, KwaZulu-Natal
15:40	**Asier Gómez-Olivencia et al.** 3D virtual reconstruction of the Kebara 2 thorax	**Kirsty Penkman et al.** EQUATE – Building a European Quatermary Aminostratigraphic Timescale
16:00	**Maria Mednikova** Altai Neanderthals and their morphological diversity	**James Blinkhorn et al.** Evaluating coastal dispersals of modern humans: Recent discoveries from coastal Kachchh, Gujarat, India
16:20	**Ricardo Miguel Godinho et al.** Bite force efficiency in *Homo heidelbergensis* vs *Homo sapiens*	**Huw Groucutt et al.** Rethinking the dispersal of *Homo sapiens* out of Africa
16:40	**Isabelle De Groote et al.** Oral health and diet change during the final Upper Palaeolithic in Northwest Africa	**John Hoffecker et al.** The Post-HE4 Expansion of the Aurignacian in Eastern Europe
17:00-19:00	**Poster Session 1 • British Museum**	

Friday, 11 September British Museum		
Each Pecha Kucha talk will consist of exactly 20 slides, displayed for 20 seconds. After each group of 3 Pecha Kucha talks, there will be 5 minutes for questions.		
Session 4 – Pecha Kucha		
9:15-9:40	**Emilie Goval et al.** The Early Upper Palaeolithic assemblage from Havrincourt (North of France): new data and interpretations	
	Alejandro García-Moreno et al. Modelling the spatiality of seasonality. Integrating seasonal data into the spatial analysis of Neumark-Nord 2/2B (Germany)	
	Andrew W. Kandel et al. Results from the renewed excavations at the Middle to Upper Paleolithic site of Sefunim Cave in Mount Carmel, Israel	
9:40-10:05	**Anna Degioanni et al.** Neandertal Demise through Modeling: The Viewpoint of Population Dynamics	
	Geeske Langejans and Lyn Wadley On the use and context of Middle Stone Age scrapers from Sibudu Cave (South Africa)	
	Emma Nelson et al. A new approach for predicting the sex of hand stencilers, with incidental insights into creative behaviour	
10:05-10:30	**João Cascalheira et al.** Climate-driven cultural change during the Upper Paleolithic: a reassessment based on the Portuguese data	
	Lewis Hou et al. Cerebral "Default Asymmetry" in global Occipital Bending and local Sylvian Fissures morphology differentiates between humans and chimpanzees (*pan troglodytes*)	
	Will Archer et al. Montagu Cave in Prehistory: current excavation and analyses of the Acheulean sequence	
10:30-11:00	**Coffee Break**	
Session 5		
11:00	**Mateja Hajdinjak et al.** An early modern human with a recent Neandertal ancestor	
11:20	**João Zilhão et al.** Is the Modern vs. Neanderthal dichotomy appropriate any longer for the technocomplexes of the Middle-to-Upper Paleolithic transition?	
11:40	**Stefano Benazzi et al.** The makers of the Protoaurignacian and implications for Neandertal extinction	
12:00	**Viviane Slon et al.** Genetic analyses of three Denisovan individuals from the Altai Mountains (Siberia)	
12:20-13:50	**Lunch Break • Poster Session 2**	
	Session 6 A	**Session 6 B**
13:50	**Adeline Le Cabec et al.** Characterizing the Dental Development and Enamel Microstructure of the *Anapithecus hernyaki* Holotype RUD09 by Synchrotron Virtual Histology	**Rafael Mora et al.** The chronology and archaeology of the Middle Pleistocene in Mieso, a new paleoanthropological sequence in the Ethiopian Rift Valley
14:10	**Alessio Veneziano et al.** Allometry and encephalisation in mandible reduction in *Homo*: a primate perspective	**Alia Gurtov** Seasonal foraging in Early Pleistocene Olduvai Gorge, Tanzania

14:30	**Marina Martínez de Pinillos et al.** Dental variability of the Pleistocene hominins from Sierra de Atapuerca. Expression of trigonid crest patterns in *Homo antecessor* and evolutionary inferences	**Melanie Beasley et al.** Seasonal variation in rainfall at Allia Bay, Kenya 3.97 Ma
14:50	**Gerhard Weber et al.** Shape variability in the human postcanine dentition	**Eleanor Scerri et al.** The Middle Stone Age of the Senegal River Valley
15:10-15:40	**Tea Break**	
	Session 7 A	**Session 7 B**
15:40	**Gabriele A. Macho and Phil Hopley** Pliocene *Australopithecus* diversity in light of climatic, taphonomic and geological information - implications for hominin dispersal into Central and Southern Africa	**Andrei Sinitsyn** Cultural unities and funerary behaviour: connected or independent?
16:00	**Susanne Haupt et al.** Diet and resource space of *Paranthropus boisei* and "*Meganthropus palaeojavanicus*"	**Elaine Turner et al.** Animal crania as funerary artefacts in the Iberomaurusian cemetery at Grotte des Pigeons at Taforalt, north-east Morocco
16:20	**Martin Friess et al.** Re-assessing morphometric affinities of MH1 (*Au. sediba*): The impact of ontogeny	**Alexander J.E. Pryor et al.** Seasonal migrations of Gravettian prey and food storage at Pavlov I
16:40	**Fernando Ramirez Rozzi et al.** Shared reduced adult size in African pygmies is the result of a convergent evolution	**Thomas Terberger et al.** Upright to eternity - a new Mesolithic burial ground in NE-Germany

Saturday, 12 September British Museum	
	Session 8
9:10	**Margherita Mussi et al.** Melka Kunture (Upper Awash, Ethiopian plateau): the earliest human settlement of a high mountain system
9:30	**Nuno Bicho et al.** Middle and Late Stone Age of the Niassa Region, Northern Mozambique
9:50	**Mietje Germonpré et al.** A comparison of two hypotheses of the domestication of the dog
10:10	**Lutz Kindler et al.** The Eemian Zoo of Neumark-Nord 2 (Germany): Neanderthal adaptations to interglacial environments on the European Plain
10:30-11:00	**Coffee Break**
	Session 9
11:00	**Paul Tafforeau et al.** Reconciling X-ray microtomography of recent fossils and paleogenetics: simple technical solutions and good practices
11:20	**Krist Vaesen and Mark Collard** Not so much strength in numbers after all – Demographic explanations of cultural change re-examined
11:40	**Israel Hershkovitz et al.** Manot 1 and its relevancy for comprehending modern human evolution
12:00	**Ella Been et al.** Human Remains from the Late Middle Paleolithic Open-Air Site of 'Ein Qashish, Yizra'el Valley, Israel

12:20-13:50	**Lunch Break • Poster Session 3**	
	Session 10 A	**Session 10 B**
13:50	**Cecilio Barroso and Miguel Caparros** Chronology of Zafarraya, Spain, and its relevance to the debate on the disappearance of the last Neanderthals in the South of the Iberian peninsula	**Daniel Richter et al.** New results on the chronostratigraphy and palaeoenvironment of the Middle-Pleistocene sequence of Schöningen
14:10	**Lucy van Dorp et al.** Inferring Human History Using DNA	**Aritza Villaluenga et al.** A Site for all Seasons: Reconstructing the Occupational History of the Middle Pleistocene Schöningen 13II-4 "Spear Horizon"
14:30	**Simon Underdown and Charlotte Houldcroft** Neanderthal Genomics Suggests a Pleistocene Time Frame for the First Epidemiologic Transition	**Thijs van Kolfschoten et al.** Lower Palaeolithic bone tools from the 'Spear Horizon' at Schöningen (Germany)
14:50	**Chiara Barbieri et al.** Paleolithic signatures from European glacial refugia revealed by mtDNA genomes	**David Hérisson et al.** Neandertal's Presence during the Eemian Interglacial in North-western Europe: a New Site at Waziers (Northern France)
15:10-15:40	**Tea Break**	
	Session 11 A	**Session 11 B**
15:40	**Karen Hardy et al.** Diet, medicines, raw materials or palaeoenvironment? A broad approach to materials extracted from palaeolithic dental calculus	**Omry Barzilai et al.** The Late Middle Palaeolithic open-air site complex of 'Ein Qashish, northern Israel
16:00	**Robert Power et al.** Dental calculus evidence of Taï Forest Chimpanzee plant consumption and life history transitions	**Yossi Zaidner et al.** Nesher Ramla karst depression, Israel: A new evidence for Middle Paleolithic adaptations during MIS 6 and 5
16:20	**Martin Haeusler et al.** Are musculoskeletal disorders evolutionary trade-offs of bipedalism?	**Zeljko Rezek** Temporalities in stone provisioning in the Middle Paleolithic stone artifact record of the cave of Pech de l'Azé IV in southwest France; Insights into the variability in Neanderthal landscape use
16:40	**Christine Tardieu et al.** Quadrupedal subjects in a family (Adana, Turkey): comparison between two adult brothers' skeletons, one bipedal, one quadrupedal. Are they similar or different?	**Miguel Caparros et al.** Analyzing Neanderthals and carnivores interactions in the surroundings of the Cave of Zafarraya (Spain) by means of a statistical path analysis
17:00-18:00	**ESHE General Assembly – British Museum**	
19:00-22:00	***ESHE Closing Party – Natural History Museum*** Cromwell Rd, London SW7 5BD, United Kingdom	

Poster Session 1 Thursday, 10 September – 17:00-19:00	
1	**Marie-Helene Moncel et al.** Acheulean technological strategies between lower and upper units at la Noira: shift or regional evolution in situ?
2	**Lesley Blundell** An Assessment of the Lower-Middle Palaeolithic Surface Artefact Scatters of the Chalk Uplands of Northwest Europe
3	**Brad Gravina et al.** One-hundred years after Peyrony: New excavations at Le Moustier (Dordogne, France)
4	**Tamara Dogandžić** Lithic Reduction Strategies in the Late Middle Paleolithic of the Balkans
5	**Christian Hoggard** Is it all just about size? Traditional and geometric morphometric approaches to Middle Palaeolithic concurrent technological blade strategies
6	**Mary Anne Tafuri et al.** Among the last Neanderthals. A reappraisal of the Grotta Breuil case-study (Monte Circeo, Latium, Italy)
7	**Stéphane Pirson et al.** New excavations in the Mesvin terrace (Belgium): implications for the appearance of Middle Palaeolithic
8	**Marcel Weiß** Another piece of the puzzle - a new site of the late Middle Paleolithic *Keilmessergruppen* in central Germany
9	**Manuel Alcaraz-Castaño et al.** New Insights For The Understanding Of The Middle Palaeolithic Settlement Of Central Iberia: Los Casares Cave Revisited
10	**Patrick Bringmans** The Middle-Upper Palaeolithic Transition in the Basin of the River Meuse, Belgium
11	**Saman Heydari-Guran** Tracking the Middle to Upper Paleolithic transition in the Kermanshah Region, West Central Zagros Mountains of Iran
12	**Fulco Scherjon** Neandertals on the move - Or not
13	**Andrea Picin** Neanderthal mobility and technological change in the northeastern of the Iberian Peninsula: the patterns of chert exploitation at the Abric Romaní rock-shelter
14	**Ekaterina Doronicheva** Raw material exploitation and transport, and the distribution of the Early Upper Paleolithic in the Northern Caucasus
15	**Gianpiero di Maida** Hello? Is there anybody out there? A review of the evidence of the first peopling of Sicily
16	**Paul Kozowyk and Geeske Langejans** Looking for glue: seeking Neandertal sites containing adhesive remains
17	**Andrew Sorensen** White light, white heat: On the relationship of Homo and lightning as a source of domestic fire
18	**Adrian Evans et al.** Using metrology to benefit refitting and microwear; Novel approaches to two powerful interpretative tools
19	**Katsuhiro Sano** Evidence for mechanically-delivered armatures from early Upper Palaeolithic sites in Japan
20	**Jun Takakura** Re-thinking small: a difference between before and after the appearance of microblade technology in northeastern Asia

21	**Elham Ghasidian** The diversity of culture among the Upper Palaeolithic in the Iranian Plateau: A comparative study of three core areas of Northern, West Central and Southern Zagros Mountains
22	**Alexander A. Bessudnov** Kostenki 21, layer III: a "Western" variant of the Eastern European Gravettian?
23	**Natasha Reynolds** A revised chronocultural framework for the Gravettian of European Russia
24	**Joao Marreiros et al.** Lithic technology variability and human ecological behavior during the Early Gravettian in Southwestern Iberia
25	**Pedro Horta et al.** Expedient tools for intensive practices: the bipolar lithic implements from the Upper Paleolithic site of Vale Boi (Southwestern Iberia)
26	**Alessandro Potì et al.** Iberomaurusian Lithic Technology. New insights from Ifri El Baroud, NE Morocco
27	**Alice Leplongeon and A. Nigel Goring-Morris** Technical diversity in the Nile Valley and the southern Levant at the end of the Pleistocene (25-15ka): evidence for contacts?
28	**Lorena Becerra-Valdivia** Chronometric investigations of the Middle to Upper Palaeolithic transition in the Zagros Mountains
29	**Martin Street and Birgit Gehlen** New AMS dating results for aurochs (*Bos primigenius*) at the initial Mesolithic site of Bedburg-Königshoven, northern German Rhineland
30	**Thibaut Deviese et al.** HPLC, an alternative and efficient purification technique for AMS dating of contaminated and low collagen bone samples – Principle and application to Palaeolithic sites
31	**Ella Egberts et al.** Optically stimulated luminescence dating of the Palaeolithic 'Super Site' Woodgreen, in the Avon Valley, Hampshire (UK)
32	**Laura C. Fitton et al.** Functional equivalence during development within a hard-object feeding primate (*Cercocebus atys*)
33	**Karen R. Swan et al.** Tooth cusp morphology and mechanical performance during hard food object breakdown
34	**Julie Lawrence** Morphological variation and covariation in the South African australopith masticatory apparatus
35	**Michael Berthaume and Kornelius Kupczik** Dental topographic analysis of *Australopithecus africanus* and *Paranthropus robustus*
36	**Clément Zanolli et al.** Tooth endostructural characterization of the Early Pleistocene specimen SK 27 from Swartkrans, South Africa
37	**Luca Fiorenza et al.** The functional role of Carabelli trait in early and late hominins
38	**Katherine Lacy and Fred Smith** The Etiology of the Horizontal-Oval Form of the Mandibular Foramen and a Reassessment of its Usefulness for Paleoanthropological Studies
39	**Kornelius Kupczik et al.** Teeth and jaws: getting closer to inferring feeding behaviour from morphometric traits in hominids
40	**Manon Galland et al.** 11,000 years of cranial and mandibular variation in Lower Nubia
41	**Elisa Bandini et al.** Is Algae Scooping Within Chimpanzees' Zone of Latent Solutions?

42	**Laura Buti et al.** 3D enamel thickness in Neandertals and *Homo sapiens* permanent lower canines
43	**Gregorio Oxilia et al.** Earliest evidence of proto-dental treatment in the Late Upper Paleolithic
44	**Ellen Schulz-Kornas et al.** Tooth wear analysis in molar samples from Natufian to modern populations in the southern Levant using the 3D surface texture approach
45	**Hila May et al.** Subsistence transition and mandible morphology: a case test from the advent of agriculture in the Levant
46	**Rachel Sarig et al.** Interproximal wear patterns of the Middle Pleistocene (420-200 kyr) Qesem Cave inhabitants
47	**Zachary Cofran** Brain growth rates in African apes and early hominins
48	**Antoine Balzeau et al.** Internal cranial anatomy of Broken Hill 1
49	**Frederick Coolidge and Amanda Harvey** Cognitive, Behavioral, and Archaeological Sequelae of a Larger Cerebellum in *Homo sapiens*
50	**Xiang Li et al.** Laterality distinguishes the brain of *Homo sapiens* from that of *Pan troglodytes*
51	**Tara Chapman et al.** The new reconstruction of 'Spyrou' – the Spy II Neandertal skeleton
52	**Antonio Profico et al.** Morphological integration and modularity in the cranium of extant and fossil Hominoidea: a 3D geometric-morphometric approach
53	**Wioletta Nowaczewska et al.** The relationship of the craniofacial size and shape with the morphological variation of the supraorbital region in the recent Homo sapiens crania
54	**Ekaterina Bulygina et al.** Mesolithic populations from the Eastern Europe and Siberia: cranial shape analysis with the help of geometric morphometric methodology
55	**Andrej Evteev** The association between craniofacial form and climate in North East Europe differs from that in North Asia
56	**Christina Nicholas et al.** A 3D Geometric Morphometric Analysis of Internal Nasal Fossa Shape Variation in Hot/Cold Climate Populations of Extant Humans
57	**Yann Heuzé** Is nasal cavity a good proxy for the study of functional nasal airways?
58	**Alexandra Uhl and Katerina Harvati** Sexual dimorphism in the bony labyrinth of geographically diverse samples
59	**Lauren Butaric and Scott Maddux** Covariation of the internal and external midfacial skeleton among modern humans of Asian descent
60	**Lumila Paula Menéndez** Morphological diversification and diet diversity in southern South America
61	**Lorenza Gagliardi et al.** Advances in virtual morphometrics: a new approach to generate 2D and 3D surface outlines on virtual specimens
62	**David Begun** A new hominoid locality from the late Miocene of Hungary

63	**Jose Braga et al.** The Kromdraai Research Project in South Africa, with its renewed excavations in 2014-2015
64	**Francis Thackeray** Sigma taxonomy in relation to palaeoanthropology and the lack of clear boundaries between species
65	**Sandrine Prat et al.** A new early *Homo* specimen from Nachukui Formation, West Turkana, Kenya
66	**Trevor Underwood** A New Model of Human Dispersal
67	**Eva Reindl et al.** Young children copy cumulative culture in a construction task
68	**Ciro Medeiros** A skills transfer hypothesis about word order comprehension
69	**Randolph Donahue et al.** The Application of Citizen Science for Education and Exploration in Paleoanthropological Field Research
70	**Daniel Hunt** Life history, social cognition, and emotion
71	**Marc Kissel** Hominids & humans: Behavioral modernity and the process of becoming human

Poster Session 2 **Friday, 11 September – 12:20-13:50**	
72	**Shannon McPherron et al.** PaleoCore: Building Data Structures and Technologies for Collecting and Sharing Paleoanthropological Data
73	**Adrian Arroyo et al.** Stone tool multi-functionality and re-use at Lomekwi 3 (3.3 Ma), West Turkana (Kenya)
74	**Julia Aramendi Picado and Manuel Domínguez-Rodrigo** Taphonomic study of AMK, Amin Mturi Korongo, at Olduvai Gorge (Tanzania)
75	**Michaela Ecker et al.** New isotopic insights into palaeoecology and palaeoenvironment over 2 Million years from Wonderwerk Cave, South Africa
76	**Kevin Kuykendall** Ten years in a Lime Mine: reflections on research at the Makapansgat Limeworks, 1994-2004
77	**Ron Shimelmitz et al.** Lateral scraper rejuvenation in 400 ka assemblages from Tabun Cave, Israel: new dimensions of raw material exploitation and tool reduction complexity in the Lower Paleolithic
78	**Carolina Mallol et al.** Advances in Microstratigraphic Dissection of Archaeological Palimpsests: The formation of a combustion feature from El Salt Middle Palaeolithic Site (Alicante, Spain)
79	**Susan M. Mentzer et al.** Middle Stone Age combustion features at Klasies River Main Site, South Africa
80	**Emily Hallinan and Matthew Shaw** A landscape perspective on Middle Stone Age behaviour from the Tankwa Karoo, Northern Cape, South Africa
81	**Julia Lee-Thorp et al.** A Late Pleistocene aridity and vegetation record from stable light isotope ratios of ostrich eggshell at Pinnacle Point, Mossel Bay, South Africa

82	**Gregor Donatus Bader and Nicholas John Conard** The Middle Stone Age lithic assemblages of Umbeli belli Rock Shelter in KwaZulu-Natal, South Africa
83	**Regine Stolarczyk and Miriam Haidle** Innovations in the spotlight: a new approach to study qualitative and quantitative differences of innovative behaviour and cultural change during the Middle Stone Age (MSA) of Southern Africa
84	**Knut Bretzke et al.** Exploring Late Pleistocene hominin behavior in the desert environments of Southeast Arabia and its implications for dispersal models
85	**Manuel Will and Alex Mackay** Convergence in derived elements of lithic technologies complicates identification of early modern human dispersals
86	**Rebecca Farbstein and William Davies** The Earliest Ceramics: interregional comparisons and implications for the study of non-traditional Palaeolithic material culture and technologies
87	**Antoine Muller et al.** Reconstructing hominin behavioural and cognitive complexity via decision making in stone knapping
88	**Damiano Marchi et al.** Proximal metacarpal 1 articular surface shape in human and nonhuman hominids: its relationship with locomotion and hand functional capabilities
89	**Nicholas Stephens et al.** Visualising trabecular bone architecture and distribution in the human hand: Variation, consistency, and implications for reconstructing behaviour
90	**Alastair Key and Stephen Lycett** On relationships between biometric variation and Lower Palaeolithic tool efficiency in differing task-type contexts: implications for the evolution of the human hand and the origin of the Acheulean
91	**Laura A.B. Wilson and Louise T. Humphrey** A Virtual Geometric Morphometric approach to the quantification of long bone bilateral asymmetry and cross-sectional shape
92	**Sandra Mathews and Martin Haeusler** Are rotator cuff lesions of the human shoulder joint related to the evolution of bipedalism?
93	**Anna Maria Kubicka et al.** Cross-sectional Shape of the Humerus in Neanderthals, Mediaeval Population from Europe and Australian Aborigines
94	**Heike Scherf et al.** Evidence of strenuous physical activity in humeral trabecular bone in a Neolithic Linear pottery Culture (LBK) population
95	**Michelle Cameron et al.** Does the upper limb morphology of Native American fur traders shed light on the unique humeral structure of Neandertals?
96	**Daniel García-Martínez et al.** Neanderthal lumbar lordosis assessed by 3D geometric morphometrics of vertebral morphology
97	**Mikel Arlegi et al.** The mid-sagittal morphology of the lower cervical spine in hominoids: preliminary evolutionary implications
98	**Marine Cazenave et al.** The inner structural morphology of the femoral head of *Paranthropus robustus*
99	**Zewdi J. Tsegai et al.** Trabecular bone architecture and distribution in the talus and distal tibia of *Homo* and *Pan*
100	**William Harcourt-Smith and Aylin Woodward** Assessing fossil hominin medial longitudinal arch structure using a multiple element approach
101	**Kevin Turley et al.** Phenotypic Plasticity: Behavioral induced change in ankle shape due to altered habitat in the Macaque model, with insights into rapid shape change in Plio-pleistocene hominins

102	**Jaap Saers et al.** Trabecular bone ontogeny in the human calcaneus
103	**Sandra Martelli and Christopher Dean** Stability of neurovascular vs. musculoskeletal landmarks on human and chimpanzee (*Pan troglodytes*) cadavers – implications for interpreting fossil hominins
104	**Kinsey Oleman-Grace** The weight of wild Gorillas
105	**Peter Heyes and Katharine MacDonald** Energetic comparison between Neandertals and Anatomically Modern Humans: no significant difference due to uncertainty in body mass estimation
106	**Thomas Atterton et al.** The Effect of Body Mass on Bone Morphology
107	**Adam D. Gordon** Evaluating missing- and complete-data techniques for estimating size variation in the fossil record
108	**Jason Nadell et al.** Skeletal development with reference to ontogeny and locomotion; a cross-sectional study of primate limb elements

Poster Session 3 **Saturday, 12 September – 12:20-13:50**	
109	**Michael Haslam et al.** Archaeological survey and recovery of wild capuchin stone tools
110	**Sarah Schwarz** Cuts, Corpses, and Cannibals: Disposal of the Neanderthal Dead in Palaeolithic Europe
111	**Tim Schüler** Age estimation of the site Weimar-Ehringsdorf - history, recent discussion and outlook
112	**Elisa Luzi et al.** The contribution of paleontological data to the chronological context of hominid occupation in Visogliano Rockshelter
113	**Andrew Shaw et al.** Reanimating the La Cotte de St Brelade 'Bone Heaps': reconstructing complex early Neanderthal responses to environmental change
114	**Marie-Anne Julien et al.** Investigating human/animal relationship during the Middle Pleistocene at La Cotte de St. Brelade, Jersey
115	**Andreas Nymark** Resilient and resourceful? A transect of Middle Palaeolithic Hominin adaptational strategies in Southwest Asia across bio-geographical zones
116	**Kate Britton et al.** Oxygen isotope analyses of *Equus* teeth evidence Last Interglacial (Eemian) and Weichselian palaeotemperatures at Neumark-Nord 2, Saxony-Anhalt, Germany
117	**Annemieke Milks et al.** Human performance trials in spear thrusting and throwing: experiments into the mechanics and biomechanics of early weapon systems
118	**Frido Welker et al.** ZooMS analysis of two Châtelperronian faunal assemblages
119	**Samantha Brown et al.** Identification of Faunal Remains from Denisova Cave through the Application of ZooMS
120	**Laura Longo et al.** Modern humans technological breakthrough: maximizing plant foods greater dietary contribution

121	**William Rendu et al.** Improving Resolution In Dental Cementum Analyses Applied To Archaeological Contexts: The CemeNTAA Project
122	**Gerlinde Bigga and Brigitte Urban** Plants from the horse butchery site of Schöningen: an archaeobotanical approach to subsistence strategies
123	**Monika Knul et al.** Neanderthal and Anatomically Modern Human changes in food resources
124	**Ainara Sistiaga et al.** What's in a meal? Assessing proportions of plant and meat intake in Paleolithic diets through faecal biomarkers
125	**Antonio Rodríguez-Hidalgo et al.** Human predatory behaviour and social implications of bison communal hunting at Gran Dolina TD10.2 (Atapuerca)
126	**Patrick Roberts et al.** Late Pleistocene human rainforest specialisation in Sri Lanka: an isotopic perspective
127	**Maria Dobrovolskaya** Diets and mobility of Altai Neanderthals from isotopic analysis data
128	**Lia Betti et al.** Climatic challenges set the pace of the Neolithic expansion into Europe
129	**Marine Frouin et al.** Dating of La Quina site: a multi-analytical approach
130	**Rachel Hopkins and Tom Higham** Dispersal, co-existence and extinction? The Middle-Upper Palaeolithic Transition along the Danube
131	**Maïlys Richard et al.** New ESR ages from Geißenklösterle cave: a chronological study for late Middle Palaeolithic and Early Aurignacian layers
132	**Guillaume Guèrin et al.** First chronometric ages for La Ferrassie Neanderthals LF1 and LF8 and a comparison with the age of LF2
133	**Juan Manuel López-Garcia et al.** Biochronological data inferred for the first human presence in western Europe (Pirro Nord 13, Apulia, Italy)
134	**Peter Allen et al.** Investigating and Visualising the Effects of Environment on Prey Detection Rates: A Key Variable in Human Evolution
135	**Phil Hopley** Reconstruction of Hominin Habitats from Environmentally Mixed Assemblages
136	**Tim Compton et al.** Late Pleistocene hominins from La Cotte de St Brelade, Jersey
137	**Marie-Hélène Dias-Meirinho et al.** Anthropological and archaeological reassessments of the evidence of inter-personnal violences in the Late Pleistocene cemetery of Jebel Sahaba (Site 117, Nile Valley)
138	**Vitale Sparacello et al.** Funerary dynamics of an epipalaeolithic cemetery: a new database on Arene Candide skeletal remains
139	**Luseadra McKerracher et al.** Longer lactation for last-borns: Evidence from modern Maya mother-child pairs

Abstracts
European Society for the study of Human Evolution

London September 2015

Poster Presentation Number 9, Th (17:00-19:00)

New Insights For The Understanding Of The Middle Palaeolithic Settlement Of Central Iberia: Los Casares Cave Revisited

Manuel Alcaraz-Castaño[1], Gerd-Christian Weniger[1], Javier Alcolea-González[2], Martin Kehl[3], Javier Baena[4], José Yravedra[5], José-Antonio López-Sáez[6], Rodrigo de Balbín-Behrmann[2], Felipe Cuartero[4]

1 - Neanderthal Museum · 2 - Área de Prehistoria, Universidad de Alcalá · 3 - Institute of Geography, University of Cologne · 4 - Departamento de Prehistoria y Arqueología, Universidad Autónoma de Madrid · 5 - Departamento de Prehistoria, Universidad Complutense de Madrid · 6 - Grupo de Investigación Arqueobiología. Instituto de Historia, CCHS CSIC

The Middle Palaeolithic occupation of the interior lands of the Iberian Peninsula, dominated by the large Spanish plateau, is poorly known. Only a few sites in these territories have yielded reliable palaeoecological and chronometric data up to the present time. Thus, the chronological framework of the Neandertal settlement in this area, and the relations between ecological variability and techno-economic behaviours developed by these human societies, are currently in need of new consistent data.

Classical debates on the Neanderthal settlement of inner Iberia, such as the long-claimed Mousterian late survival in the central and southern areas of the peninsula, or the nature of human adaptations to the harsh environments of the upland regions of the Spanish plateau, are currently under dispute.

In this communication we present the first results of a new interdisciplinary research project conducted at the Middle Palaeolithic site of Los Casares (Northern Guadalajara province, Spain). Los Casares is a limestone cave located in the Upper Tagus River basin, in an elevated area (1050 above sea level) of the southern Spanish plateau close to the Iberian system range. The archaeological potential of Los Casares cave is known since the late 19th century, but it was in the 1930´s when the site became famous due to the discovery of Upper Palaeolithic engravings in its walls. Later on, in the 1960´s, the archaeological excavations conducted at the site by I. Barandiarán showed a series of Pleistocene layers yielding a modest assemblage of Mousterian lithic artifacts and fauna, associated to a Neandertal metacarpal.

However, since the 1960´s no other studies have been carried out at Los Casares, and hence the site lacks modern geoarchaeological, chronometric, palaeoecological and techno-economic analyses. Our research in Los Casares was thus focused on bringing into light new data aimed at improving the minimal information gathered at this site so far. Our specific objectives (and methods) can be summarized as follows:

1) Study of the site formation processes (micromorphology, sedimentology and taphonomy). 2) Chronometric analysis of the Mousterian occupations (14C, OSL and U/Th dating). 3) Study of the environmental and climatic setting of the area during the Mousterian period (pollen, phytolith, microfaunal and sedimentological analyses). 4) Study of human-environment interactions and techno-economic and social behaviours of Los Casares Neandertals (lithic technology, zooarchaeology and modelling all data).

Here we present the first results of these analyses, and we discuss them in the context of the current problems of the Neandertal settlement of central Iberia. We pay special attention to the evolution of population dynamics in the area and the relations between human behaviours and climatic and environmental change.

Acknowledgements: This research is supported by a Marie Curie Intra European Fellowship within the 7th European Community Framework Programme. It is also benefited from the CRC 806 "Our Way to Europe", funded by the *Deutsche Forschungsgemeinschaft*, and the Spanish Research Project HAR2013-4370-P of the *Plan Nacional de I+D+i* of the Ministerio de Economía y Competitividad. Fieldworks in Los Casares cave were authorized by the *Dirección General de Cultura de la Junta de Comunidades de Castilla – La Mancha* (Spain).

Poster Presentation Number 135, Sa (12:20-13:50)

Investigating and Visualising the Effects of Environment on Prey Detection Rates: A Key Variable in Human Evolution

Peter Allen[1], Jan Wiener[1], Christos Gatzidis[1], Chris Stringer[2], John Stewart[1]

1 - Bournemouth University · 2 - Natural History Museum

The nature of the landscape in which humans live has a direct effect on the ungulate prey species present as well as the way in which humans will hunt them. For instance in open habitats, like grasslands, humans are thought to use pursuit hunting while in closed environments, like woodlands, they use encounter or ambush hunting. These hunting styles are believed to affect the anatomy of the humans due to differing loccomotory styles. Pursuit hunting is believed to be correlated with long limbs and a relatively gracile body form as it involves endurance running. Presumably, closed environments which lead to encounter hunting select for other body forms. Environment affects the positive feedback between hunting style and body form via locomotion mode. However, there is a missing part of this feedback process that involves the ungulate species and prey detection. Although prey detection rates are dictated by environmental conditions and they in turn affect the hunting style and even the anatomy of the humans there has been little work done trying to understand its role in human evolution. This project aims to test the hypothesis that prey detection rate will vary according to vegetational environment and assess how this may relate to what is known about former environments in Europe during the Late Pleistocene. In this project, we will combine methods from computer graphics and experimental psychology to answer key questions in human evolution. We will create virtual environments that will be displayed on ViRtUOS an immersive VR and eye-tracking research platform. In the experiments, participants will be presented with virtual sceneries and asked to indicate whether any prey is present. We shall start to investigate the prey detection rate in environments from dense woodland to open grasslands as extremes. We will then examine the irregular vegetational continuum between these extremes to see how prey detection rates vary. To add a level of reality to this investigation the vegetations investigated will be those inferred and simulated over Europe between 50 and 20 thousand years ago. Recording participants' eye-movements will allow for an in-depth understanding of visual search strategies and – in case multiple animals are present – which prey animal was detected. To investigate the impact of changing environments on prey detection, environmental factors such as tree-, understory- and grass density will be systematically manipulated. Participants' responses will not only inform about prey detection rates in different environments, but also about prey detection times, prey distance, and visual search strategies. These data can then be related to possible hunting styles to predict what may have been hunted in certain times and places which in turn can be tested using the archaeological record.

Poster Presentation Number 74, Fr (12:20-13:50)

Taphonomic study of AMK, Amin Mturi Korongo, at Olduvai Gorge (Tanzania)

Julia Aramendi Picado[1], **Manuel Domínguez-Rodrigo**[1]

1 - Complutense University of Madrid

AMK (Amin Mturi Korongo) is a recently discovered Olduvai Bed I site (>1.84 Ma) consisting of at least three archaeological levels where human presence has been detected in the form of sporadic human fossil remains and lithics. Thanks to its location at the eastern Olduvai palaeo-lake alluvial plain, an area characterised by dense vegetation and intermittent superficial low energetic water flows, AMK appears as a close and low-competition environment, which predators would have made use of to consume and exploit carcasses. In order to determine the agency of the bone accumulations at AMK, the 198 recovered remains (including several hominin fossils) were analysed from a taphonomic perspective. Remains were classified and identified according to their size, bone portion and anatomical part to specify the NIPS, MNE and MNI of each level with higher accuracy, as well as the size and type of animal, where possible. Surface macroscopic and microscopic marks on bone surfaces and breakage patterns and notches were studied and statistically analysed for each level independently, using the free software R. Such analysis allows the distinction between biotic and abiotic factors contributing to the final assemblage appearance. The detection of frequency patterns of anthropic and biotic carcass exploitation has been largely used to reconstruct the post-depositional history of archaeological sites, especially when more than one agent seem to be involved in the accumulation process. In the case of AMK, tooth marks were studied in greater detail according to the type, size and amount of marks, including pits, scores, punctures and notches. Due to the fossil arrangement detected on the field, special attention was paid to disarticulation patterns and bone density and fragmentation, which may be related to the type of agent responsible for the accumulation, the action of geological post-depositional events and time of exposure. Additionally, orientation patterns were taken into consideration to assess the impact of water flows on the registered faunal arrangement and possible biases that could be affecting the taphonomic interpretation of the site.

Despite the influence of some water channels, which is detectable at AMK in the form of anisotropy, a bias towards less dense elements and the presence of catfish, the taphonomic history of AMK could be reconstructed thanks to the good preservation of its remains. Our results suggest that AMK is a palimpsest created by the action of several agents superimposed over time on the landscape. Taphonomic analyses reveal the predominant presence of carnivores, showing different behavioural patterns reflected in different fragmentation degrees and mark type frequencies. This has led us to conclude that this distinction is most likely the result of the action of different carnivores such as felids, known for fairly complete and even articulate elements, and hyaenids, capable of fracturing bones into very small pieces. While these two patterns can be detected and are supported by the quantity of pits, scores and punctures, as well as by the furrowing and breakage patterns, human presence seems to be very sporadic and certainly not the accumulation agent at this site. Only a couple of anthropic marks and lithics were identified, the discovery of actual hominin remains providing the main evidence for human presence at AMK.

In sum, AMK could be described as a natural background scatter in a space intensively covered with vegetation that resembles the ones found at FLK North, surrounding the human created FLK Zinj, yet linked to the recently discovered, and human-created site, PTK. In so doing, AMK results can be added to the debate on early human scavenging *versus* hunting, with hominins disregarding complete abandoned bones.

Acknowledgements: We thank the Tanzanian Commission for Science and Technology (COSTECH), the Department of Antiquities and Ngorongoro Conservation Area Authority in the Ministry of Natural Resources and Tourism for permission to conduct research at Olduvai Gorge. We also thank the Spanish Ministry of Economy and Competitiveness for funding this research through the HAR2013-45246-C3-1-P project and the Ministry of Culture for funding our research through their Archaeology Program Abroad program. Finally we would also like to acknowledge the support of Fundación Bancaria Caixa through its scholarship programme for postgraduate studies.

Pecha Kucha Presentation: Session 4, Fr (10:05-10:30)

Montagu Cave in Prehistory: current excavation and analyses of the Acheulean sequence

Will Archer[1], Darya Presnyakova[2], Alexandra Sumner[3], Vera Aldeias[1], Shira Gur Arie[4], Marion Hernandez[1], Matt Shaw[3], Guillaume Porraz[5,7,8], Louisa Hutten[3], Cedric Poggenpoel[3], Charles M. Keller[6]

1 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 2 - Universität Tübingen, Abteilung Ältere Urgeschichte und Quartärökologie, Tübingen, Germany · 3 - Department of Archaeology, University of Cape Town, South Africa · 4 - Research Group on Plant Foods in Hominin Dietary Ecology, Max-Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 5 - CNRS, UMR 7041-ArScAn-AnTET, MAE, Université de Paris X, Nanterre, France · 6 – Professor Emeritus, University of Illinois, Urbana Champaign, U.S.A. · 7 – CNRS, USR 3336, French Institute of South Africa, Johannesburg, South Africa · 8 – Evolutionnary Studies Institute, University of the Witwatersrand, Johannesburg, South Africa

It is widely demonstrated that hominin behavior underwent dramatic changes shortly after the onset of the Middle Stone Age ("MSA"). However, the mechanisms associated with the transition from the preceding Acheulean remain poorly understood, largely due to the paucity of localities documenting a stratigraphic succession between the Acheulean and MSA. Cave and rock-shelter contexts in southern Africa tend to be associated with modern human occupations, including some of the earliest known evidence for a multitude of behaviorally modern cultural tendencies. The Acheulean, conversely, is traditionally associated with anatomically and behaviorally archaic species of the genus *Homo*, with occupation contexts found predominantly in open wetland environments.

Here we report on preliminary results from renewed excavations at Montagu Cave (South Africa). This site was initially excavated in 1964/5 by Charles Keller and others and preserves a unique sequence with stratified deposits of Acheulean overlain by MSA occupations. Our current project objectives include excavation of both the MSA occupations and the underlying deeply stratified Acheulian deposits using modern excavation and recording methodologies. A dual aim is (1) the continued study of vast collections of previously excavated but unanalyzed Acheulean assemblages housed in the Iziko Museum (Cape Town), and (2) gathering of new contextual and chronological data from excavations of intact deposits at the site. Our interdisciplinary approach includes studies on site formation processes, geoarchaeology, OSL dating, lithic analysis, lithic raw-material sourcing, and phytolith identification.

The renewed fieldwork program at Montagu provides scope for investigating detailed questions concerning hominin behavioural variability, in a time window just prior to the period characterized by rapidly increasing complexity in the Southern African archaeological record. In addition, we are able to explore how this increasing complexity manifests itself in direct comparison with in situ instances of chronologically preceding material cultures, conventionally assumed to be pre-modern.

References:[1] Keller, C.M. 1966. Archaeology of the Montagu Cave. Unpublished Ph.D. Thesis. University of California, Berkeley.[2] Keller, C.M. 1973. Montagu Cave in Prehistory: a Descriptive Analysis. Anthropological Reports Vol 28. University of California Press, Berkeley.

Poster Presentation Number 98, Fr (12:20-13:50)

The mid-sagittal morphology of the lower cervical spine in hominoids: preliminary evolutionary implications

Mikel Arlegi[1], Asier Gómez-Olivencia[1], Ella Been[2]

1 - Dept. Estratigrafía y Paleontología, Euskal Herriko Unibertsitatea, Bilbao, Spain · 2 - Department of Anatomy and Anthropology, Sackler Faculty of Medicine, Tel Aviv University, Israel

In the last decade there has been an increase of the studies related to primate vertebral column's morphology and biomechanics, mainly focussing in body posture and taxonomic differences between different species (e.g., [1-3]). However, not much has been published about the non-human primate cervical area since Schultz [4] (but see [5]). The main goal of this work is to offer for the first time information on the mid-sagittal plane of the lower cervical spine (C3-C7) using both traditional morphometry (TM) and geometric morphometrics (GM) from a large sample of hominoids, including fossil remains.

The main core sample includes cervical vertebrae from 142 extant hominoid adult individuals (*Pan*, n=44; *Gorilla*, n=29; *Homo sapiens*, n=54; *Pongo*, n=7 and Hylobatidae, n=5). The fossil record includes the ct-scans of the *Homo neanderthalensis* individuals of la Chapelle-aux-Saints 1 (C6 and C7) and Regourdou 1 (C5 and C7) plus the cast of the seventh cervical of the juvenile individual MH1 attributed to *Australopithecus sediba*. For this study both TM and GM methods were used. For the core sample, a total of 28 landmarks -five on the C3, C4 and C5 and six on the C6 and C7- from the mid-sagittal plane were taken from each complete individual using a 3D Microscribe SX2. Five linear and one angular measurement were derived from these landmarks to be analysed by means of TM methods. Traditional morphometry methods were used to obtain absolute and relative values for six variables from the cervical vertebrae. To complement traditional methodology, GM methods were used in order to better understand the cervical morphology and variability. Two methods were performed based on Procrustes superimposition coordinates results: PCA (principal components analysis) to assess for interspecific variability and diversity among groups and Regression to analyse the influence of size on shape of the cervical vertebrae in the different groups.

Traditional morphometry results show different morphology patterns in the cervical vertebrae for the hominoid group. In general terms great apes show longer cervical vertebrae that bear relatively longer and more horizontal orientated spinous processes (SP), and cranio-caudally relatively short vertebral bodies compared to modern humans (MH). Neandertals' cervical vertebrae and SP' morphology compared to that of MH are longer showing a more horizontal oriented angle of the SP. These results are in congruence with those from GM where this variability is well represented by the first two principal components from the PCA analysis. The regression analysis shows that the values representing MH draw a different allometric axis in the whole cervical vertebrae regarding the non-human primates. The values representing Neandertals individuals follow the same allometric pattern as in *H. sapiens*. In contrast, the values representing MH1 plot in the same slope of regression as those from the non-human primates.

This variability in the cervical morphology could represent a biomechanical advantage for the different body posture and locomotion ways represented among hominoids [5]. The differences in the allometric patterns of modern humans arose after the appearance of bipedalism, MH1 is thought to be a biped and thus we hypothesize that these differences associate with differences in neck posture.

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References: [1] Russo, G.A., 2010. Prezygapophyseal articular facet shape in the catarrhine thoracolumbar vertebral column. Am. J. Phys. Anthrop. 142, 600-612. [2] Been, E., Gómez-Olivencia, A., Kramer, P.A., 2012. Lumbar lordosis of extinct hominins. Am. J. Phys. Anthrop. 147, 64-77.[3] Gómez-Olivencia, A., Been, E., Arsuaga, J.L., Stock, J.T., 2013a. The Neandertal vertebral column 1: The cervical spine. J. Hum. Evol. 64, 608-630. [4] Schultz, A. H. 1961. Vertebral column and thorax. Primatologia. 4, 1-66. [5] Nalley, T.K., Grider-Potter, N., 2015. Functional morphology of the primate head and neck. Am. J. Phys. Anthrop. 156, 531-542.

Poster Presentation Number 73, Fr (12:20-13:50)

Stone tool multi-functionality and re-use at Lomekwi 3 (3.3 Ma), West Turkana (Kenya)

Adrian Arroyo[1], Nicholas Taylor[1], Sonia Harmand[1,2], Helene Roche[1], Michel Brenet[3,4], Jason Lewis[2]

1 - CNRS, UMR 7055 Préhistoire et Technologie, Université Paris Ouest Nanterre La Défense, France · 2 - Turkana Basin Institute, Stony Brook University, USA · 3 - CNRS, UMR 5199, PACEA, Université Bordeaux 1, France · 4 - Inrap, Centre Mixte de Recherche Archéologique, Campagne, France

The Nachukui Formation of West Turkana (Kenya) is exceptional for preserving numerous Early Stone Age (ESA) localities spanning the period 3.3 to 0.7 Ma that have greatly enhanced our understanding of Plio-Pleistocene hominin technical and cognitive abilities. Yet in spite of high resolution insights drawn from reconstructions of Oldowan lithic chaînes opératoires, on the western shore of Lake Turkana wider issues concerning stone artefact life history and function(s) remain unexplored. Here we report a case of remarkable flexibility in stone tool use and re-use from Lomekwi 3, a 3.3 Ma archaeological site featuring the world oldest technological repertoire so far identified by the West Turkana Archaeological Project (WTAP) in the Nachukui Formation. A combined approach harnessing techno-typological, experimental, refitting and macro- and microscopic analyses reveals that Lomekwi 3 hominins transformed a single large tabular phonolite cobble in four distinctive exploitation phases incorporating percussive and core-reduction activities, during two or more temporally discrete activity episodes. A clear macroscopic double patina that follows the artefacts' technological features reveals that a period of abandonment separated two initial exploitation phases in which the cobble was used both as an active element (percussor) and knapped by bipolar technique, before being re-used in two subsequent exploitation phases as a passive element (anvil) and then final reduced by passive hammer technique. These results constitute early evidence for flexibility in the conceptualisation, transformative possibilities and potential uses of lithic raw materials and raise questions regarding the impact of resource and site re-use on Pliocene foraging patterns. Moreover, the observation of multiple, sequential and/or pene-contemporaneous technical strategies applied to individual lithic objects has implications for the interpretation of the earliest lithic assemblages. The unexpected degree of stone tool multi-functionality and re-use identified may represent a recurrent archaeological signature of the initial ESA record at 3.3 Ma; behaviours warranting further, targeted investigation.
Acknowledgements: We thank the office of the President of Kenya and the National Museums of Kenya for permission to conduct research; the French Ministry of Foreign Affairs, French National Research Agency (ANR-12-CULT-006-01), Fondation Fyssen, the National Geographic Society and INTM Indigo for financial support; Total Kenya and the Turkana Basin Institute for logistical support.

Poster Presentation Number 107, Fr (12:20-13:50)

The Effect of Body Mass on Bone Morphology

Thomas Atterton[1], Fatima Perez De Heredia Benedicte[1], Claire Stewart[2], Tristan Lowe[3], Maria Del Puy Portillo[4], Leixuri Aquirre [4], Isabelle De Groote[1,5]

1 - Research Centre in Evolutionary Anthropology and Palaeoecology, Liverpool John Moores University · 2 - Stem Cells, Ageing and molecular Physiology Unit, Research Institute for Sport and Exercise Sciences, Liverpool John Moores University · 3 - Manchester X-ray Imaging Facility (MXIF), University of Manchester · 4 - Nutrition and Obesity Research Group, University of the Basque Country · 5 - Earth Sciences Department, The Natural History Museum London

Introduction: A major problem in both palaeoanthropology and archaeology is the distinction between the effects of body mass and activity on skeletal remains in both the archaeological and fossil record. In this pilot study we aimed to provide a new tool with which to determine the effect body mass has on bone, using geometric morphometric shape analysis (GMSA) and cross-sectional strength analysis (CSSA). We studied bones from lean (control) and obese rats (n=9 rats/group) that were raised in metabolic cages and sacrificed at 17 weeks of age. The metabolic cages allowed us to remove activity as a factor as they limit the exercise the rats could partake in. The samples were kindly provided by the Nutrition and Obesity Research Group of the University of the Basque Country. The rat carcasses were micro-CT scanned, at the Manchester X-ray Imaging Facility (MXIF), for femur shape and cross-sectional analysis. Methods: GMSA, on a set of 19 landmarks representing the overall shape of the right femur, was performed using the MorphoJ package in Avizo 9.0 software. CSSA was also performed on the right femur of each rat. Cross-sections were obtained at the midshaft and the most lateral point of the third trochanter and constitute the most variable areas of the femur. ImageJ and the moment macro plugin were used to acquire the cross-sectional properties. Subsequently, stepwise discriminant function analysis (sDFA) was conducted to assess differences between the lean and control rats. Results: The GMSA analysis showed that Principal Component 1 (PC1) explained 50% of the variation in the sample and clearly separates obese from controls. Upon further examination of PC1, the most variable landmark was the medial distal condyle, suggesting that as the rat gets larger, the medial distal epicondyle gets longer. This would indicate greater stress on the medial side of the knee joint due to increased body mass. The CSSA variables TA (Total area of bone), CA (Cortical area of bone), Ix (Anterio-Posterior (AP) bending rigidity), Iy (the medio-lateral (ML) bending rigidity), Imax (Maximum bending rigidity), Imin (Minimum bending rigidity), Imax/Imin (ratio of maximum and minimum bending rigidity), J(second polar moment of area)), Zx (AP bending strength), Zy (ML bending strength) and Theta (orientation of maximum bending rigidity) [1, 2] were significantly different at the 99% level using an independent samples t-test, showing that multiple biomechanical and structural variables alter with the increase in body mass. sDFA was able to discriminate between obese and controls at both midshaft and third trochanter cross-section locations with high cross-validated accuracies. At midshaft, sDFA classified both groups with an accuracy of 88.9%, cross-validated at 83.3%. Third trochanter cross-sectional properties classified the groups successfully with an accuracy of 100%, cross-validated at 94.1%. At midshaft, only Iy was retained in the sDFA. The obese rats had a larger mean Iy value (0.72 ± 0.7) compared to the controls (-0.74 ± 0.64), indicating that as body mass of rodents increased, so did bending rigidity in the ML direction. At third trochanter there were three steps in the sDFA using the properties Zy, Theta and Imax/Imin, respectively. Zy and Theta were significantly larger in the obese (0.71±0.70 and -88.93±0.29, respectively) than in controls (-0.77±0.64 and -89.41±0.15, respectively), while Imax/Imin was larger in the controls (241.46±21.81) compared to the obese rats (211.53±33.57). These results suggest that Zy, Theta and Imax/Imin at third trochanter can change due to differing stresses on muscles around the femoral shaft, particularly in the medio-lateral plane. In conclusion, this pilot study confirms the usefulness of GMSA and CSSA to discriminate between remains of lean and obese individuals, and constitutes a preliminary step in our ability to distinguish the effects of body mass from activity in the archaeological record.

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Poster Presentation Number 82, Fr (12:20-13:50)

The Middle Stone Age lithic assemblages of Umbeli belli Rock Shelter in KwaZulu-Natal, South Africa

Gregor Donatus Bader[1], **Nicholas John Conard**[1]

1 - Department of Early Prehistory and Quaternary Ecology & Senckenberg Centre for Human Evolution and Palaeoenvironment, University of Tübingen

Since the first important publication on the Middle Stone Age (MSA) of South Africa by Goodwin and van Riet Lowe in 1929 [1], research in the country has helped shape our view of this period. Starting in the late 1980ies, when it became clear that the oldest remains of anatomically modern humans are associated with the MSA, research in South Africa has intensified and contributed greatly to our understanding of human evolution and African perhistory. Many MSA sites that have been excavated and published in recent years including Blombos Cave, Klasies River, Diepkoof or Pinnacle Point are located along the western and southern coastal belt. By contrast the whole region of KwaZulu-Natal provides only a limited number of sites. Altogether, only 5 MSA sites are known from this region. These are Sibudu, Umhlatuzana, Border Cave, Holley Shelter and Umbeli belli. Furthermore only the first three of them are published in an adequate way, while Holley Shelter was recently studied by the authors [2]. In order to increase our knowledge of the MSA in KwaZulu-Natal, we recently started a lithic analysis of the MSA material of Umbeli belli. The site is situated near Scottsbourgh overlooking the Mpambanyoni river and was excavated in 1979 by Charles Cable [3] using careful methods including sediment sieving through a 5 mm mesh and defined geological horizons. Umbeli belli provided three Later Stone Age (LSA) layers at the top of about 20 cm thickness and a 1 m thick MSA deposit below, which Cable excavated in 9 spits. Here we present our first results in terms of lithic technology from the lowermost 3 Spits (6, 5C, 5B) of the MSA deposit. In order to get a controlled sample we used a cut off size of 3 cm. However in all spits the small debitage is preserved and amounts of several thousand pieces. In the lowest spit 6, people used hornfels, dolerite, quartz and quartzite in comparable amounts. All pieces are unretouched blanks with the exception of one bifacial preform. Many pieces show cobble like cortex pointing to the frequent use of river cobbles as raw material. Since spit 6 contained only 20 pieces >3cm it is not adequate for providing statistical valuable data. Spit 5C contains 350 pieces, spit 5B over 600 and both many thousand pieces of small debitage. In general the two spits differ only in terms of artefact density. During their deposition the sites occupants mainly knapped hornfels followed by dolerite. To a more limited amount they used also quartz, quartzite, mudstone, sandstone, shale and ccs. Hornfels and dolerite pieces show mostly cobble like cortex, as do many pieces from quartz, quartzite and sandstone . In terms of technology, the knappers used platform cores mostly but also discoidal and Levallois cores are present. About 85 % of the blanks are flakes and another 15 % are blades and points. Few of the platforms are facetted and most pieces show plain or cortical, mostly thin platforms. The tool component is with 20 % in 5C and 17 % in 5B high for MSA standards but comparable to for example the post-Howiesons poort of Sibudu. Knappers produced mostly pointed forms, including unifacial and bifacial points, but also scrapers. Unifacial points however occur about twice as often as bifacial points. All of them show intensive surface shaping, pointing to the use of soft hammer percussion. Within the small debitage many pieces could have been identified as surface shaping flakes providing characteristic attributes like sharp platform angle, lip, fan like shape and broken profile. This supports on the one hand the stratigraphic integrity of the site and shows on the other that these tools have produced directly on the site. Our preliminary work represents a starting point for future research including a complete analysis of the collection, as well as new excavations at the site using modern standards.

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Poster Presentation Number 48, Th (17:00-19:00)

Internal cranial anatomy of Broken Hill 1

Antoine Balzeau[1,2,3], **Laura T. Buck**[4,5], **Dominique Grimaud-Hervé**[1,2], **Chris B. Stringer**[4]

1 - Équipe de Paléontologie Humaine, UMR 7194 du CNRS · 2 - Département de Préhistoire du Muséum national d'Histoire naturelle, Paris, France · 3 - Department of African Zoology, Royal Museum for Central Africa · 4 - Earth Sciences Department, Natural History Museum, London, UK · 5 - ADaPt Project, Division of Biological Anthropology, University of Cambridge, UK

The fossil cranium from Broken Hill (Broken Hill, Northern Rhodesia, now Kabwe, Zambia) is a key specimen in the study of human evolution. It is one of the best preserved fossils from the Middle Pleistocene, a period over which there is currently much debate within palaeoanthropology, and some special anatomical features displayed by Broken Hill 1 make its taxonomic attribution particularly controversial even within this group. We give a precise description of the internal anatomical features of Broken Hill 1, including the distribution of cranial vault thickness and its internal composition, the size of paranasal pneumatisation, the morphology of the temporal pneumatisation and the endocranial anatomy, including the endocast. The study of these informative parameters requires, or is facilitated by, high resolution microCT data, which has not previously been employed for overall studies of this important specimen. Following description of the fossil, comparisons are made with data on other chronologically and taxonomically relevant specimens from our previously published studies of the anatomical features analysed. Broken Hill 1 shows some unusual anatomical features, such as marked frontal paranasal pneumatisation and a fairly high cranial vault thickness. However, for many of the features analysed, this fossil does not exhibit the apomorphic conditions observed in either Neanderthals or among *Homo sapiens*, as its idiosyncrasies can be partly explained by an allometric relationship relative to the features observed in *Homo erectus sensu lato* and are thus likely to be symplesiomorphic. These original findings on the internal morphology of the Broken Hill 1 cranium provide new information that aids the interpretation and understanding of hominin evolution and particularly adds to the discussion of the contribution of this important fossil to that story. More complete descriptions of other key fossil hominins and of their internal cranial features will be necessary before it is possible to discuss further the status, the definition and the geographic extension of *Homo heidelbergensis* and/or *Homo rhodesiensis*.

Poster Presentation Number 41, Th (17:00-19:00)

Is Algae Scooping Within Chimpanzees' Zone of Latent Solutions?

Elisa Bandini[1], **Sarah Beck**[1], **Claudio Tennie**[1]

1 - The University of Birmingham

Chimpanzees (*Pan t. troglodytes*) have often been described as having one of the most extensive repertoires of cultural behaviours in the animal kingdom [1]. However, much contention over the definition of culture and the origins and transmission mechanisms of these behaviours still remains. Whiten et al. [2] collected data on chimpanzee behaviours across six long-term African field sites, categorising 39 behaviours as 'cultural' due to the fact that they were present in two or more sites but practiced slightly differently across these communities. Algae scooping, a behaviour in which wild chimpanzees in Bossou, Guinea, use tools to feed on aquatic algae, did not reach cultural status because Whiten et al. reported it only in Bossou but absent due to ecological explanations in all other sites. Recent observations of the algae and the same scooping behaviour at two other sites (in Mahale, Tanzania and Odzala National Park, The Republic of Congo) now suggest that this classification is no longer valid, and following Whiten et al.s' requirements [2], algae scooping would now be listed as a cultural chimpanzee behaviour. Whiten et al. claim that cultural behaviours do not spread throughout chimpanzee communities without some form of social learning. Humle et al. [3] further purport Whiten et al.'s statement by suggesting that algae scooping in Bossou demonstrates complex forms of social transmission due to the slight differences in intracommunity technique. However, very little is actually known about the origins and transmission methods of this behaviour. In this study we hypothesised that the base technique of algae scooping might be within the chimpanzee's Zone of Latent Solutions [4]. The Zone of Latent Solutions is a species' cognitive repertoire. In this study we presented two groups of captive chimpanzees with all the ecological requirements for algae scooping in order to see whether the behaviour arose spontaneously, and therefore could be considered within the species' cognitive repertoire, or if it required some form of social learning to develop and spread. Naïve chimpanzees in both groups spontaneously used tools and a scooping technique very similar to their wild counterparts. This suggests that algae scooping is a behaviour within chimpanzee's Zone of Latent Solutions. This does not completely rule out social transmission playing a role in the individual actions of the technique, however, we suggest that on a basic level the behaviour derives from chimpanzee's cognitive repertoire and does not necessarily require social learning to develop. This research highlights the importance of re-examining wild chimpanzee behaviours that have been classified as cultural in order to fully understand their origins and transmission mechanisms. Further research on chimpanzee's Zone of Latent Solutions may also aid in informing our understanding on the evolution of early human cognition and material culture.
Acknowledgements: EB would like to thank Twycross Zoo for their much appreciated collaboration. This research was made possible through funding from the Economic and Social Research Council.

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Podium Presentation: Session 10A, Sa (14:50)

Paleolithic signatures from European glacial refugia revealed by mtDNA genomes

Chiara Barbieri[1,2], Sara De Fanti[2], Stefania Sarno[2], Federica Sevini[2], Dario Vianello[2], Erika Tamm[3], Ene Metspalu[3], Mannis van Oven[4], Marco Sazzini[2], Claudio Franceschi[2], Davide Pettener[2], Donata Luiselli[2]

1 - Max Planck Institute for Evolutionary Anthropology · 2 - Università di Bologna · 3 - Estonian Biocentre · 4 - Erasmus MC – University Medical Center Rotterdam

The southern regions of Europe represent one of the earliest routes of dispersal into the continent from the Middle East. During the glacial phase, southern refugia became cores of diversity and deeply influenced the subsequent re-colonization of the continent at the end of the Paleolithic. Southern Italy is geographically centered in the Mediterranean and corresponds to one of the major glacial refugia, but its role in the process was so far scarcely considered from an Anthropological Genetics perspective. Molecular studies already addressed the pre-Neolithic dynamics in the continent, tracing genetic signatures of the early inhabitants, for instance with the study of early divergent lineages still found in contemporary human populations. One of them is mitochondrial haplogroup HV*(xH,V), a poorly investigated branch whose precise internal phylogeny reconstruction is complicated by the occurrence of instable mutations. Its spread is associated with a recent population expansion from the Franco-Cantabrian glacial refugium, a region where most of the samples reported in literature come from. The possibility of carefully mapping the genetic variation in contemporary populations and of verifying pre-Neolithic signals in key regions depends primarily on the availability of unbiased datasets, and on the resolution power of the markers analyzed.

In this study, we analyze complete mtDNA genome sequences from ~300 individuals belonging to haplogroup HV* (i.e. HV with the exception of its subclades H and V), including newly generated sequences from 60 Italian individuals retrieved from a comprehensive survey of the Italian uniparental genetic landscape. Accurate phylogenetic analyses carried out with BEAST and networks are compared to previous knowledge of this haplogroup, allowing us to refine the phylogenetic and temporal topology of the most relevant nodes. We confirm a major signal of expansion that probably followed the Late Glacial Maximum and preceded Neolithic population movements. We are also able to detect signals of ancient structure connecting Italy to Eastern Europe and to the Middle East, suggesting the important role played by the Italian peninsula in the pre-Neolithic colonization of the European continent. Furthermore, we discover new lineages, some of which appear to be endemic to Italy. We therefore suggest that Italy played a pivotal role as a reservoir of mtDNA diversity during the glacial phase. We finally contextualize our results with the prehistory of Southern Italy, where Mesolithic and Neolithic material cultures exhibit strong signs of continuity.

Our results contribute to a more exhaustive review of the pre-Neolithic dynamics in Southern Europe, broadening our understanding of the diffusion of early modern humans in the continent.

Podium Presentation: Session 10A, Sa (13:50)

Chronology of Zafarraya, Spain, and its relevance to the debate on the disappearance of the last Neanderthals in the South of the Iberian peninsula

Cecilio Barroso[1], **Miguel Caparros**[2]

1 - Fundación Instituto de Investigación de Prehistoria y Evolución Humana Lucena, Córdoba · 2 - Muséum National d'Histoire Naturelle, Département de Préhistoire, Paris

Neanderthal human remains corresponding to a minimum number of 9 individuals with ages of beween 14 months and 30 years were unearthed in the cave of the Boquete de Zafarraya, Spain, during archaeological excavations led by Cecilio Barroso Ruiz [1] in 1982-1983 and 1992-1994. These fossils were found in Mousterian stratigraphic levels with a significant lithic assemblage characterized by a large Levallois technology percentage with a typology including flakes, side scrapers, denticulates, Mousterian points, etc. These beds included also a substantial faunal record made up of large herbivores (*Capra pyrenaica, Cervus elaphus, Sus scrofa, Bos primigenius, Rupicapra pirenaica, Equus caballus, Equus hydruntinus*), carnivores (*Panthera pardus, Cuon alpinus, Crocuta crocuta, Ursus arctos, Vulpes vulpes, Lynx pardina*), lagomorphs, insectivores, chiropters, and avifauna. These assemblages were found in a precise stratigraphic context with a rigorous excavation methodology. Based on biostratigraphic analysis, the initial chronology attributed to the site suggested that the Pleistocene sedimentary levels were late in their formation (inter Würm II-III or even Würm III) which supposedly reflected a late survival of Neanderthals in Andalucia, Southern Spain. Various dating techniques [2] such as C-14, U/Th, ESR and RAA were utilized with the aim of finding a more reliable age to confirm the late presence of Neanderthals in Zafarraya estimated at betwen 31,000 to 33,000 years BP [3]. Recent dating results obtained by Michel [4], and in particular Wood [5], are significant and shed new light on the debate related to the paradigm of the late survival of Neanderthals in Southern Spain. Most interesting is the fact that a fauna sample next to the Neanderthal remains previously dated at 33,300 ± 1,200 BP, resulted in an increased age of >46700 BP with the ultrafiltration protocol developped by the C14 laboratory at the University of Oxford [5]. Furthermore, in the same research, two bones treated for the first time produced an infinite date while the other provided a date of 46300 ± 2,500 BP, close to the limit of the method. These results cast doubts on the late survival of Neanderthals in Zafarraya. Therefore, on the basis of these recently published chronology studies, we suggest that the question of the "late survival of Neanderthals" in other archaeological sites of the South of the Iberian peninsula must be reassesed in order to clarify such an important issue in European human palaeontology and prehistory.

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Podium Presentation: Session 2, Th (13:20)

The MSA/LSA transition in North Africa: population continuity or not?

Nicholas Barton[1], **Abdeljalil Bouzouggar**[2], **Simon Collcutt**[3], **Jacob Morales**[4], **Laine Clark-Balzan**[5]

1 - University of Oxford · 2 – INSAP, University of Rabat · 3 – OAA Ltd · 4 – University of Gran Canaria · 5 – RLAHA, University of Oxford

In North Africa it has been assumed that a major population change occurred in the Late Pleistocene which coincided with the cultural transition from the Middle Stone Age (MSA/Aterian) to the Later Stone Age (LSA/Iberomaurusian). The nature and timing of this cultural transition has however been the subject of intense debate [1-3]. According to recent phylogenetic studies an early dispersal of M1 and U6 lineages into North Africa occurred at ∼40-45 ka (thousands of years ago) [4], which would support a potentially 'early' date for this transition. Conversely, other studies have suggested multiple events with a major expansion of the U6 lineages in North Africa ∼22 ka [5]. The latter would imply a 'later' age for the replacement of MSA by the LSA.

Up until now it has been difficult to test such ideas directly against the archaeological record because of the absence of reliable dating evidence from sites covering this timespan. In this paper we report on new results of work on MSA and LSA deposits from Taforalt Cave in Morocco. We describe dates using multiple methods (OSL, TL and AMS radiocarbon) from the youngest MSA levels that contain a Levallois flake industry with the frequent occurrence of side scrapers. The sediments are also noteworthy for the presence of rich hearth layers which contain fauna and abundant carbonised plant remains including seeds of several edible plant species, most notably grain legumes. According to present estimates the MSA lasted until at least 27-28 ka ago. These levels are succeeded chronologically by those with a non-Levallois flake industry dating to 20.4 ka ago and a long sequence of LSA Iberomaurusian deposits beginning at 18.1 ka ago. This would tend to favour a younger replacement age model and suggests the MSA persisted later in this region than it did in Southern Africa or western Eurasia.

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Podium Presentation: Session 11B, Sa (15:40)

The Late Middle Palaeolithic open-air site complex of 'Ein Qashish, northern Israel

Omry Barzilai[1], Ravid Ekshtain[2,3], Ariel Malinsky-Buller[2], Noam Greenbaum[4], Nuha Agha[1], Nadav Nir[3], Ruth Shahack-Gross[5], Mareike C. Stahlschmidt[6], Lena Brilovsky[2], Maria Krakovsky[2], Netta Mitki[2], Polina Spivak[1], Ariel Vered[1], Yoel Roskin[7], Naomi Porat[8], Micka Ullman[2], Erella Hovers[2]

1 - Israel Antiquities Authority, Jerusalem, Israel · 2 - Institute of Archaeology, The Hebrew University of Jerusalem, Israel · 3 - Department of Anthropology, Harvard University, USA · 4 - Department of Geography & Environmental Studies, University of Haifa, Israel · 5 - Kimmel Center, Weizmann Institute of Science, Rehovot, Israel · 6 - Institute for Archaeological Sciences, University of Tübingen, Germany · 7 – Department of Maritime Civilizations, University of Haifa, Israel · 8 – Luminescence Dating Lab, Geological Survey of Israel, Jerusalem, Israel

The Late Middle Paleolithic (LMP) settlement patterns in the Levant were multifaceted and included repeated usage of caves for habitations in the Mediterranean woodland region as well as recurring visits to favorable localities within the open landscape for various tasks. Historically, caves have been the focus of research in the Mediterranean zone. The discovery of several LMP open-air sites in this region over the last decade shifted some of the focus to LMP behaviors associated with the open landscape . One of these sites is 'Ein Qashish, discovered in 2004 and excavated between 2009-2011 [2-3]. Due to highway construction works the site was subjected in 2013 to an extensive salvage excavation that exposed a total area of 650 m2 to a maximum depth of 4.5 m, which revealed a stratified open-air site complex. 'Ein Qashish is located in the Jezreel Valley, ca. 25 km east of Mount Carmel cave sites. The site contains a sequence of at least four archaeological levels all situated on the flood plain of the paleo-Qishon stream. The archaeological levels were dated by OSL that placed the entire sequence between 70-60 ka, comparable in age to the LMP sites of Kebara and Amud caves. The archaeological levels at Ein Qashish differ in their micro-environments, taphonomies, artifact densities, and some characteristics of lithic and faunal assemblages. Levallois technology is present in low frequencies in all the levels, and in some cases, pointed and elongated items relative frequencies is higher. Assemblage compositions indicate on-site core reduction, combined with import of finished items. Technological refits were found in three of the assemblages. The faunal remains, containing cut marked bones, include ungulate species known from caves (gazelle, fallow deer) as well as large bovids (e.g., aurochs) that are rare in cave sites. Inter-assemblage differences in the densities and the preservation of lithic and faunal finds are only partially attributed to taphonomic agents, which suggests that they reflect differences in the nature and intensity of activities in the various occupation horizons. Special finds include an imported Hexaplex trunculus shell from the Mediterranean, ochre, pitted stone anvils, and human remains attributed to Neanderthals. The series of the archaeological levels at Ein Qashish provides an extraordinary opportunity to study the Levantine LMP settlement systems from a landscape perspective, emphasizing their diversity and illuminating ecological and social factors that shaped these systems.

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Podium Presentation: Session 3A, Th (15:20)

The 3D structure of thoracic vertebrae and their significance for size and shape of the ribcage in Neandertals

Markus Bastir[1], **Daniel García-Martínez**[1], **Alon Barash**[2]

1 - Museo Nacional de Ciencias Naturales (CSIC), Madrid, Spain · 2 - Faculty of Medicine Galilee, Bar Ilan University, Zefat, Israel

Previous studies of rib morphology have suggested increased thorax capacity in Neandertals when compared to modern humans [1-3]. However, the thorax consists of the vertebral spine, the ribs, and the sternal complex. Therefore assessments of thorax capacity on ribs only might not provide a complete picture. The three-dimensional spatial configuration of the thoracic vertebrae is important for the understanding of the size and shape of the thorax because the vertebral body and transverse processes provide the articulation and attachment sites for the ribs. Recent research on sexual dimorphism of thoracic vertebrae in modern humans has shown that the dorsal flexion of the transverse processes relative to the vertebral body in males is greater than in females [4]. This difference in the orientation of transverse processes rotates the attached ribs in a way that increases thorax width and could thus be a further mechanism contributing to Neanderthal thorax size. In addition, increased dorsal flexion of the transverse processes is discussed regarding thoraco-lumbar spine curvatures and related to spine invagination, an anatomical adaptation of the trunk to bipedal posture [5]. Here we used 3D geometric morphometrics to analyze 46 landmarks of thoracic vertebrae ranging from levels 1 to 10 from a modern human reference sample (N=239) and compare these with thoracic vertebra from three Neandertal males: Kebara 2 (N=10), La Ferrassie 1 (N=3), La Chapelle aux Saints 1 (N=6). We explored size and shape variation and addressed the hypothesis that the transverse processes of thoracic vertebrae of Neandertals are more dorsally oriented than in modern humans. Centroid size analysis suggests that thoracic vertebrae are consistently larger in Neandertals. Shape analyses do not support the hypothesis of greater dorsal transverse process orientation in upper Neandertal thoracic vertebrae. However, we found a clear trend towards more dorsally flexed transverse processes in the lower thoracic vertebrae of the Neandertal sample. In addition, 3D analysis also indicated a less caudal inclination of their spinous processes. These findings support the hypothesis that the lower ribcage of Neandertals was capacious not only because of longer ribs [3], but also by interplay between longer ribs and more dorsally flexed transverse processes. Differences in size and other shape features imply a different morphological pattern of the overall thoracic spine morphology in Neandertals [5]. Enlarged lower thorax capacity affects also the static properties and the postural stability of the Neandertal trunk and should be reflected by modifications of the lower spine. The observed differences in dorsal transverse process flexion are compatible with greater invagination particularly of the lower spine. This could account for necessary coordination between rib cage proportions and spino-pelvic alignment [5]. Although the morphological features of thoracic vertebrae reported here establish a clear link between the respiratory apparatus, the locomotor system and Neandertal body shape as an integrated lower trunk system, more research on the interaction between thorax morphology and spine curvatures is necessary.

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Acknowledgements: We thank Ella Been, Asier Gómez-Olivencia and the Paleoanthropology Group MNCN for discussions.

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Podium Presentation: Session 6B, Fr (14:30)

Seasonal variation in rainfall at Allia Bay, Kenya 3.97 Ma

Melanie Beasley[1], Ian Orland[2], John Valley[2], Margaret Schoeninger[1]

1 - Dept of Anthropology, University of California, San Diego · 2 - Dept of Geosciences, University of Wisconsin, Madison

The ecological niche that early hominins exploited is assumed to have played an essential role in the origins of our lineage and selection for distinguishing characteristics such as bipedalism. Therefore, reconstructing the paleoenvironment is essential for understanding the contributing and motivating factors that resulted in such significant morphological changes. Paleoenvironmental reconstructions in East Africa often rely on surface-collected fossil fauna species lists, carbon isotopes from paleosol carbonates, and bulk carbon and oxygen isotope data from tooth enamel to interpret the past environment. However, these types of data traditionally combine multiple temporal and geographically dispersed components. This project will reconstruct seasonal patterns of rainfall 3.97±0.03 Ma at Allia Bay, Kenya to refine the definition of a mosaic paleoenvironment of *Australopithecus anamensis*, the earliest confirmed obligate hominin biped. Seasonal rainfall patterns are reconstructed using a secondary ion mass spectrometer (SIMS) to generate high-resolution serial spot analyses (13 μm spots) of stable oxygen isotopes in fossil faunal tooth enamel ($\delta^{18}O_{en}$) from a well-characterized excavation. Area 261-1 at Allia Bay represents one of the few excavations in East Africa with *in situ* material recovered with deposition limited to approximately 60 ka of time that ensures relatively high-temporal-resolution paleoenvironment data will be generated. At tropical latitudes, where Allia Bay is located, seasonal changes in precipitation amounts can result in major shifts in vegetation in open grassland habitats. In contrast, seasonality has limited impact to vegetation in forest ecosystem. The oxygen isotope ratios in enamel of non-drinking species will track intra-annual changes in relative humidity and those of water-dependent species will track variation in precipitation amounts. The fossil enamel analyzed in this study represent fauna occupying the Turkana Basin during a fluvial phase when the Omo River (originating in the Ethiopian Highlands) provided the most important water source, which based on previous work, would have tracked the precipitation changes. This presentation will highlight the variable seasonality recorded during enamel development for browsers (giraffidae, elephantidae, and deinotheriidae) and grazers (hippopotamidae, suidae and bovidae) indicating the different seasonal impact to $\delta^{18}O_{en}$ within a single mosaic habitat. For mid-sized herbivores, enamel deposition occurs at an approximate daily rate of 10 μm, which is within the SIMS spot analysis capability. Previous serial samples of bulk powder enamel in modern gazelle teeth indicate that the seasonal rainfall at Lake Turkana has an intra-annual variation of approximately $\Delta^{18}O_{en}$ = 2.5‰ [1]. The fossil samples represent intra-annual variation with the approximate range of amplitude difference in seasonal change in oxygen isotope values being as follows: browsers = 3.4‰; grazers (suidae and bovidae) = 2.4‰; hippopotamidae = 1.4‰. Overall the range of $\Delta^{18}O$ values fluctuated for the species by 9‰ for the browsers and by 10‰ for the grazers at the site during the period of enamel development represented by these samples. This snapshot of seasonal rainfall recorded at Allia Bay suggests a great amount of variation in the source oxygen isotope values that *Au. anamensis* would have had to cope with during its occupation at the site. Phylogenetic analysis suggests that each site-sample associated with *Au. anamensis* and *Au. afarensis* captures a different point along the evolutionary trajectory of early hominins, so it is critical to reconstruct the paleoenvironment of each site to evaluate the interplay between habitat and human evolution. These first-ever site- and time-specific ecological data are a step toward understanding the seasonality of the environment where our unique locomotor system flourished.

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Poster Presentation Number 28, Th (17:00-19:00)

Chronometric investigations of the Middle to Upper Palaeolithic transition in the Zagros Mountains

Lorena Becerra-Valdivia [1], **Katerina Douka**[1], **Behrouz Bazgir**[2,3], **Marcel Otte**[4], **Thomas Higham**[1]

1 - RLAHA, University of Oxford · 2 - Institut Català de Paleoecologia Humana i Evolució Social · 3 - Universitat Rovira i Virgili · 4 - Université de Liège

The Middle to Upper Palaeolithic transition is often linked with a bio-cultural shift involving the arrival of modern humans and the concomitant replacement of Neanderthal populations across Eurasia. The region encompassed by the Zagros Mountains assumes importance in discussions of the movement of early modern humans out of Africa, as its geographic location is central to all pertinent migrational areas—Asia, Europe, and the Middle East—pointing to east and west. Consequently, the establishment of a reliable chronology in the area is crucial in the understanding of hominin dispersal during this period and the cultural developments it ignited. However, due to a 20-year hiatus in archaeological investigation within Iran, and the poor preservation of organic material extracted from archaeological sites in the Zagros Mountains, a clear chronological definition of the Middle to Upper Palaeolithic transition has not yet been fully accomplished. Indeed, very few dates obtained through use of absolute dating methods have been obtained and subsequently published [1, 2, 3]. To improve this situation, work has begun in the radiocarbon dating of organic materials, including faunal bone, charcoal, seeds, and shell from the archaeological sites of Kobeh Cave, Kaldar Cave, Ghār-e Boof, and Shanidar Cave. In this process, a suite of advanced methodologies have been employed, which include (i) the pre-screening of bone samples using %N as marker for determining collagen content for use in radiocarbon dating [4]; (ii) rigorous sample pre-treatment protocols designed to remove exogenous contaminants, such as the acid–base-oxidation/stepped combustion (ABOx–SC) method for charcoal [5]; and (iii) the calibration and Bayesian modelling of resulting AMS radiocarbon determinations using the software OxCal 4.2. As such, this poster will present new chronometric data obtained for the aforementioned archaeological sites, including the implications of the results for hominin dispersal during the Middle to Upper Palaeolithic transition in the region and beyond.

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Podium Presentation: Session 9, Sa (12:00)

Human Remains from the Late Middle Paleolithic Open-Air Site of 'Ein Qashish, Yizra'el Valley, Israel

Ella Been[1,2], Lihi Levin[1], Omry Barzilai[3], Ravid Ekshtain[4], Ariel Malinsky-Buller[4], Noam Greenbaum [5], Nuha Agha[4], Yoel Rak[6], Erella Hovers[4]

1 - Department of Anatomy and Anthropology, Tel Aviv University · 2 - Department of Physical Therapy, Ono Academic College · 3 - Israel Antiquities Authority · 4 - Institute of Archaeology, The Hebrew University of Jerusalem · 5 - Department of Geography and Environmental Studies, University of Haifa · 6 - Department of Anatomy and Anthropology, Sackler Faculty of Medicine, Tel Aviv University

'Ein Qashish is an open-air, late Middle Paleolithic site located on the bank of the Qishon River, on the eastern piedmont of Mt. Carmel in the Yizra'el Valley, Israel. This location is interesting because it is close to many of the major Middle Paleolithic cave sites in northern Israel, in an area where no open-air sites were previously known. The site is situated on the paleo-floodplain of the Qishon stream, where many relatively high-energy tributaries flowed from the steep slopes of Mt. Carmel into the main, low-energy channel. An extensive salvage excavation (~650 m2) in 2013 revealed the presence of at least four Middle Paleolithic occupation horizons in a 4.5 m sedimentary sequence, the top of which is 3.5 m below the present-day surface. These occupations were dated by optically stimulated luminescence (OSL) to 70-60 ka. All the occupations are associated with the Middle Paleolithic on the basis of lithic assemblage characteristics. Human remains were found in three stratigraphic layers. One of these occurrences consisted of one femur, two tibiae, and two fibulae in spatial association on one of the better-preserved occupation horizons. Out of the five lower-limb bones, only the femur and two tibiae are preserved well enough for study. The purpose of this study is to investigate and describe the taxonomic affiliation, age, and sex of these bones. Such fossils are of importance given the age of the site and the complex population dynamics that have been proposed recently for Middle Paleolithic hominin groups in the Levant. Results: The left femur is nearly complete from head to articular condyles. Its overall shape is robust and highly curved, with the apex of the curvature located distal to the midshaft. The midshaft shape ratio (pilastric index, 99.1%) indicates a rounded cross section. The midshaft robusticity index (14.9) is very high compared with that of *Homo sapiens* and Neandertals. The distal articular surfaces are small in relation to femur length, and the distal epiphysis is not completely fused. Both tibiae are fragmentary and slightly deformed. Their shafts are noticeably narrow mediolaterally, with an almond-shaped cross section. The crural index (0.81) indicates that the tibiae are short in relation to femur length. Discussion: The two hominins known from the second half of the Middle Paleolithic period (120-50 ka) in northern Israel are *H. sapiens* and *H. neanderthalensis*. The high robusticity index of the femoral shaft, its rounded cross section, and its high degree of curvature are characteristics that are well documented in Neandertals and lie in contrast to the oval and more gracile shape of the midshaft in *H. sapiens*. The combination of these characteristics in the 'Ein Qashish femur strongly suggests that the bones belonged to a Neandertal. The almond-shaped cross section of the tibial shaft and the low crural index reinforce this conclusion. On the basis of the long bones' length and the degree of epiphyseal fusion, the bones from 'Ein Qashish appear to belong to a young adult (18-25y). The femur falls at or above the mean for Neandertal males in terms of both length and robusticity. The tibiae present a somewhat more complex picture: whereas the tibial length falls above the mean for Neandertal males and females, the tibial robusticity lies closer to the mean value for Neandertal females than for Neandertal males. The remains from 'Ein Qashish constitute the first find of bones in a Levantine Middle Paleolithic open-air archaeological site and one of the few such finds in Eurasia. Investigations of the specific contextual relationship between the bones and the material culture evidence are currently under way. Our analysis indicates that the bones most likely belong to one individual (although they were discovered unarticulated), a young adult male Neandertal. This find is an addition to other skeletal remains from the Levant that have been attributed to this population.

Poster Presentation Number 62, Th (17:00-19:00)

A new hominoid locality from the late Miocene of Hungary

David Begun[1]

1 - University of Toronto

Surface survey of the late Miocene sediments surrounding a small gypsum mine in the Hungarian village of Alsótekekes (48° 25'295."N, 20° 39'28.8"E; Alt. 495 m) resulted in the recovery of a deciduous upper central incisor of a hominoid. Previous surveys and some sediment processing at the site have recovered a few fossils. The paleontological evidence is insufficient to be completely confident in the age of this new locality, but the meager collection of fossils is nevertheless consistent with the age of the R.II locality at Rudabánya, best known for the presence of the stem hominine *Rudapithecus hungaricus*. Rudabánya is an extremely rich paleontological assemblage dated to 10 Ma (MN 9.) The presence at Alsótekekes of *Hippotherium* and *Anapithecus*, found together only in Vallesian age localities (MN9-10) and an insectivore fauna most similar to that from Rudabánya and Can LLobateres (MN 9), strongly suggests an early Vallesian age (MN 9.) Alsótekekes is about 5 km from Rudabánya and the geomorphology of the region is also consistent with the conclusion that both sites are similar in age. The interpretation of the insectivore assemblage suggests that Alsótekekes may be slightly older than Rudabánya. The morphology of the hominoid specimen is clearly that of a great ape, though the deciduous I1 is not known for any European Miocene ape, making comparisons with other European great apes impossible. Features typical of adult incisors such as median pillars, mesial and lateral ridges and cresting are absent. The tooth is long relative to breadth and has an elongated root with an oval cross section. The incisive edge is minimally worn but there is polishing on the entire tooth surface. Labially a longitudinal groove runs from a notch on the cervix part way toward the incisive edge. Lingually a similar groove runs from a barely perceptible lingual cingulum to the incisive edge. The overall morphology is clearly inconsistent with that of either a pliopithecoid or a cercopithecoid, as is the size, but more specimens are needed to determine to which known hominoid, if any, this specimen can be attributed.
Acknowledgements: Research supported by NSERC.

Podium Presentation: Session 5, Fr (11:40)

The makers of the Protoaurignacian and implications for Neandertal extinction

Stefano Benazzi[1], Viviane Slon[2], Sahra Talamo[3], Fabio Negrino[4], Marco Peresani[5], Shara Bailey[6], Susanna Sawyer[2], Daniele Panetta[7], Giuseppe Vicino[8], Elisabetta Starnini[9], Marcello A. Mannino[3], Piero A. Salvadori[7], Matthias Meyer[2], Svante Pääbo[2], Jean-Jacques Hublin[3]

1 - Department of Cultural Heritage, University of Bologna · 2 - Department of Evolutionary Genetics, Max Planck Institute for Evolutionary Anthropology · 3 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology · 4 - Dipartimento di Antichità, Filosofia, Storia e Geografia, Università di Genova · 5 - Sezione di Scienze Preistoriche e Antropologiche, Dipartimento di Studi Umanistici, Università di Ferrara · 6 - Center for the Study of Human Origins, Department of Anthropology, New York University · 7 - CNR Institute of Clinical Physiology, National Research Council, Pisa, Italy · 8 – Museo Archeologico del Finale · 9 – Scuola di Scienze Umanistiche, Dipartimento di Studi Storici, Università di Torino

The timing and pattern of the biological and cultural shifts that occurred in Western Europe around 45,000-35,000 calendar years ago (cal BP) fuel continuous debates among paleoanthropologists and prehistorians [1, 2]. During this time period, Neandertals were replaced by anatomically modern humans (AMH), and a variety of "transitional" and early Upper Paleolithic cultures emerged. Among them, the Protoaurignacian is crucial to the current debate about the timing of arrival of AMH and their interaction with Neandertals, although it remains uncertain who were the makers of this culture [3]. Here we provide evidence that at two sites in Northern Italy the Protoaurignacian is associated with AMH, through the investigation of a lower left lateral deciduous incisor (Ldi_2) from Riparo Bombrini (Western Ligurian Alps, Italy) and an upper right lateral deciduous incisor (Rdi^2) from Grotta di Fumane (Western Lessini Mountains, Italy). We used digital morphometric methods based on microtomographic data to analyze the three-dimensional relative enamel thickness (RET) index of the Bombrini tooth. We also analyzed the mitochondrial DNA from the Fumane 2 dental specimen. The RET index of Bombrini is higher than any values obtained for Neandertals and is close to the AMH mean. The Fumane 2 mitochondrial genome falls within the variation of modern humans and basally in haplogroup R. In addition, new chronometric data for the Protoaurignacian of Riparo Bombrini show that the tooth falls between 40,710 and 35,640 cal BP. The Grotta di Fumane tooth, based on the recent dating of the Protoaurignacian sequence, dates from 41,110 to 38,500 cal BP [4]. These teeth are the oldest human remains in an Aurignacian-related archeological context, suggesting that by 41,000 cal BP, AMH of Protoaurignacian culture spread into Southern Europe along the Mediterranean coast. Since the last Neandertals date to 41,030-39,260 cal BP [5], we suggest that the Protoaurignacian triggered the demise of Neandertals in this part of Europe.

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Podium Presentation: Session 2, Th (13:40)

Virtual reconstruction of the mandible ATD6-96 (Gran Dolina-TD6, Sierra de Atapuerca, Spain) and the reassessment of the taxonomical signal of *Homo antecessor* mandibles

José María Bermúdez de Castro[1], Laura Martín-Francés[1], María Martinón-Torres[1], Mario Modesto[1], Marina Martínez de Pinillos[1], Cecilia García [1]

1 - Centro Nacional de Investigación sobre la Evolución Humana (CENIEH), Burgos, Spain

ATD6-96 is the left half of a gracile mandible of an adult individual with premolars and molars in place. It was found in 2003 in the TD6 level (OIS 21, 0.85 Ka) of the Gran Dolina cave site of the Sierra de Atapuerca, northern Spain. The specimen is broken at the level of the lateral incisor-canine septum. A first study of this specimen was published two years later . In order to obtain additional information, we have made a virtual reconstruction of the mandible. The specimen ATD6-96 was scanned with a Tomographic system (Tomograph YXILON Compact Yxlon International, X-Ray Gmbh) housed at the University of Burgos, using the following settings: voltage 130 kV, amperage 4 mA and resultant voxel size of 0.109mm x 0.109mm x 0.20mm. The resulting images were imported into Amira (Visage Imaging) software to obtain the 3D volume of the mandibular left side. Following, a second reconstruction was made by mirror-imagining the original stack of images (left hemimandible) to obtain the right hemi-mandible and create the 3D volume. As the canine alveolus is not complete (due to a post-depositional breakage) it was necessary to mirror the remaining half. The reconstructed 3D volume was then aligned and placed resulting in an entire alveolar rim; this was also performed on the right side. Despite the 3D reconstruction of the mandibular fragments, the symphyseal region is still missing. To reconstruct the symphysis, we defined two landmarks placed at the interdental septum, between the canine and the lateral incisor. In order to complete our reconstruction, we have obtained information taking as a reference: 1) a modern human sample, 2) a fossil hominin sample, and 3) the size of the root of the TD6 permanent lower incisors. We rotated the created volumes (right and left hemi-mandibles) on the "x, y and z" planes until the anatomical position was obtained, trying that the wear plane of all teeth is positioned approximately in the same plane, perpendicular to a vertical line. Finally, all the measurements were taken on the 3D volume models for comparative purposes. In our first study, it was concluded that ATD6-96 shows a primitive structural pattern shared with all African and Asian specimens . Furthermore, ATD6-96 is very small and exhibits a remarkably gracility, like the other TD6 mandibles. In this aspect, *H. antecessor* has clearly diverged from the African hominins, and ATD6-96 shares his/her gracility particularly with the Early and Middle Pleistocene Chinese specimens. Moreover, ATD6-96 shows a remarkable medial pterygoid tubercle, which is very frequent in Neandertals and in the Middle Pleistocene Sima de los Huesos hominins . Concerning the digital reconstruction, the main finding is that ATD6-96 had a derived parabolic dental arcade, measured by the index of the alveolar arcade. Interestingly, the value obtained for this index in ATD6-96 is similar to the mean values of Neandertals and the Sima de los Huesos hominins, and higher that that obtained in other Middle Pleistocene African, Asian and European specimens. Thus, the value of the alveolar arcade index adds to the list of the "Neandertal" features observed in the ATD6 hypodigm so far. As we have concluded in previous studies, all these features cannot not be considered as Neandertal autopomorphies, but traits which may have appeared much earlier than we had previously considered, in an Early Pleistocene hominin population . Summarizing and in general terms, the TD6 mandibles clearly diverged from the Pleistocene African pattern and show more affinities with the Eurasian specimens.

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Poster Presentation Number 35, Th (17:00-19:00)

Dental topographic analysis of *Australopithecus africanus* and *Paranthropus robustus*

Michael Berthaume[1], **Kornelius Kupczik**[1]

1 - Max Planck Weizmann Center for Integrative Archaeology and Anthropology, Max Planck Institute for Evolutionary Anthropology

Australopithecus africanus and *Paranthropus robustus* are characterized by having largely overlapping diets with a few key differences: compared to *A. africanus*, *P. robustus* has been suggested to consume relatively less C4 foods, less leaves, and more brittle foods. These conclusions have been supported by isotope and microwear textural analyses, but corroborated by few dental morphological studies. Here, we performed three metrics of dental topographic analysis (relief index/RFI, Dirichlet normal energy/DNE, and ambient occlusion/PVC) on the occlusal surface of six mandibular second molars of *A. africanus* and five mandibular second molars of *P. robustus*. In dental topographic studies, it has been observed that strepsirhines, platyrrhines, and apes that consume more fiborous and/or folivorous matter tend to have higher DNE and RFI and lower PVC values compared to strepsirhines, platyrrhines, and apes that consume more frugivorous, omnivorous diets and/or hard matter. Because of this, we would expect there to be a substantial amount of overlap in dental topographic scores between *A. africanus* and *P. robustus* and for *A. africanus* to have relatively higher RFI and DNE values and lower PVC values than *P. robustus*. As predicted, there was a significant amount of overlap in dental topographic values. Interestingly, when the surfaces are simplified down to both 10,000 and 20,000 triangles, a necessity for DNE, all three dental topographic variables gave the opposite trend than was expected, indicating a shift towards higher fiber and/or folivory in *P. robustus* and/or a shift towards higher fruit and/or omnivory in *A. africanus*. These results run counter to the dental topographic slope results published by Ungar (2007). Differences in these results are likely to differences in acquiring the initial occlusal morphology: namely, differences in initial resolution of the scans, and that CT scans of the original teeth can pick up more detail than tactile scanning molds of teeth. In combination with the isotope and microwear textural analyses, these results suggest that, in addition to a largely overlapping diet, *P. robustus* could have been consuming relatively more underground storage organs (USOs) than *A. africanus*, as USOs are fibrous, requiring a tooth with higher DNE and RFI and lower PVC, the grit on their surface would cause more enamel pitting, and USOs would produce a higher C3 signature. In addition (or alternatively), *A. africanus* could have had a more omnivorous diet, as this would have caused less enamel pitting, a higher C4 signature, and would have required a tooth lower DNE and RFI and higher PVC.

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Poster Presentation Number 22, Th (17:00-19:00)

Kostenki 21, layer III: a "Western" variant of the Eastern European Gravettian?

Alexander A. Bessudnov[1]

1 - Institute for the History of Material Culture

In the period 24-20 14C ka BP at least four variants of the Gravettian technocomplex are recognized in the Kostenki area (Voronezh Oblast, Russia). The Gravettian attribution of the Kostenki sites is traditionally based on the predominance of backed retouch and the presence of some typical Gravettian tools in the lithic assemblages. The issue of cultural similarities and differences among material from different sites against a background of common technological features is currently the most pressing research question. Due to the stratigraphic contemporaneity of all Gravettian sites at Kostenki it appears necessary to use data from other (sometimes distant) regions to determine the internal differentiation of the Gravettian at Kostenki. Cultural layer III of Kostenki 21, sometimes described as the Gmelinskaya archaeological culture/Gmelinian, has no direct analogies with other Gravettian sites on the Russian Plain. Excavations over an area of more than 500 m2 revealed several accumulations of cultural remains and small above-ground circular dwelling structures. The lithic and bone tool-kit from different parts of the excavation reflects various types of activity. According to radiocarbon dating, the age of the settlement is about 22-23 14C ka BP. The knapping technology of Kostenki 21(III) is typically prismatic. Nevertheless, a lack of high-quality raw material sources led to the wide usage of small bladelets and burin spalls which were produced on thick blades and flakes using the burin spall technique. The tool-kit is characterised by the presence of backed bladelets, end-scrapers on blades, different types of burins, truncations, some borers and points. Among burins, burins on truncation are not numerous; dihedral and multi-faceted burins predominate. Some of the latter could have been used as cores. Backed points with backed bases usually described as "Anosovka points" or *Federmesser* are also found. The most characteristic tools are shouldered points whose dimensions and shape are different from those recovered at Kostenki 1(I). Bone and ivory tools from Kostenki 21(III) include various points, awls and needles. Among the rich collection of ornaments two engraved figurines of mammals made on flat sandstone pebbles are of great interest. Although some similar stone and bone implements can be found in various collections from the Kostenki-Borshchevo area, the industry of Kostenki 21(III) appears to be unique. The closest analogies for the shouldered points can be seen in Magdalenian sites in France (Abri Faustin, La Rouvlère, etc.) and Epigravettian sites in Italy (Grotta Paglicci). The engraved figures represented at the site are also more characteristic of the Western European Palaeolithic. At the same time the absence of some typical Gravettian tools (e.g. Gravette points) does not permit the attribution of the industry of Kostenki 21(III) to the Gravettian *sensu stricto*.

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Poster Presentation Number 129, Sa (12:20-13:50)

Climatic challenges set the pace of the Neolithic expansion into Europe

Lia Betti[1], **Anders Eriksson**[2], **Ron Pinhasi**[3], **Andrea Manica**[2]

1 - Department of Life Sciences, University of Roehampton · 2 - Department of Zoology, University of Cambridge · 3 - School of Archaeology, University College Dublin

Recent ancient DNA evidence from hunter-gatherers and early farmers in Europe, at the transition to a Neolithic lifestyle, strongly supports a demic diffusion model of Neolithic expansion from the Levant. This evidence has virtually closed a long-standing debate on the major importance of acculturation of foragers in the early phases of the European Neolithic transition. On the other hand, substantial uncertainty still remains as to the factors that determined the main directions and the tempo of the Neolithic expansion, especially regarding the colonisation of Northern Europe by farming communities. Radiocarbon dates from Early Neolithic sites in this region seem to indicate a decrease in the rate of the expansion northwards, which has been alternatively explained by stronger resistance from local foraging communities, a shift from demic to slower cultural diffusion, or a direct effect of colder climatic conditions on the subsistence of agricultural populations in northern regions. This study examined the changes in speed of the Neolithic diffusion into Europe along the main directions of the expansion, and tested the hypothesis that the Northern European slowdown is related to regional climatic conditions, less suitable for the Levantine Neolithic "package" of cultivated plants. We expanded Pinhasi et al.'s dataset of Early Neolithic radiocarbon dates for Europe and the Middle East, by updating the extant entries and adding new ones based on recent dating of old and new sites (expanded from 735 to 1,375 sites). Using the higher definition achieved, we determined the main axes of expansion from the Levant into Western, Northern, and Eastern Europe, as well as the speed along these routes. The new data revealed a marked slowdown, or a temporary pause, in the Neolithic diffusion towards Northern Europe around 5700 BCE, before farming colonies had reached the coast of the North Sea. The pause was followed by a slow and irregular expansion into the British Isles, and later Scandinavia. When the direction and pace of the expansion was superimposed and compared to regional palaeoclimatic data, the analyses revealed an association between this slowdown and cooler average temperatures of summer months, suggesting that climate during the farming growing season might have been a determining factor in setting the pace of the Neolithic expansion in Northern Europe.

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Poster Presentation Number 83, Fr (12:20-13:50)

Middle and Late Stone Age of the Niassa Region, Northern Mozambique

Nuno Bicho[1], Jonathan Haws[2], Mussa Raja[3], Omar Madime[3], Célia Gonçalves[1], João Cascalheira[1], Vera Aldeias[4], Michael Benedetti[5], Telmo Pereira[1]

1 - ICArEHB - Universidade do Algarve · 2 - Dept. of Anthropology, University of Louisville · 3 - Universidade Eduardo Mondlane · 4 - Dept. of Human Evolution, Max Plank Institute · 5 - University of North Carolina – Wilmington

Located between modern-day South Africa and Tanzania, both of which have well-known and extensive Stone Age records, Mozambique and its Stone Age sequence remained largely unknown in the broader context of African Pleistocene prehistory. This is in spite of the country's critical position linking southern and eastern Africa, and of its clear potential to inform various models about recent human evolution, since the geography of Mozambique makes it a natural area of interest to evaluate the success and diffusion of *Homo sapiens* outside of southern Africa. Based on the early maps from Santos Júnior [1] and more recent data acquired through various projects, namely that of J. Mercader in northern Mozambique [2], we were able to produce a series of maps for the Stone Age prehistory of Mozambique [3]. The maps were also based on a critical evaluation of the sites and a review of some of the materials that are presently curated at the IICT (Instituto de Investigação Científica e Tropical) in Lisbon, Portugal. Up to 2013, there were a total of 258 referenced Stone Age sites for all of Mozambique, located in all 10 districts, but concentrated mostly in the Maputo, Sofala and Tete regions. We were able to list the geographic locations of 141 sites, of which only 70 are precisely located. There are 53 sites attributed generically to Stone Age, while the remaining include 79 multicomponent sites (mostly with ESA and MSA artifacts), 68 Early Stone Age (ESA), 39 Middle Stone Age (MSA) and 19 Late Stone Age (LSA). Here, we present the first results of field survey in the Niassa lake region, in northern Mozambique, that took place during the month of July of 2014. We focused on 4 main areas: 1) Both margins of the Lunho River Valley with its estuary running to the Malawi Lake, near the town of Metangula; 2) The inland limestone valley of Malulu; 3) The inland outcrops of Xiugulu (gneisse) and Unango (leucogranite). A non-systematic survey was carried out by foot, directed to those specific areas where geomorphology and geology increased the chances to find both Stone Age sites, including fluvial terraces and caves/rockshelters. The team developed a specific Apps site location with smartphone GPS [4], that can be downloaded freely, and survey was aided by the use of a Phantom 2 drone and a GoPro camera with live feed. Smartphones are helpful for general site location, with errors between 2 and 6 meters. In addition to these, we also used a high precision hand held GPS (Trimble Geo XT) with maximum of 50 cm errors. This was used for mapping all the main survey lines carried out by the team and later in the camp plotted on Google earth. We were able to find 64 open air sites, 5 caves and 20 rockshelters. There are 21 Middle Stone Age sites, 9 Late Stone Age and 7 multicomponent sites with MSA and LSA. We identified 1 Iron Age open air location. In addition, we also found 20 Stone Age sites, but we were no able to assign them to any of the 3 Stone Age phases as well as five other sites with no attributable chronology. In almost all cases we collected artifacts that could help to identify the chronology and phase of the human occupation. The great majority of the materials are in quartz, but there is also some in a diversity of cherts. In two particular cases, Ncuala (Lunho valley) and Chicaza (Malulu) we carried out more detailed work. In the first case, we collected systematically all surface materials based on a grid, while on the second case we tested the rockshelter down to 1,5 meters. Here we were able to identify 3 layers with human occupation, dated to between modern times and Late Stone Age. The later was dated by radiocarbon to c. 20.000 BP.

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Poster Presentation Number 123, Sa (12:20-13:50)

Plants from the horse butchery site of Schöningen: an archaeobotanical approach to subsistence strategies

Gerlinde Bigga[1], **Brigitte Urban**[2]

1 - Senckenberg Centre for Human Evolution and Palaeoenvironment, Tübingen, Germany · 2 - Institute of Ecology, Leuphana University Lüneburg, Germany

The work of archaeobotanists in Palaeolithic contexts is hampered by the poor preservation of organic plant parts. Pollen grains, phytoliths and other micro remains occur, but can only be identified up to family or genus level. Botanical macro-remains, however, make it often possible to distinguish different species. Subfossil fruits, seeds and wood can be found in waterlogged sites, such as Schöningen (DE) or Ohalo (IL), charred fruits, seeds or tubers are known from Middle and Upper Palaeolithic contexts, e.g. Vanguard and Gorham's Cave (Gibraltar), Dolni Vestonice (CZ) or Aurensan (FR). But these spots are only small windows into the past and a connection between plant remains and plant use by hominins is hard to prove. The sediments in Schöningen contain abundant botanical macro-remains and offer the opportunity to reconstruct the local vegetation in detail. Several hundred wood fragments and 38 sediment samples from different archaeological horizons were available for analysis. The sediments were water screened for botanical macro-remains. Fruits, seeds and wood were identified with the help of different reference collections and current literature. The reconstructed local vegetation of the "Horse Butchery Site" (Schöningen 13II-4) includes more than 21.000 diaspores of aquatic plants, lake shore vegetation, and shrubs and trees of an adjacent fen wood. Information about the usability of plants from ethnobotanical literature supplement the botanical record. It shows, that many of the species found in Schöningen have edible plant parts: young shoots, leaves, berries, fruits and nuts from various species were available between spring and autumn. From late summer up to spring the lake shore vegetation yielded a rich energy source in the form of underground storage organs (USOs). Wood was available all year round for different needs. Various plants providing fibres, medical active substances, fuel, bitumen, tannin or insecticides occur, too. Besides the natural deposited remains, the wooden spears and other tools are an exceptional evidence for plant use - as raw material . The artifacts also show, that the hominins of Schöningen had the cognitive abilities and technical skills to gather different plant parts and process them for their purposes. Hunter-gatherer today show, that plants play an important role in their societies all over the world [3, 4]. Considering a strategy for the Middle Pleistocene that is close to foragers in temperate climates today, vegetable food must have been a significant part of the diet. Starch rich USOs, nutritious fruits, nuts and sugar-containing phloem are good sources of energy, vitamins and minerals and were rarely left unexploited. Meat of big herbivores could not satisfy the metabolic needs alone . Therefore, even when the direct evidence for plant consumption is missing, it does not mean that plants have not been used for dietary purposes or as raw material. On the contrary, the exploitation of these resources is inevitable.

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Podium Presentation: Session 3B, Th (16:00)

Evaluating coastal dispersals of modern humans: Recent discoveries from coastal Kachchh, Gujarat, India

James Blinkhorn[1], **Pottentavida Ajithprasad**[2], **Avinandan Mukherjee**[2]

1 - University of Cambridge · 2 - Maharaja Sayajirao University, Baroda

Models focused upon coastal routes have played an important role in shaping the landscape of the modern human dispersals debate. Prominent formulations of coastal dispersal models suggest that a package of marine resource exploitation, the development of microlithic technologies and use of symbolic material culture would have facilitated rapid dispersal around the Indian Ocean rim (e.g. [1, 2]). However, such models remain poorly supported by the archaeological record, and reliant upon simplistic typological comparisons across large stretches of time and space that do not appear robust in the face of detailed scrutiny. South Asia is identified as a key context for evaluating alternate models of human dispersal, due to its critical geographic position for eastward dispersals, high genetic diversity indicative of an early colonisation by modern human populations, and a mosaic ecology that is well suited to supporting hominin populations. Recent archaeological discoveries in South Asia have played an important role in the formulation of coastal dispersal models, but this evidence is derived from inland, rather than coastal, sites. However, the timescale typically proposed for human dispersals in coastal models corresponds with periods of lower sea levels. As a result, the majority of evidence to effectively support, or refute, these models is likely to be submerged, on the continental shelf, rendering it impractical, unaffordable, or impossible to access.

Recent fieldwork has been undertaken by the Gateway of South Asia project following the identification of Kachchh (Gujarat, India) as a unique region to evaluate coastal dispersals. The hill ranges of central Kachchh rise up from the alluvial plains and deltaic sediments of the Indus, presenting access to lithic raw materials resources as well as freshwater. Tectonic uplift has resulted in coastal deposits from low sea level stands over the Last Glacial Maximum appearing above the modern sea level. This presents a unique combination of features that are important for both the Palaeolithic occupation of Kachchh, and for identifying evidence for these occupations in the archaeological record, making it an ideal region to evaluate coastal models for modern human dispersals.

Survey was undertaken to appraise the potential of existing Palaeolithic sites in Kachchh for further investigation, and to identify new sites in both south and north flowing drainage basins that preserve previously dated sediment formations. In total 25 sites were discovered or revisited, comprising Late Acheulean, Middle Palaeolithic and microlithic sites that were repeatedly identified in distinct geomorphic contexts. Section scraping and preliminary excavations identified Palaeolithic artefacts in low-energy alluvial contexts within Late Pleistocene sediment formations. On-going analyses of lithic assemblages from these sites, as well as their palaeoenvironmental context present the first opportunity to directly assess the predictions of coastal dispersal models from geographic contexts directly associated with the Late Pleistocene coastline. Critically, comparisons of lithic technology at a local, regional and inter-regional scale fail to support the assertions of coastal dispersal models.

Acknowledgments: We thank the Archaeological Survey of India and the Maharaja Sayajirao University, Baroda, for supporting and permitting this research.

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Poster Presentation Number 2, Th (17:00-19:00)

An Assessment of the Lower-Middle Palaeolithic Surface Artefact Scatters of the Chalk Uplands of Northwest Europe

Lesley Blundell[1]

1 - University College London Institute of Archaeology

Chalk is one of the most widespread sedimentary rocks in Europe, from the coastlines of the North Sea to north central France [1]. It is significant because it contains flint, a durable siliceous rock which has been used in Europe for stone tool manufacture over the past 1 million years, above and beyond any other rock type. Clay-with-flints, a Quaternary residual deposit, outcrops widely on the Chalk uplands. The chalklands of northwest Europe have been central to the development of Palaeolithic archaeology [2]. In 1859, validation of Boucher de Perthes' discoveries on the Somme by Prestwich and Evans established human antiquity. In 1899 handaxes from the North Downs were accepted as the first properly contextualised evidence of glacial and pre-glacial occupation in Britain [3]. The geomorphology of the surrounding land and geological deposits in which palaeoliths are found is crucial [4]. This research directly addresses the potential of that geological context to inform Middle Pleistocene archaeology. Treating Clay-with-flints as a proxy for the degree of erosion suffered by the Chalk uplands my model predicts that where little Clay-with-flints survives finds will mostly have eroded away. Where dense Clay-with-flints survives finds will be obscured by the geology. Survival between these two extremes will result in artefacts eroding out. The relative density of upland find-spots will thus increase with the increasing density of Clay-with-flints, up to the point at which the archaeology is so well preserved by dense Clay-with-flints that the number of finds drops sharply. To test the model data was drawn from three areas – the Chilterns, North and South Downs of southern Britain. Results will be tested against data for the Somme uplands of north-west France. The block of land between each breach in the Chalk escarpment was treated as a separate unit. The areas of Chalk and Clay-with-flints in each unit were calculated and the percentage of Clay-with-flints to Chalk established. In total 1,798 find-spots were plotted onto geological maps, the bedrock and superficial deposit context of each was analysed and sites lying on Chalk or Clay-with-flints counted. Sites on other superficial deposits were excluded. Scatter diagrams were created to test any relationship between find-spot density and the geology. Apparent anomalies were identified and their possible causes analysed. Surviving Clay-with-flints density varies significantly between the areas, as do average find-spot numbers. Despite this, results from all three areas indicate that, as Clay-with-flints density increases, up to 30-35% of each landscape block, so does the number of find-spots. Beyond this, finds-spot numbers drop off. Collector bias was shown to be responsible for almost all identified anomalies. Those remaining may be real archaeological distributions reflecting human landscape use.

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Poster Presentation Number 63, Th (17:00-19:00)

The Kromdraai Research Project in South Africa, with its renewed excavations in 2014-2015

Jose Braga[1], **Francis Thackeray**[2], **Laurent Bruxelles**[3], **Francis Duranthon**[4], **Ray Couzens**[2], **Frikkie de Beer** [5]

1 - University of Toulouse (Paul Sabatier) · 2 - University of the Witwatersrand, South Africa · 3 - Laboratoire TRACES, France · 4 - Museum d'Histoire Naturelle de Toulouse · 5 - South African Nuclear Energy Corporation

Kromdraai is a hominin site situated in the Gauteng Province of South Africa. It yielded the holotype of Paranthropus robustus, described by Robert Broom in 1938. Subsequent excavations were undertaken by C.K. Brain, E.S. Vrba, F. Thackeray and J. Braga. The Plio-Pleistocene hominins found before 2014 from Kromdraai B (KB, 26°00'41"S, 27°44'60"E) were recovered from at least two stratigraphic units representing distinct depositional cycles and separated by major disconformities. In a number of both cranial and dental features, the states shown by some of these KB Paranthropus robustus specimens are conservative when compared to more derived conditions displayed by not only South African conspecifics from the nearby site of Swartkrans, but also the post-2.3 Myr East African P. boisei. This finding may indicate that some KB hominins lie closer to the origin of a putative Paranthropus monophyletic clade represented in both South and East Africa. However, this question can be addressed only through a full understanding of the extension, stratigraphy and absolute dating of the KB hominin-bearing deposits. Since April 2014, the Kromdraai Research Project (KRP) opened up the excavation of a vast unexplored area (up to 200 m2) situated to the north of the previous Kromdraai B site. This newly explored area is called the "KB extension site". It contains decalcified and calcified fossiliferous sediments, as well as flowstones representing the earliest known infilling of the KB cave system (i.e., older than the previously known KB deposits). After three field seasons in 2014 and 2015, the KB extension site turns out to be very rich in micro- and macrovertebrate fossils, including fossil hominins. Here we present a summary of (i) the full extension of the Kromdraai hominin-bearing deposits; (ii) the new KB stratigraphic interpretation; (iii) some of the 500 newly discovered fossils from the KB extension site. We then discuss how these discoveries can contribute to a better understanding of the origin of the Paranthropus clade in South Africa.
Acknowledgements: This work was supported by the South African National Research Foundation, the French Ministry of Foreign Affairs, and the French Embassy in South Africa through the Cultural and Cooperation Services. We thank Stephany Potze, curator of the Palaeontology Section of the Ditsong National Museum of Natural History (Pretoria), for her continuous support.

Poster Presentation Number 85, Fr (12:20-13:50)

Exploring Late Pleistocene hominin behavior in the desert environments of Southeast Arabia and its implications for dispersal models

Knut Bretzke[1], Max Schaefers[1], Natalie J. Russell[2], Simon J. Armitage[2], Adrian G. Parker[3]

1 - University of Tübingen · 2 - Royal Holloway, University of London · 3 - Oxford Brookes University

The Arabian Peninsula plays an important role in models of human expansion out of Africa and the colonization of western Asia. Recent studies clearly show that climatic conditions in Arabia during the Late Pleistocene changed significantly and included periods of increased precipitation with favorable living conditions, despite its unfavorable environment at present. Such periods may represent windows of opportunities for the influx of human populations into Arabia. To gain more knowledge about spatial and chronological details of human expansions into the Arabian Peninsula and adjacent regions in western Asia, it is important to better understand the dependence of Late Pleistocene hominin groups on climatic conditions. More precisely, one key question would be: Did humans adapt to arid environments and thereby lessen their dependence on humid conditions? If this is true, expansion into and occupation of Arabia would not be confined to chronologically short windows of opportunity. The major challenge in this context is how to identify an adaptation to desert environments. We argue here that long term survival in arid environments necessitates an adaption to the rapidly changing spatial distributions of essential resources, including water, plants and game. We thus expect that an adaptation to arid environments is related to an increased flexibility in terms of land use. We further assume that spatially flexible settlement behavior is related to increased economization of lithic raw material to cope with uncertainties in its supply. To test these hypotheses we analyzed lithic assemblages from the Late Pleistocene sequence at Jebel Faya located on the northern edge of the Rub' al-Khali desert in the interior of the Emirate of Sharjah, UAE. The results of this study will be chronologically contextualized and discussed against the background of paleoclimatic data from the site to explore the diachronic dynamics of our indicators of mobility, economization and paleoenvironments and to deduce implications for human settlement dynamics on the Arabian Peninsula during the Late Pleistocene.

Poster Presentation Number 10, Th (17:00-19:00)

The Middle-Upper Palaeolithic Transition in the Basin of the River Meuse, Belgium

Patrick Bringmans[1]

1 - The 'Veldwezelt-Hezerwater' Neanderthal Research Centre

At Veldwezelt-*Hezerwater* (Lanaken, Province of Limburg, Belgium), 24 archaeological loci were discovered at different spots . Only 7 of the 24 discovered loci seemed to represent in situ sites. The MLMB Site at Veldwezelt-*Hezerwater* is dated around 47 ky BP and represents the last known open-air Neanderthal settlement during the Middle Weichselian in the Basin of the River Meuse and even in the Benelux. From 47 ky BP on, we see Neanderthals appear in the Mosan caves, while at the same time, no open-air sites have been attested . The important Spy fossils were associated to the so-called 'Lincombian-Ranisian-Jerzmanowician' , a transitional techno-complex characterized by the presence of leaf-points made from blades. It is important to note that around that time the climate became much colder and at the same time, the mega fauna starts to disappear in North-West Europe . Our research shows that open-air sites were usually gathering places of big-game hunters, while cave sites show evidence of more selectivity in the kinds of animals hunted and an emphasis on small-game hunting. This latter tendency would result in changing hunting strategies and a rapidly changing array of weapons and lithic implements. It shows that caves were probably the last refuges of the Neanderthals in the Basin of the River Meuse. As a result of the dramatic climate swings and the retreat of the steppe in the second half of MIS 3, the Neanderthals would have to survive in ever-smaller groups, becoming largely confined to the caves. While wandering in deep caves might have had 'metaphysical' dimensions for Neanderthals, this behaviour was reserved mainly for burial activities . The two burials at Spy cave showed that Neanderthals intentionally buried their dead. There is a hint that this behaviour and the 'Transitional Mousterian Industries' lie upon the threshold of something new. For instance, the 'Lincombian-Ranisian-Jerzmanowician' can probably not be considered as a facies of another techno-complex (e.g., Aurignacian, Szeletian or Bohunician). We can conclude that the typo-technological 'adaptations' of the 'Transitional Mousterian Industries' were probably not the result of a 'cultural' shift, but a response to changing needs and constraints under changing environmental settings. Most of the technological adaptations seem to reflect the responses of Palaeolithic people towards changing 'niche' resource opportunities. The traditional hypothesis of a massive biological and cultural 'Aurignacian Wave' sweeping away the Neanderthals should be questioned.

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Poster Presentation Number 117, Sa (12:20-13:50)

Oxygen isotope analyses of *Equus* teeth evidence Last Interglacial (Eemian) and Weichselian palaeotemperatures at Neumark-Nord 2, Saxony-Anhalt, Germany

Kate Britton[1,2], **Thomas Tütken**[3,4], **Sabine Gaudzinski-Windheuser**[5,6], **Wil Roebroeks**[7], **Lutz Kindler**[5], **Mike Richards** [2,8]

1 – Department of Archaeology, University of Aberdeen, UK · 2 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 3 - Institute of Geosciences, Johannes Gutenberg University Mainz, Germany · 4 – Steinmann Institute, Division of Mineralogy, University of Bonn, Germany · 5 - MONREPOS Archaeological Research Center and Museum for Human Behavioural Evolution, Neuwied, Germany · 6 - Johannes Gutenberg–Universität Mainz, Institut für Vor- und Frühgeschichte, Germany · 7 - Faculty of Archaeology, Leiden University, The Netherlands · 8 – Department of Anthropology, University of British Columbia, Canada

Here we present phosphate oxygen isotope ($\delta^{18}O_P$) compositions of horse (*Equus sp.*) tooth enamel from the Eemian and Weichselian site of Neumark-Nord 2, Germany, providing proxy evidence for past local mean air temperatures. Based on the relationship between $\delta^{18}O_P$ of bioapatite, body water, local precipitation and air temperature, $\delta^{18}O_P$ from mammalian skeletal remains of obligate drinking species can be used to reconstruct palaeoclimatic conditions and determine palaeotemperatures in continental environments. Bulk samples of tooth enamel (predominantly permanent third molars and second premolars) from horses dating from both the Eemian (interglacial) and early Weichselian (glacial) levels (n=26) at Neumark-Nord 2 were utilised to explore contemporary mean air temperature (MAT) differences between these two phases during the formation of the Neumark-Nord sequence. Enamel samples from each tooth were homogenised, and pre-treated using 30% hydrogen peroxide (H_2O_2) in order to remove organics, rinsed and then dried. Powered samples were dissolved in 2M hydrofluoric acid (HF), and the resultant phosphate solution was neutralised with 25% ammonia solution (NH4OH). A silver phosphate (Ag_3PO_4) precipitate was formed through the addition of 2M silver nitrate ($AgNO_3$) solution to each sample. $\delta^{18}O_P$ values were determined (in triplicate) by TC-EA/CF-IRMS at the Department of Geology, University of Tübingen. Long-term laboratory reproducibility was reported as ±0.3‰ (1σ). The mean $\delta^{18}O_P$ values of bulk samples range from 15.0±0.7‰ (1σ) in the early Weichselian (archaeological find level NN2/0) to 16.1±0.4‰ in the Eemian (archaeological find level NN2/2B), indicating a mean annual temperature difference of ∼3°C – with an Eemian MAT slightly higher than modern day Germany at this locality, correlating with other proxies, and a Weichselian MAT ∼2°C lower than present. The future potential of the oxygen isotope analyses of faunal bioapatite in the characterisation of terrestrial palaeoclimatic conditions, using bulk or intra-tooth approaches, is explored.

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Poster Presentation Number 120, Sa (12:20-13:50)

Identification of Faunal Remains from Denisova Cave through the Application of ZooMS

Samantha Brown[1], **Michael Buckley**[2], **Anatoly Derevianko**[3], **Michael Shunkov**[3], **Thomas Higham** [1]

1 - RLAHA, University of Oxford · 2 - Faculty of Life Sciences, University of Manchester · 3 - Institute of Archeology and Ethnography in Novosibirsk

In 2010, hominin remains excavated from Denisova Cave, located in the Altai region of Siberia, revealed that the Palaeolithic was perhaps far more diverse than had previously been expected. A distal manual phalanx, located in layer 11 of the cave's strata, and subjected to mtDNA analysis, was found to belong to an otherwise unknown hominin type. The Denisovans (named for the cave in which they were found) belonged to a lineage which diverged from that of modern humans twice as early as Neanderthals [1;2]. The discovery highlighted the wealth of knowledge still to be unlocked from the Palaeolithic of the Altai, and the need for efficient and reliable species identification to aid in this understanding. It is not uncommon to find faunal remains during excavations at Denisova Cave, though the discovery of morphologically identifiable bones is rare. Rather, bones are often highly fragmented. Excavations in 2014 produced 2,000 such bones from Denisova Cave, all of which required species identification. These were excavated from layer 11, the context in which the Denisovan type phalanx was located, and layer 12, in which Neanderthal remains were later discovered. Due to the small size of these fragments, traditional morphological analysis was not possible. As such, other methods need to be explored, and here Zooarchaeology Mass Spectrometry (ZooMS) was applied. Identification through the application of ZooMS is possible as each species has a unique combination of peptides within their collagen, acting as a species-specific fingerprint. The method requires that small samples (<20 mg) are partially demineralised and the solubilised collagen treated with a protease enzyme such as trypsin, which undertakes digestion and enzymatically cuts the collagen into peptides. The mass-to-charge (m/z) ratios of these peptides is then measured using MALDI-ToF-MS (Matrix-Assisted Laser Ionization Time of Flight Mass Spectrometry) and the results are compared against an extensive reference collection of known species. The method is high-throughput, allowing for a large number of samples to be analysed in a relatively short period of time. This poster presents the results of this analysis and the species identified within the assemblage; highlighting the invaluable nature of ZooMS as a time- and cost-efficient means of identifying significant fauna samples amongst large collections of fragmented remains.

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Poster Presentation Number 54, Th (17:00-19:00)

Mesolithic populations from the Eastern Europe and Siberia: cranial shape analysis with the help of geometric morphometric methodology

Ekaterina Bulygina[1], **Anna Rasskasova**[1], **Denis Pezhemski**[1]

1 - Research Institute and Museum of Anthropology, Moscow State University, Russia

Several Mesolithic and early Neolithic populations dated to 10,000 – 6,000 years BC from Russia, Romania and Ukraine have been analysed by means of quantifying their 3D cranial shape. The whole sample comprised 85 individuals, including Mesolithic and Neolithic groups from Yuzhny Oleni Ostrov (Russia); Vasilievka, Voloshkoe and Vovnigi (Ukraine); Varasti (Romania); Itkul and Ust-Isha (South Siberia) and Locomotiv (East Siberia). A comparative set of modern populations was sampled to include representatives from Europe, Africa, Eastern Asia and (native) America. Apart from the standard geometric morphometric procedures, we cluster ordinated data to establish potential relationships between groups and use permutation of individual distances to establish the significance of the group differentiation. The method of analysis is first verified with the help of the modern populations that have varied geographical provenance. We establish that no cranial data, whether the face and the neurocranium are analysed together or separately, allow us to recover geographical relationships between the modern populations in our sample. Nevertheless, clusters that have been recovered with the help of the whole cranium data correspond well with the expected generic relationships between the sampled modern groups. As a result, we choose to analyse the shape of the complete cranium, where such is available, in fossil individuals as well. Our results highlight a high level of variation within Mesolithic and within Neolithic populations of the Eastern Europe and Siberia as compared with the pooled sample of the modern humans from different geographical locations worldwide. However, a certain structure among the analysed groups can still be revealed. The results suggest that Mesolithic groups from the Dnieper region have close morphological affinities with each other, while Yushny Oleni Ostrov have a large overlap with modern humans in general and with some of the mongoloid groups in particular. Neolithic groups are, on the whole, closer to modern populations than to the Mesolithic sample. At the same time, Siberian individuals show a complex pattern of morphological relationships which may be revealing of their genetic identity. On the whole, our results invite further discussion on the origins and affinities of the Eastern European Mesolithic and Early Neolithic groups as well as call for the research into the impact that the choice of data has on the results of 3D morphological analyses.
Acknowledgements: This works has been supported by the grant of the Russian Foundation for Basic Research No № НК 13-06-00045.

Podium Presentation: Session 1, Th (10:40)

Prey Mortality Profiles and Two Million Years of Efficient Hominin Hunting

Henry Bunn[1]

1 - University of Wisconsin-Madison

Butchery damage and skeletal element profiles of fossil ungulate bones from Early Pleistocene archaeological sites in Africa established that Oldowan hominins used stone tools to systematically process large animals for meat and marrow . Arguably, that left unresolved the significant question of how hominins acquired those large carcasses in the first place, by hunting or by some form of scavenging. Answering that could reveal how capable and how human they were in meat foraging and some basic social adaptations such as food transport and sharing. Recently, mortality profile analysis of prey animal teeth from the same 1.8 Ma site at Olduvai Gorge, Tanzania (FLK Zinj), used tooth eruption and occlusal wear to group mortality data into Juveniles, Prime Adults, and Old Adults and to plot them on triangular graphs. That revealed a living-structure (or catastrophic) mortality profile abundant in prime adults and a statistical mismatch between butchered large bovids at FLK Zinj and modern lion or other carnivore prey (i.e., effectively falsifying scavenging hypotheses). A statistically indistinguishable match between FLK Zinj and both (1) ethnographically observed Hadza bow and arrow hunting, and (2) published, undisputed reconstructions of Late Pleistocene spear hunting from the African Middle Stone Age and the European Upper Paleolithic, plausibly indicates that Early Pleistocene *Homo* used wooden spears as an efficient ambush hunter like more recent descendants [2, 3]. Lacking any recovered projectile weaponry of Early Pleistocene age (although indirectly, skeletal adaptations in *H. erectus* for throwing are consistent), such interpretation remains open to alternatives. For example, one suggestion is that even "Acheulean-age hominins obtained few large mammals, whether by hunting or scavenging."

To investigate the 1.5 Ma period, broadly speaking the "Acheulean age" of *H. erectus* and *H. heidelbergensis*, intervening between FLK Zinj and the Late Pleistocene, new mortality data for large ungulates are presented here from two sites, (1) BK, a 1.3 Ma Developed Oldowan site in Bed II, Olduvai, and (2) Elandsfontein, a ~ 0.6 Ma Acheulean site in South Africa. For each assemblage, analysis of identified teeth involved specimen-by-specimen comparisons to determine comprehensive estimates of the minimum number of individuals (MNI) in each species and the age at death of each identified individual. From BK, the MNI for three species of large bovids is 32, and from Elandsfontein, the MNI for six species of large bovids is 125. For each assemblage, living-structure mortality profiles with abundant prime adults are documented, likely resulting from efficient hominin hunting. Collectively, these mortality profiles document a nearly 2 Ma-long trend of efficient hunting by evolving species of *Homo*, and the likelihood that the evolutionary dynamics selecting for efficient meat foraging and related socioecological adaptations for humanness were initiated early in the Pleistocene.

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Poster Presentation Number 59, Th (17:00-19:00)

Covariation of the internal and external midfacial skeleton among modern humans of Asian descent

Lauren Butaric[1], **Scott Maddux**[2]

1 - Des Moines University · 2 - University of Missouri

Maxillary sinus volume has long been thought to covary with internal nasal breadth following climatic pressures, but recent studies indicate that sinus shape (i.e., the distribution of that volume) is more strongly influenced by zygomatic position and facial height—at least among morphologically diverse samples of modern humans. The current study further investigates maxillary sinus and midfacial shape covariation among samples with (relatively) similar zygomatic orientation to investigate more nuanced relationships between the internal and external midfacial skeleton. Using CT scans, we digitized 25 coordinate landmarks from three modern human samples: Southeast Asians (n=20), Buriats (n=19), and Inuits (n=20). A simultaneous-fit Two-Block Partial Least Squares (2B-PLS) analysis demonstrates significant overall covariation between the midface (Block1) and sinus (Block2) (RV=0.364, P< 0.0001). PLS1 (46.36% of covariation, r=0.751) relates to covariation between facial height and alveolar prognathism with sinus height, width, and depth. Regional differences in PLS1 scores are significant (MANOVA: Wilks' lambda = 0.446, P<0.0001). Specifically, individuals with positive PLS1 scores (i.e., Buriats and Inuits) exhibit relatively more orthognathic and superiorly-inferiorly taller faces in conjunction with relatively taller and medio-laterally wider sinuses compared to individuals with negative PLS1 scores (i.e., Southeast Asians). Further, while there is little difference in the relative anterior-posterior depth of the sinus across the samples, among Buriats and Inuits maximum depth is positioned high in the midface (below the orbits) compared to Southeast Asians (at the level of the nasal floor). Interestingly, internal nasal breadth appears to play little to no role in the pattern of covariation between the sinus and midface in these samples, despite marked climatic differences related to geographic origin. Thus, our results further suggest that maxillary sinus shape reflects multiple aspects of midfacial morphology and not nasal cavity morphology alone. This study provides the impetus for future research incorporating additional landmarks (and semilandmarks) to more fully investigate the complex 3D morphology of the maxillary sinus and its role within the midfacial skeleton.
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Poster Presentation Number 42, Th (17:00-19:00)

3D enamel thickness in Neandertals and *Homo sapiens* permanent lower canines

Laura Buti[1], Adeline Le Cabec[2,3], Robin N.M. Feeney[4], Jean-Jacques Hublin[2], Stefano Benazzi[1,2]

1 - Department of Cultural Heritage, University of Bologna, Ravenna, Italy · 2 - Department of Human Evolution Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 3 – ESRF – The European Synchrotron, Grenoble, France· 4 - UCD School of Medicine and Medical Science, Health Sciences Centre, University College Dublin, Ireland

Over the last decades, the growing support of 3D data has led to develop comparative morphometric and qualitative methods to increase the number of fossils suitable for more comprehensive dental analysis [1]. Enamel thickness figures prominently in studies of human evolution, particularly with hominoid taxonomy, phylogeny, and paleodiet [2, 3]. Attention has focused on molar teeth, recently utilising advanced technologies with novel protocols [3]. Despite important results achieved thus far, further work is needed to investigate all tooth classes. We apply a recent approach developed for anterior teeth [4] to investigate 3D enamel thickness of hominin canines. MicroCT data of 38 unworn/lightly worn *Homo sapiens* (Early: n= 4; Upper Paleolithic: n=4; Recent: n=21) and Neandertal (n=9) permanent lower canines were segmented using Avizo 7 to reconstruct 3D digital models of the teeth. The cervical line was digitized on each 3D model using the spline function in Rapidform XOR to separate crown from root dentine. Volumes of enamel and of crown dentine, and the enamel-dentine junction surface were measured to compute Relative Enamel Thickness (RET). Mean RET value for Neandertals (12.7±1.8) falls below the mean computed for *H. sapiens* (Upper Paleolithic=15.6±2.9; Early=14.0±1.9; Recent=15.5±2.6). Results of the permutation test between Neandertal and recent humans support the significant difference in RET (p=0.0055), a useful index for the taxonomic discrimination between modern humans and Neandertals. This preliminary study confirms this trend for lower permanent canines [2], using a 3D protocol which is reproducible, has little subjectivity, and is particularly effective for the uneven contour of cervical enamel in anterior teeth. In recent literature, although the majority of datasets are based on micro-CT scans, the analysis of dental tissues in Neandertal and *H. sapiens* permanent lower canines have been performed on virtual longitudinal sections [2, 5]. Our preliminary 3D analysis of permanent lower canines support the general findings that Neandertal have thinner enamel than *H. sapiens*, as observed in molars. Future contributions will incorporate increased sample sizes and include worn teeth to investigate whether the RET index continues to discriminate between Neandertal and *H. sapiens* canines.

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Poster Presentation Number 96, Fr (12:20-13:50)

Does the upper limb morphology of Native American fur traders shed light on the unique humeral structure of Neandertals?

Michelle Cameron[1], Heather Lapham[2], Colin Shaw[1]

1 - Phenotypic Adaptability, Variation and Evolution Research Group, Department of Archaeology and Anthropology, University of Cambridge, UK · 2 - Department of Anthropology, Southern Illinois University, Carbondale, IL

Neandertal humeri have pronounced right-dominant bilateral strength asymmetry (24-57 %) and anteroposteriorly (AP) strengthened diaphyseal shape (Ix/Iy = 1.27-1.30) [1]. The 'hide-scraping' hypothesis suggests that hide preparation activities may explain this morphological pattern unique to Neandertals . Two modern human Native American skeletal collections from Virginia, USA, provide the opportunity to test this hypothesis. Archaeological materials associated with hide processing suggest that individuals from the pre-contact Crab Orchard site (ca. 1450-1600) processed hides largely for domestic use, whereas individuals from the Trigg site (ca. 1600-1650) were heavily involved in the processing and commercial trading of deerskins with Europeans [2]. Bone beamers and mussel shell scrapers found at the Trigg site may have been used in a comparable manner to hafted end-scrapers and side-scrapers associated with Late Pleistocene Neandertals. This study tests whether hide scraping among modern humans leads to the upper limb AP strengthening and bilateral asymmetry that is characteristic of Neandertals. The diaphyseal humeral structures of Crab Orchard and Trigg males and females will be used to assess whether particular morphological patterns correspond with a presumed increase in hide processing activities. Three questions were considered: 1) are humeri more robust among the intensely hide-processing Trigg individuals; 2) is right-biased bilateral asymmetry and AP strengthened diaphyseal shape evident among the Trigg individuals; and 3) is there a sex-based division of hide processing labour? Humeral cross-sectional geometric properties were evaluated at 35% of bone length (middistal) using periosteal molds to test these hypotheses. Diaphyseal strength was assessed using total subperiosteal area (TA) and torsional strength (J), while diaphyseal shape was assessed using anteroposterior relative to mediolateral bending strength (Ix/Iy) and maximum relative to minimum bending strength (Imax/Imin).

Overall, neither significant bilateral asymmetry, nor antero-posterior hypertrophy were observed among the Crab Orchard or Trigg populations. Relative to Crab Orchard, Trigg humeral strength was significantly higher among males, but bilateral asymmetry and diaphyseal shape were not significantly different. Bilateral asymmetry values were low in both populations for TA (3.79-6.57%) and J (4.98-10.5%). Male diaphyses were not particularly AP strengthened (Ix/Iy = 0.95-1.04), however female diaphyses approached Neandertal values (Ix/Iy = 1.11-1.29). Hide processing, may have caused the increased humeral strength properties found at the Trigg site, but appear to have not significantly affected diaphyseal shape or bilateral asymmetry in the manner common to Neandertals. The different scraping methods or tool types used by the Crab Orchard and Trigg samples as compared to Neandertals may have required different upper limb actions, resulting in different morphological patterns. In terms of sexual dimorphism, higher humeral strength among males, compared to females, could be reflecting hormonal differences between the sexes, which may produce different norms of reaction in response to mechanical stimuli. It may also suggest that Virginian males performed more intense and/or more repetitive activities than females. The relatively high AP strengthening among Trigg females suggests they undertook more AP directed upper limb activities. The different patterns of upper limb morphology observed in Neandertals and Native Americans from pre-colonial Virginia suggest these populations had either different approaches to hide processing, varying responses to mechanical stimuli, or undertook quite different upper limb activities that are reflected in their humeral morphology.

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Podium Presentation: Session 11B, Sa (16:40)

Analyzing Neanderthals and carnivores interactions in the surroundings of the Cave of Zafarraya (Spain) by means of a statistical path analysis

Miguel Caparros[1], Cecilio Barroso[2], Anne Marie Moigne[3], Antonio Monclova[4]

1 - Muséum National d'Histoire Naturelle, Département de Préhistoire, Paris · 2 - Fundación Instituto de Investigación de Prehistoria y Evolución Humana Lucena, Córdoba · 3 - Muséum National d'Histoire Naturelle, CERP, Tautavel · 4 - Grupo PAI-HUM 440, Área de Prehistoria. Facultad Filosofía y Letras, Cádiz

We present here a novel approach to study the interactions of Neanderthals and carnivores in the cave of Zafarraya by comparing the lithic archaeological and faunal records of the site with a statistical path analysis.

A multiple regression with independent variables such as for example lithic and carnivore elements could be used to explain herbivore accumulation, the dependent variable. The main drawback of multiple regression is that it assumes that the independent variables are direct unrelated causes of the dependent variable, disregarding the indirect causal relationship that might exist between them. Alternatively one could use the correlation coefficients between all the variables to make inferences on herbivore accumulation and Neanderthal – carnivore competition for nutritional resources. However, correlation analysis serves to determine only whether two variables are interdependent or co-vary, but does not assert a causal relationship between them. Path analysis, developed by Sewall Wright [1], is a powerful statistical technique considered as an extension of multiple-regression that takes into account the effects of correlated independent variables. In light of the shortcoming of regression and correlation analyses, we used a statistical path analysis to infer the causal relationships between the herbivore prey accumulations and the presence of accumulators (carnivores and Neanderthals) in this site after taking into account the reciprocal influence of the accumulator variables.

The results of the statistical analyses confirm and shed further light on previous taphonomic and zooarcheological research. The findings concur with the two-species Lotka-Volterra competition model for resources which stipulates that when niche overlap is complete the species with the larger fitness excludes the other. Our analysis shows that in the immediate vicinity of the cave the fitness of Panthera was greater than Neanderthals', i.e. when Panthera was present it excluded Neanderthals as evidenced by the record of Capra and Rupicapra remains. It also shows that further in the southern hills and the polje where large herbivores roamed, Neanderthals had a greater fitness than carnivores which translated into their primary accumulation in the cave of remains of C.elaphus and other large herbivores.

Coexistence from occasional niche overlap is apparent when one or the other predator scavenged, but from a time prospective it must have been short periods linked to seasonality, weather conditions and occupation randomness. In Zafarraya, the archaeological record would indicate that the degree of fitness of the herbivore prey accumulators, carnivores or Neanderthals, was related to the nature of the geomorphological domains in the vicinity of the cave and the favored foraging areas of hunted herbivores.

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Pecha Kucha Presentation: Session 4, Fr (10:05-10:30)

Climate-driven cultural change during the Upper Paleolithic: a reassessment based on the Portuguese data

João Cascalheira[1], **Nuno Bicho**[1], **João Marreiros**[1], **Telmo Pereira**[1]

1 - ICArEHB, University of Algarve, Portugal

Recently it was argued that climatic deterioration during the Heinrich Events (HE) 4, 3 and 2 were the main driving forces for changes in human population dynamics [1] and settlement patterns [2] during the transition from Middle to Upper Paleolithic as well as during the Upper Paleolithic of Iberia. The strong aridity levels resulting from these events caused the cultural and settlement pattern changes, respectively, the Mousterian-Aurignacian (c. 39 ka cal BP), Aurignacian-Gravettian (30.5 ka cal BP) and Gravettian-Solutrean transitions (c. 25 ka cal BP). Additionally, changes in social structure, settlement pattern/mobility and technology [3, 4] have also been seen as reactions to some of these rapid cooling climatic events. While we agree that climatic shifts, more so rapid ones, can have a strong impact in human population dynamics, including regional extinctions, we find more difficult to use HE episodes as a single criteria for the explanation of the diverse techno-typological alterations known to have occurred at the onset of each Upper Paleolithic cultural phase. In this context, we have recently carried out a chronological and techno-typological critical reassessment of the Portuguese Upper Paleolithic in order to precisely define the cultural structures and starting moments of each of the regional identified techno-complexes (i.e., Gravettian, Proto-Solutrean, Solutrean and Magdalenian). When crossed with the record of climatic and ecological alterations coming from high-resolution terrestrial and marine pollen sequences, the available data allowed us to adjust the climate-driven model, and to argue that not only cold drastic episodes are associated with the long-term cultural changes. In fact, our model is based on diversity, both climatic and ecological, as previously argued by Pereira and Benedetti [5] for raw materials acquisition. Both warming (D-O) and cooling (HE) events were responsible for the regional and local ecological changes in terms of vegetation cover, forest density, fauna availability, access and diversity and may have been the direct triggers for the cultural changes seen during the Portuguese Upper Paleolithic: 1. Increase in vegetation cover and forest density as well as in the prey availability during the warmer periods (D-O events) seems to have been the triggers for the Gravettian and the Magdalenian, which produced similar stone tool technological systems based on backed points used to produce projectile tips for throwers; 2. Decrease in vegetation cover and forest ecology, as well as in prey species during the cooler periods (HE2 and LGM), adding different projectile technologies to those already known, to improve hunting productivity in diverse settings of open field and small occasional forested thickets, but where prey was likely more abundant. This is the case of the Proto-Solutrean and the Solutrean, clear two cultural phases within the same evolutionary and adaptive path. Interestingly, technological solutions in terms of hunting tips and projectiles seem to be identical in those cases of climatic improvement and expansion of tree cover. Lastly, human adaptive systems, that took form in the material culture of the Gravettian, Proto-Solutrean, Solutrean and Magdalenian, followed both resilient and innovative forms, suggest that there was no population turnover at any of those moments. The exception was the settlement of the newly arriving Anatomically Modern Humans with the Gravettian, replacing the previous Neanderthal populations of central and southern Portugal. With this exception, cultural changes do not correspond to new populations coming in, but to new adaptive necessities that were triggered by the changing ecology and amount, availability and access to resources.
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Poster Presentation Number 99, Fr (12:20-13:50)

The inner structural morphology of the femoral head of *Paranthropus robustus*

Marine Cazenave[1,2], José Braga[1], Frikkie De Beer[3], Jakobus W. Hoffman[3], Roberto Macchiarelli[4,5], John Francis Thackeray[2]

1 - UMR 5288 CNRS, Université de Toulouse · 2 - Evolutionary Studies Institute, University of the Witwatersrand · 3 - South African Nuclear Energy Corporation · 4 - UMR 7194 CNRS, Muséum National d'Histoire Naturelle · 5 - Département Géosciences, Université de Poitiers

Evidence from the Pleistocene site of Swartkrans suggests a strong toe-off during walking in *Paranthropus robustus* (*P.r.*), which is compatible with habitual terrestrial bipedality [1]. However, given that body shape and bipedal gate in this taxon differed in many aspects from the extant human condition, we expect that the biomechanically-related signature imprinted at the coxo-femoral joint differs between *Paranthropus* and *Homo* in terms of site-specific inner structural arrangement. To test this hypothesis, we detailed by micro-focus X-ray tomography four *P.r.* adult femoral ends from Swartkrans. The specimens represent two likely male (SK 82 and SK 97) and two likely female individuals (SK 3121 and SKW 19) [2]. Acquisitions were performed at Necsa, Pelindaba (SK 82, SK 97, SK 3121), and at Wits, Johannesburg (SKW 19), at resolutions ranging from 20 to 70 μm (isotropic voxel size). The extant human condition (EH) is represented by nine adults of both sexes (3 M, 6 F) sampling five Khoesan and four Zulu individuals from the Dart Skeletal Collection, Johannesburg, and the McGregor Museum, Kimberley, respectively. The structural properties of the network have been investigated by tentatively assessing 18 standardized circular regions of interest (ROIs) extracted from 9 sections and 7 cubic volumes (VOIs). The parameters considered in the quantitative analyses include: trabecular number (Tb.N); trabecular thickness (Tb.Th.); Results show that Tb.N, Tb.Th., BV/TV, Tb.Sp., and BS/TV behave as the most discriminant parameters, the cancellous network in *Paranthropus* being relatively and absolutely denser, but also less homogeneously structured (i.e., locally more contrasted) compared to the human condition; on the other hand, trabecular spacing and degree of anisotropy are less marked in *P.r.* Additionally, the orientation angle of the trabeculae assessed along the mediolateral (coronal) plane is slightly lower in *P.r.* (c. 20° vs. c. 30° in EH). Interestingly, even if at this stage we cannot confidently assess any sex-related difference in structural patterning, we nonetheless note that, compared to the likely male representatives of their taxon, *P.r.* females display a higher number of thinner trabeculae to an extent not observed in our comparative human sample.
Acknowledgements: B. Billing, L. Kgasi, D. Morris and S. Potze for access to fossil and comparative material; K. Jakata for acquisitions at Wits; K. Carlson for scientific collaboration and data sharing (SKW 19). Funding from AESOP program.

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Poster Presentation Number 51, Th (17:00-19:00)

The new reconstruction of 'Spyrou' – the Spy II Neandertal skeleton

Tara Chapman[1,2], Serge Van Sint Jan[2], Antoine Balzeau[3,4], Alon Barash[5], Ella Been [6,7], Gilles Berillon [8], Benoit Beyer[2], Jonathan Brecko[9], Jérôme Coupier[2], Isabelle Crevecoeur[10], Asier Gómez-Olivencia[11,12], Anne Hambucken[1], Stéphane Louryan[2,13], Aurore Mathys[8], Céline Mathieu[2], Fedor Moiseev[2], Caroline Polet[1], Marcel Rooze[2], Hélène Rougier[14], Victor Sholukha[2,15], Patrick Semal[8]

1 - Operational Direction Earth and History of Life, Royal Belgian Inst. of Natural Sciences · 2 – Lab. of Anatomy, Biomechanics and Organogenesis, Univ. Libre de Bruxelles · 3 - UMR 7194, CNRS, Dépt. de Préhistoire, MNHN · 4 - Dept. of African Zoology, Royal Museum for Central Africa · 5 - Faculty of Medicine in the Galilee, Bar Ilan Univ. · 6 - Dept. of Anatomy and Anthropology, Tel Aviv Univ. · 7 - Physical Therapy Dept., Ono Academic College · 8 – UPR 2147, CNRS: Dynamique de l'évolution humaine : individus, populations, espèces · 9 – Scientific Service Heritage, Royal Belgian Inst. of Natural Sciences · 10 – UMR 5199-PACEA, CNRS, Univ. Bordeaux · 11 – Dept. Estratigrafía y Paleontología, Euskal Herriko Unibertsitatea · 12 – IKERBASQUE. Basque Foundation for Science · 13 – Dept. of Radiology, ULB Erasme hospital · 14 – Dept. of Anthropology, California State Univ. Northridge · 15 – Dept. of Applied Mathematics, Peter the Great St. Petersburg Polytechnic Univ. (SPbPU)

Researchers are increasingly using computer software and morphometrics to assist with reconstruction of fossil hominin material although the majority of reconstructions focus on a single bone. The Spy II skeleton was found in Belgium in 1886 and is relatively complete [1]. The aim of this study was to virtually recreate the Spy II Neandertal using mirror image counterparts of Spy II material and other scaled Neandertal fossil remains (Neandertal 1, La Ferrassie 1 and 2, Kebara 2) to complete missing parts. Computed Tomography (CT) scans were taken and analysed to create 3D bone models. 3D models were imported into 'lhpFusionBox' which is a state of the art musculo-skeletal software developed at the Université Libre de Bruxelles (ULB). Standardised anatomical landmarks (ALs) were palpated on well-defined bony landmarks on individual bone models. Where possible, ALs were used for 3D spatial scaling transformations between bones using a validated registration method which tracked the dispersal of ALs following geometrical transformations. ALs were further used for establishing measurements which enabled a scaling via length where 3D registration was not possible. There are partial or complete remains available for all long bones, the skull, a patella and scapulae. When complete Spy II bones were missing, we scaled bones of other Neanderthals using available Spy II bones such as La Ferrassie 1 for the hand and La Ferrassie 2 for the foot. The Kebara 2 pelvis and thorax were used as the only remain with a possible attribution to Spy II is a small piece of sacrum. The vertebral column reconstruction follows what has been done by Been et al. [2] and ribs and cervical vertebrae were taken from the reconstructed Kebara 2 thorax from Sawyer and Maley [3] (with the exception of ribs 1 and 2 where Kebara 2 original models were used). The pelvis and reconstructed thorax were scaled to the size of Spy II using a detailed scaling procedure involving the Spy II femur and the Neandertal 1 pelvis and femur [4]. Large scale geometrical and morphological reconstructions between different specimens have not been attempted using computing technologies (ICT). The scaling techniques developed in lhpFusionBox add to the growing toolkit of ICT software and tools for fossil hominin reconstruction. The complete Neandertal skeleton has been printed in polyamide resin and used as the base for Neandertal models based on scientific evidence in museums [4]. The skeleton is also the first step towards a detailed musculo-skeletal biomechanical analysis currently in progress.

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Poster Presentation Number 47, Th (17:00-19:00)

Brain growth rates in African apes and early hominins

Zachary Cofran[1]

1 - Nazarbayev University

Brain growth is a critical life history variable, as both infants and mothers must meet the energetic demands of developing this expensive tissue. Previous work has shown that humans achieve their large adult brain sizes, at least in part, by maintaining high growth rates for the first two years of postnatal life. This strategy likely could not have evolved without extensive alloparental care to alleviate the metabolic burden on mothers. To elucidate the origins of this unique pattern, human brain growth is placed in comparative and evolutionary context by reconstructing growth rates in *Pan troglodytes*, *Gorilla beringei*, and fossil hominins. For extant samples with known ages at death, growth curves are first estimated with cubic spline regressions. Arithmetic growth velocities are then calculated from the regression estimates of brain size for a given age. Average annual velocities are estimated for *Australopithecus afarensis, A. africanus* and *Homo erectus*, allowing for uncertainty in neonatal brain size, infant age and infant brain size. Average annual rates are calculated for extant samples for comparison with fossil hominins. Consistent with previous work, humans retain elevated rates of brain growth for the first two postnatal years compared to the apes. Gorillas have surprisingly high velocities, elevated above both chimpanzees and humans, for the first few weeks after birth. These high rates decrease rapidly, reaching zero grams per year by 2-3 years of age, whereas chimpanzee rates do not reach zero until 3-4 years. *Australopithecus* average annual rates of brain growth overlap with ape ranges, whereas *H. erectus* is at the low end of the human range. This indicates that the extended period of high brain growth rates probably did not evolve until after the emergence of the genus *Homo*. Results highlight variation in brain growth and life history strategies among the Homininae. The stark difference in patterns of brain growth deceleration between chimpanzees and gorillas underscores the unique life history and developmental strategies of each species, and renders the notion of "ape-like" brain growth problematic.

Poster Presentation Number 137, Sa (12:20-13:50)

Late Pleistocene hominins from La Cotte de St Brelade, Jersey

Tim Compton[1], Matthew M. Skinner[2,3], Robert M. G. Martin[3], Louise Humphrey[1], Matthew Pope[4], Martin Bates [5], Andrew Shaw[6], Chris Stringer[1]

1 - Department of Earth Sciences, Natural History Museum, London · 2 - School of Anthropology and Conservation, University of Kent, Canterbury · 3 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig · 4 - Institute of Archaeology, University College London · 5 - School of Archaeology History and Anthropology, University of Wales Trinity St David, Lampeter · 6 - Centre for the Archaeology of Human Origins, University of Southampton

The hominin remains from La Cotte de St Brelade all originate from an area of complex sedimentation at the site where the North and West Ravines meet. Analysis of the existing archive, and modern survey of the site, have allowed us to clearly identify the location and stratigraphic context from which the human teeth where recovered and, more generally, the position and context of the human occipital fragment. Although the deposits from this part of the site were removed during the 20th century their stratigraphic equivalents extend into areas of remaining sediment within the main West Ravine. OSL dating, undertaken in 2011 within the middle parts of this sequence, approximately 4m below the location where the teeth were discovered, suggests that the deposits containing the teeth and the occipital fragment both post-date 47k years B.P. We therefore consider it highly likely that both will ultimately be dated to within the mid-late Weichselian. Originally described by Keith and Knowles in 1912 [1] and later by Stringer and Currant in 1986 [2], twelve isolated permanent fully erupted teeth are available for study; two now represented only by casts. These come from at least two individuals (and a maximum of eight). Both individuals had fully erupted third molars. Crown and root morphology indicates that they are Neanderthal, and their size and shape is consistent with this, but some aspects are unusual - sagittal sulcus on lower fourth premolars not interrupted, no mid trigonid crest on lower third molar, three cusped upper second molar, and a relatively small hypocone on the upper first molar. The level of taurodontism exhibited is considerable, and its occurrence at this site is one of the earliest descriptions of this characteristic. Wear on the teeth is moderate and mainly horizontal and, if they come from two individuals, the rate of attrition was low. There is little chipping of the enamel but two teeth, an upper fourth premolar and an upper first molar, have ante mortem fractures of the distal enamel rim. Possible non-masticatory wear includes 1) fine mesiodistal grooves on the occlusal surface of a lower central incisor and 2) particularly worn down mesial/distal occlusal edges, together with pitting of the enamel, of a lower canine and a lower fourth premolar. The enamel of the teeth is regular but there is multiple furrow-form hypoplasia on the lower canine and single furrows on other teeth that could have been developing concurrently. Analysis of crown, enamel-dentine junction, and root morphology of upper and lower molars employing CT scans confirms that they are Neanderthal and not modern human. Two traits at the EDJ of lower molars appear primitive compared to other Neanderthals - the form of expression of the protostylid, and minimal expression of trigonid crests. Two upper molars express a post-paracone tubercle at the EDJ. These have been documented in a number of other European Neanderthals. All specimens have poorly preserved dentine adjacent to their pulp cavities, possibly representing poor mineralization of the teeth during life. The occipital fragment comprises a small part of left occipital squamous from a child of approximately 8 years, with a fully open lambdoid suture and well-formed transverse sulcus.

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Poster Presentation Number 49, Th (17:00-19:00)

Cognitive, Behavioral, and Archaeological Sequelae of a Larger Cerebellum in *Homo sapiens*

Frederick Coolidge[1], **Amanda Harvey**[1]

1 - University of Colorado, Colorado Springs

The cerebellum (literally = little brain) is intimately and reciprocally connected to every major region of the cortex, particularly the prefrontal cortex and the parietal lobes. Although the cerebellum only accounts for 10% of the brain's total volume, it is estimated to comprise 50% to 80% of the 100 billion neurons in the human brain. The traditional functions of the cerebellum have been long known to be the control of fine motor movements, motor action planning, and motor sequencing. Through comparative studies, it has been demonstrated that the posterior portions of the cerebellum in extant humans appear to be more recently evolved compared to nonhuman primates, such that these areas have been labeled *neocerebellar.* Provocatively, Weaver in 2005 proposed that the cerebellum to cerebrum ratio was greater in *Homo sapiens* than in Neandertals. More recently, have also asserted that the cerebellum is proportionately larger in *Homo sapiens* than Neandertals. In 1993, Ito proposed that the cerebellum might be involved in cognitive functions as well as motor functions, such that thoughts and ideas might be refined like the refinement and sequencing of motor movements. In the past decade, there has developed a preponderance of empirical evidence that the more newly evolved areas of the cerebellum are involved in higher cognitive functions including language, inner speech, higher-order rule formation, attention, and verbal and visuospatial working memory. If the hypothesis that the cerebellum is larger in *Homo sapiens* than Neandertals is further substantiated, then the likelihood that some of the subtle archaeological differences between the two human types, which appear to favor greater cognitive flexibility, creativity, and innovation to the former might provide a partial explanation for the archaeological differences. It must be noted that a current hypothesis , which maintains there were no differences between the two human types, makes no mention *whatsoever* of neurological structural differences or brain shape differences that have been empirically well documented [1, 4, 5]. It is an inherent assumption in the present paper that these substantiated brain shape differences are likely to have cognitive, behavioral, and archaeological sequelae.

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Pecha Kucha Presentation: Session 4, Fr (9:40-10:05)

Neandertal Demise through Modeling: The Viewpoint of Population Dynamics

Anna Degioanni[1], Christophe Bonenfant[2], Sandrine Cabut[1], Silvana Condemi[3]

1 – AMU LAMPEA, Aix-en-Provence, France · 2 - LBBE Université Claude Bernard, Lyon, France · 3 - AMU ADES, Marseille, France

The cause of the demise of the Neandertals, the well-known middle Pleistocene population, is the topic of an unresolved debate. The demographic differences between Neanderthals and modern humans (fecundity rate or diversity in timing of maturation) may have had a major impact on this demise. The aim of our study is to analyze this phenomenon using a demographic approach in accord with the hypothesis that the Neanderthal population was already demographically weakened or endangered when modern humans arrived in Europe. We began [1, 2] to analyze this phenomenon in terms of a very simple demographic approach in order to test the hypothesis that demographic variations in fertility and/or survival rates might have led to a reduction in the size of the Neanderthal population. In this paper we propose a more complex model on the basis of animal ecology, aiming to identify parameters that correspond to the decay and extinction of the Neandertal population over a period of 10,000 years, beginning from an initial population of 70,000 individuals, which were divided into at least three geographical subgroups [4, 5], the first corresponding to southern Europe, the second to central Europe, and the third to eastern Europe and Asia. We used the Leslie matrix which requires the survival, the fertility and the migration rates for each age group. Since the demographic rates for the Neanderthals are unknown, we used a random selection from a beta distribution of each parameter for each age group, for each geographical subgroup, and for each of the 10,000 years. The model we have developed allows us to affirm that very small changes in fertility and / or survival rate are sufficient to account for the disappearance of the Neandertal population. Among these subgroups, the eastern European subgroup was the first to disappear, followed by the demise of the central European subgroup and finally by that of southern Europe. This study is part of the multidisciplinary project NEDEMO (Neanderthal Demise Modeling), which aims to identify the demographic parameters (fertility, survival rates, structure and variation in population size) that would have caused the disappearance of the Neandertal population.

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Podium Presentation: Session 3A, Th (16:40)

Oral health and diet change during the final Upper Palaeolithic in Northwest Africa

Isabelle De Groote[1,2], **Jacob Morales**[2], **Louise Humphrey** [3]

1 - Liverpool John Moores University · 2 - Departamento de Geografía, Prehistoria y Arqueología, Universidad del País Vasco · 3 - The Natural History Museum,London

This study evaluates changes in subsistence behaviour at the end of the Palaeolithic in Northwest Africa. The pre-agricultural occupants of what is now Morocco, Algeria and Tunisia have been studied since the beginning of the 20th Century and have been assigned to two main industries: The Iberomaurusian (21,000BP-8,000BP) primarily in Morocco and Algeria, and the Capsian in Algeria and Tunisia (10,000BP-7,000BP). Despite intensive study of the Iberomaurusian and Capsian lithic technologies, differences between the subsistence strategies and lifeways of their makers are still poorly understood. Previous work has highlighted very high caries prevalence at the Iberomaurusian site of Grotte des Pigeons, Taforalt, Morocco. In addition, charred macrobotanical evidence from the site suggests that these Late Palaeolithic people may have included wild plant foods into their diet that would have contributed not only to their poor oral health, but would also have enabled the inhabitants of Grotte des Pigeons to occupy the cave for more extended periods of time than was possible on a traditional hunter-gatherer diet. The first aim of this study was to ascertain whether the pattern of oral pathology observed at Taforalt was typical in the Iberomaurusian period. Secondly, we investigated whether the transition to the Capsian industry brought with it a change in oral health and subsistence behaviours. Dento-alveolar pathologies were analysed in 110 individuals (2039 tooth sites) from the Iberomaurusian and 19 individuals (410 tooth sites) from the Capsian The Iberomaurusian sample shows high caries rates with 59% of observed teeth affected by caries and 107 out of 110 individuals having at least one carious lesion. The predominant types of carious lesions were occlusal caries, usually accompanied by high attrition rates. Abscesses were present in 5% of the observed Iberomaurusian tooth sites. In the Capsian sample caries rates remained very high with 48% of observed teeth affected, and 14 out of 19 individuals exhibiting caries. Charred macrobotanical evidence also shows similarity in plant components at some Iberomaurusian and Capsian sites. Evidence from the Iberomaurusian site in Taforalt and the Capsian site of Mekta, Tunisia, show that at both sites, the most frequently surviving plant foods are pine nuts (IB 24.8% CAP 47% of total assemblage) and acorns (IB and CAP both 38%). At both sites rhizomes of esparto grass are present which may indicate the use of basketry to harvest and store these wild plant foods. Faunal evidence reveals a high prevalence of edible terrestrial molluscs in both Iberomaurusian and Capsian sites indicating that the harvesting of molluscs was a key component of subsistence strategy in both periods [3, 4]. Nevertheless, despite these apparent similarities in oral health, plant foods, and mollusc consumption some changes have been noted. The Capsian technological complex is distinguishable from the Iberomaurusian and a transition from large and medium size game to small and very small game during the Capsian has also been observed . The evidence presented here shows that the transition to the Neolithic in Northwest Africa was preceded by changes in subsistence strategy that enabled hunter-gatherers adopt more sedentary seasonal occupation patterns. The systematic exploitation of wild plant resources had profound consequences on oral health due to increased consumption of fermentable carbohydrates. The question remains whether the Iberomaurusian and Capsian populations represent two distinct groups or whether the or whether these similarities in oral health and subsistence behaviour are a further indication of long-term population continuity in the Maghreb.

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Podium Presentation: Session 1, Th (11:20)

Excavations in the EFHR complex (Olduvai Gorge, Tanzania). Implications for the emergence of the Acheulean in East Africa

Ignacio de la Torre[1], Lindsay McHenry[2], Michael Pante[3], Jackson Njau[4]

1 - Institute of Archaeology, University College London · 2 – Dept. of Geosciences, University of Wisconsin-Milwaukee · 3 – Dept. of Anthropology, Colorado State University · 4 – Dept. of Geological Sciences, Indiana University

This paper reports recent archaeological excavations at EF-HR (Olduvai Gorge, Tanzania) by the Olduvai Geochronology Archaeology Project (OGAP). The EF-HR site was originally excavated and published by Mary Leakey (1971), and was at the time considered as the world's earliest Acheulean site, hence becoming a key reference for discussions on the emergence of this technology. Despite its relevance, no fieldwork was undertaken at EF-HR for over five decades, until OGAP resumed excavations. Since 2009, OGAP has conducted detailed stratigraphic studies of the sequence, extended excavations in the main site at EF-HR, and has also placed eleven additional trenches within an area of approximately 1sq km, in order to sample the same stratigraphic interval as in the main trench across a wider part of the paleo-landscape. Our new stratigraphic work suggests that EF-HR might be positioned higher in the Bed II sequence than previously proposed both by Leakey and Hay . This has relevant implications for the age of the site and its stratigraphic correlation with Olduvai Middle Bed II sites such as MNK and FC. In addition, a more recent age for the EFHR assemblage has an impact on the tempo and modo of the transition to the Acheulean, and also requires reconsideration of the late Oldowan at Olduvai Gorge. The archaeological excavations at the main site and nearby trenches have unearthed a considerably large new assemblage, with more than 2,000 fossils and artefacts, which include several dozens of handaxes in clay, sand, and gravel deposits. This enables reconstructing a detailed story of the paleoecological setting, the taphonomy and technology of the EF-HR assemblage, particularly with regards to the reduction methods and the chaine operatoire characterizing the earliest large cutting tools in East Africa. In addition, our test-trenching approach has detected conspicuous differences in density of artefacts across the landscape, with a large cluster of archaeological material in and around the main trench, and more tenuous human activity in more distant satellite trenches. In summary, renewed fieldwork at EF-HR by OGAP has unveiled important stratigraphic, technological, and taphonomic data that should play a relevant role in shaping an updated view of the origins of the Acheulean at Olduvai Gorge, and which will be discussed within the context of East Africa and beyond.

Acknowledgements: We thank the Tanzanian government for allowing us to conduct field research at Olduvai, under permits from the Tanzania Commission for Science and Technology, the Tanzania Antiquities Department, and the Ngorongoro Conservation Area Authority. This research was funded by grants from NSF(BCS-0852292 and the European Research Council (Starting Grants-283366.

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Poster Presentation Number 30, Th (17:00-19:00)

HPLC, an alternative and efficient purification technique for AMS dating of contaminated and low collagen bone samples – Principle and application to Palaeolithic sites

Thibaut Deviese[1], Daniel Comeskey[1], Eileen Jacob[1], Crista Wathen[1], James McCullagh[2], Thomas Higham [1]

1 - University of Oxford - Research Lab for Archaeology · 2 - University of Oxford - Chemistry Research Lab

The efficient removal of carbon-based contaminants from samples prior to AMS dating is one of the most important parameters in the reliable application of the radiocarbon method. Chemical protocols using combination of acid and alkaline solvents have been developed for all types of organic samples and these are constantly assessed and revised to address difficult and persistent cases of contamination [1-2]. Since 2001, members of the Oxford Radiocarbon Accelerator Unit (ORAU) have also been working on the application of ultrafiltration for dating bone. An ultrafilter is a molecular sieve that separates high from low molecular weight (MW) fractions. High MW components will include undegraded alpha chains of amino acids, whilst low MW components can include degraded amino acids and peptides, and soil-derived contaminants, all of which are discarded after separation. In 2000, testing of the method was undertaken in Oxford and it was first applied to material from the British Palaeolithic (2000–2005) and later to the western European Palaeolithic (2006–2009) sites. The efficiency of ultrafiltration to remove contamination and therefore improving the precision of the dating has been demonstrated on a broad range of samples analysed in our lab. However, in some cases, the ultrafiltration is not efficient enough to fully remove contamination and the multistep procedure, including the ultrafiltration, can be problematic for low collagen samples. These limitations are particularly relevant for the Palaeolithic samples analysed as part of the PalaeoChron project. The reason is that Pleistocene material contains much greater quantities and types of contaminants and the organic matter we use for dating is often badly degraded. PalaeoChron aims to research and further develop some of the current pre-treatment protocols in particular using High Performance Liquid Chromatography (HPLC). Over the last five years, the ORAU started to use liquid chromatography to separate the amino acids obtained after hydrolysis of collagen samples [3-5]. Again, this has proven to be a very efficient technique to remove contaminants from collagen samples. This poster will present, with some chosen examples of samples from Palaeolithic sites such as Kostenski and Sungir, the efficiency of the technique to eliminate contaminants by comparison with more traditional methods. This poster will also present the importance of using liquid chromatography for samples with very low collagen (C/N ratio inferior to 2) where the standard procedure would not allow for the production of enough graphite for the AMS dating.

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Poster Presentation Number 138, Sa (12:20-13:50)

Anthropological and archaeological reassessments of the evidence of inter-personnal violences in the Late Pleistocene cemetery of Jebel Sahaba (Site 117, Nile Valley)

Marie-Hélène Dias-Meirinho[1], Daniel Antoine[2,3], François Bon[1], Isabelle Crevecoeur[4]

1 - UMR5608-TRACES, Université de Toulouse Jean Jaurès, France. · 2 - Institute for Bioarchaeology, Department of Ancient Egypt and Sudan · 3 - The British Museum, London · 4 - UMR 5199-PACEA, CNRS, Université de Bordeaux, France.

The late Pleistocene and early Holocene are marked by major climatic changes whose effects on human populations are poorly understood. In the Nile Valley, possible refuge zone during the periods of high climatic constraints, hyper-arid environmental conditions are documented until the onset of the Holocene. Here we present an integrative approach to the analysis of the Jebel Sahaba collections to discuss the cultural behavior of human groups in the Nile Valley during this time of hyper-arid conditions. Jebel Sahaba (Site 117), dated to at least 11,600 years old [1], is the earliest Cemetery in the Nile Valley. Excavated by Wendorf in the sixties [2] the 61 buried individuals of this funerary complex are well-known for showing, in nearly half of the cases, traces of inter-personnal violences. The presence of cutmarks, traumatic lesions and embedded lithic artifacts in the human remains have been first described by Anderson [3], and since then, this assemblage is considered as possible evidence of organized warfare [4]. Since 2013, we have started a reassessment of the anthropological and archaeological evidence from the site in order to characterize the nature of the osseous lesions at a microscopic level, and to describe the archaeological assemblage. Our current examination of the skeletal material from 33 primary individual, double and multiple burials has underlined the projectile origin of most of the bone lesions. In addition, we have been able to increase to number of observable lesions and to recognize previously unidentified embedded lithic in fresh as well as healed trauma. The lithic analysis reveals a clear difference in raw material and technology between the artifact collected at the surface of the graveyard and the one found inside the volume of the individuals during the excavation. Despite its strong variability, most of the lithic artifacts found inside the burials can be identified as projectiles. Several hypothesis have been proposed to explain the Jebel Sahaba funerary assemblage whether it was the reflection of a mortality crisis (related to a single conflict), or a specific place of deposition for individuals subjected to a violent death. No gender selection or age-at-death anomaly was observed in the treatment of the deceased. Only a deficit in perinatal individuals is present. If multiple burials with up to 4 individuals buried simultaneously are present, perturbations for later depositions are also documented in several cases. While acknowledging the fact that the Jebel Sahaba Cemetery could be a specific place of deposition, the archaeo-anthropological data also support that this assemblage reflects the occurrence in the Nile Valley, at the end of the Pleistocene, of sporadic and recurrent episodes of inter-personnal violences.

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Poster Presentation Number 15, Th (17:00-19:00)

Hello? Is there anybody out there? A review of the evidence of the first peopling of Sicily

Gianpiero di Maida[1]

1 – University of Kiel

Sicily is the largest island of Mediterranean, but given its proximity to the firm land, it holds a very peculiar status, to the point that it has been even questioned its truly insular nature («Sicily [...] is—and has been over the Quaternary—so close to Italy that it falls into the quasi-insular category»,[1]). Recent studies moreover showed that during the LGM, Sicily has been connected to Italy, being *de facto* not an island for a given timespan («The minimum duration of the land bridge, assuming no erosion of the seafloor, would have been 1.5 ka, from 21.5 to 20 cal ka BP»,[2]).

This proximity (or even connection) has understandably increased the expectations of archaeologists and researchers, who - based on the record of the southern Italian peninsula - searched for spurs of peopling older than the one and only surely present in the archaeological record of Sicily (that took place during the very late phases of Pleistocene, in the Lateglacial).

That's why repeatedly, from the second postwar period onwards, claims of lower Palaeolithic industries have been laid (always strictly based on surface finds, out of stratigraphy). After a cautious initial enthusiasm, many of these finds have been called into question, when not clearly disproved. Also in the case of a more solid and credible claim (a possible Aurignacian lithic industry at Fontana Nuova, Ragusa[3]), the absence of any absolute dating and the use of the typology for the attribution, casted a very long shadow on this lone evidence (see a new interpretation for the lithic complex of Fontana Nuova, now attributed to a more plausible Epigravettian phase, in [4]).

This poster proposes an overview and at the same time a review of these questionable attributions, adding a brief parallel of the testimonies actually available for the first colonization of other islands in the Mediterranean and finally the presentation of the few data available (consistent with the archaeological record) concerning the palaeogenetic of the first inhabitants of Sicily.

Acknowledgements: I would like to thank my supervisors, Prof. J Müller and Prof. T. Terberger, for the useful suggestions and the initial spark.

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Poster Presentation Number 128, Sa (12:20-13:50)

Diets and mobility of Altai Neanderthals from isotopic analysis data

Maria Dobrovolskaya[1]

1 - Institute of Archaeology RAS, Moscow, Russia

Archaeological study of the northwestern Middle Paleolithic Altai sites opened the new look to the peopling of the Neanderthals in the Eurasia [1]. Paleoecological approaches to the study of lifestyle, diet and mobility of groups of Neanderthals contributed to the understanding of the processes of the peopling of the Neanderthals of Altai. The results of the isotopic studies (13/12 C and 15/14 N ratio) of Western European Neanderthals bone collagen samples indicated high proportion of herbivore meat in the diet [2]. Bone collagen analysis of the samples from skeletal fragments from Okladnikov Cave (Altai) confirmed this trend [3]. Individual data varies from -20‰ to -19‰ (δ13/12 C), and from 13 to 14.4‰ (δ 15/14 N). Local herbivore fauna are characterized by carbon delta from-21, 5‰ to – 19, 4‰ and nitrogen delta from 8, 7‰ to 10, 7‰ [4]. A high human nitrogen ratio might related to freshwater fish in the diet, but in this case, the carbon ratio should be much lower. So the question about freshwater sources can discussed. The study of Neanderthal mobility connected with strontium isotopes analysis approaches. The data of 87Sr/86Sr ratio in the tooth from Okladnikov Cave were published [5]. Based on these data, assumed for a sedentary life of the Neanderthal from cave Okladnikov Cave. New information about of the 87Sr/86 Sr ratio variability through Neanderthals and animals from Okladnikova Cave, Denisova Cave, Chagirskaya Cave can be used to reconstruct the mobility of the humans as well as hunted species. Strontium 87Sr/86 Sr ratio obtained for the human bone samples and animal (hyenas and bear) bone samples shows great similarity. Differences observed between the strontium ratio that identified for the human bone and herbivores (bison) bone samples. Based on these trends it is possible to assume that the main hunting territories of the Neanderthal groups were located at some distance from the caves.

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Poster Presentation Number 4, Th (17:00-19:00)

Lithic Reduction Strategies in the Late Middle Paleolithic of the Balkans

Tamara Dogandžić[1]

1 - Max Planck Institute for Evolutionary Anthropology, Department of Human Evolution

Middle Paleolithic occupation of southeast Europe, compared to other parts of the continent, is still insufficiently studied and understood. Therefor techno-typological characterization, geographical diversity and temporal trends of Middle Paleolithic industries in the Balkans and their potential association with climate, environment and faunal exploitation still remain to be discerned. Middle Paleolithic assemblages from this region have been described with reference to Mousterian facies as defined elsewhere, e.g. Eastern Charantian, Balkan Levallois Mousterian, Denticulate Mousterian, or by artifact size characteristics, as is the case the with the so-called Micromousterian assemblages. The goal of this study is to investigate main characteristics of Mousterian assemblages from the Adriatic region of the Balkan peninsula, so as to identify patterns of diachronic change in stone tool production. The study is based on the new analysis of lithic assemblages from two sites in Montenegro, rock-shelters Bioče and Crvena stijena, the latter representing one of the best known stratified sites in the region, with 19 Middle Paleolithic layers. Sample used in this study comes from deposits in Crvena stijena that range from MIS 5b to MIS 3, while upper sequence of Bioče that is still undated, potentially corresponds to MIS 4 and MIS 3. Starting from the assumption that the variation in Mousterian industries to a large extent stems from changing patterns of blank production and subsequent tool use and modification, this analysis focuses on the relationship of core reduction systems and toolkit maintenance. General trends in blank production are based on shifts of core reduction systems and changes in the production of blanks of different morphologies. These patterns are coupled with the evidence on the extent of use and resharpening of tools. An attempt is made to identify variation of technological behavior over time that would reflect changes in artifact life history strategies. Finally, data from these two sites will be integrated in the wider context of Neandertal occupations and industrial variability in the Balkans peninsula.
Acknowledgements: I wish to thank Max Planck Society for supporting this project, Shannon P. McPherron and Jean-Jacques Hublin for their supervision, Lj. Đuričić, Z. Vušović-Lučić, and Dušan Mihailović for access to collections.

Poster Presentation Number 69, Th (17:00-19:00)

The Application of Citizen Science for Education and Exploration in Paleoanthropological Field Research

Randolph Donahue[1], Adrian Evans[1], Louise Leakey[2], Chris Lintott[3], Robert Davis[1], Andrew Wilson [1], Thomas Sparrow[1], Robert Harman[1]

1 - University of Bradford · 2 - National Museum of Kenya · 3 - University of Oxford

Citizen science is an expanding area of academic/public interaction that engages new audiences through the use of internet based discovery and documentation tasks. It has been used to document new planets, decipher texts, and digitise museum objects.

The "Fragmented Heritage" project explores the use of this research tool with two aims: 1) to engage the public with palaeoanthropology by providing them a role in the search for fossilised remains and tools - field survey aimed towards the recovery of hominid material and associated fauna is currently among one of the most inaccessible processes to the public; 2) to illustrate that crowd-sourced data can be a useful and potentially transformative resource for field researchers. It is currently an expensive process, requiring experienced teams of fossil prospectors to walk over large and (presently) largely inhospitable 'badlands' – the additional data provided through crowd sourcing has the potential to increase efficiencies in prospection while providing a multitude of other useful datasets.

A new aerial based imaging platform developed by the project allows the documentation of ground surfaces at a sub-millimetre resolution. This system was deployed in fossil-bearing landscapes east of Lake Turkana in Kenya. In the first season the system collected 500,000 georeferenced images from a combined 0.7km square area. These have been put online through a crowd-sourcing platform and, through the use of training tools published in tandem, citizen scientists have been able to engage with a search of the documented landscapes. The results of this project are yet to be fully evaluated as our first images are still under analysis by our citizen scientists. The process itself serves as an educational platform for engaging the public with the types of tasks performed at the most rudimentary level of field research and, when tied to a knowledge database, is a useful tool for outreach. The most basic use within the academic environment is the ground-truthing of the crowd-sourced database of potential positive fossil and tool identifications, which may result in the discovery of new hominid material.

The potential of the system as it evolves is limited partly by the imagination of researchers able to engage with these new open image datasets. Identified materials can be imaged for size categories, thereby permitting the impact of stream sorting to be assessed at these localities. Fossil species can be identified from the images and used to reconstruct local palaeoenvironmental conditions. It can be used to identify hot spots of particular fossil remains without having to collect entire assemblages across the landscape. It can be used to define time periods represented at each locality. Changes in artefact densities will help to identify habitation or carcass processing site locations.

This paper presents our initial findings on the capabilities of this framework as an educational and exploratory tool and explores how this research might progress in the future.

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Poster Presentation Number 14, Th (17:00-19:00)

Raw material exploitation and transport, and the distribution of the Early Upper Paleolithic in the Northern Caucasus

Ekaterina Doronicheva[1]

1 - Peter the Great Museum of Anthropology and Ethnography (the Kunstkamera), Russian Academy of Sciences

Recent data from Mezmaiskaya, Ortvala Klde, Dzudzuana, and Bondi totally changes our understanding of the industrial peculiarities, human adaptations and distribution of the Early Upper Paleolithic (EUP) industries in the Caucasus [1, 4]. The evidence from the Northern Caucasus show that the earliest EUP assemblages appeared in the region ~38-37 kya cal BP (Mezmaiskaya, layer 1C) and existed until the onset of the Last Glacial Maximum (at ~25 kya) that caused a large ecological crisis and total change of local ecosystems. The EUP appeared in the region as a formed cultural tradition, including a knapping technology oriented towards the production of bladelets and microbladelets, prevailing of bladelet tools (mostly backed bladelets and Gravette points), developed bone industry including personal ornaments, and new strategies of raw material procurement and transportation. The studies suggest the distribution of the EUP into the Caucasus from the Levant. Many researchers note similarities between EUP industries in the Caucasus and Levantine Ahmarian, which is characterized by a high percentage of bladelets and microbladelets, and prevailing of tools on bladelets and microbladelets [4, 1]. The paper presents an original study of raw material exploitation and transport strategies in the EUP in the Northern Caucasus. The author studied materials from three stratified EUP sites, including Mezmaiskaya cave (layers 1C, 1B and 1A), Korotkaya cave (layer 2) and Gubs I Rockshelter (layer 2), containing 5744 lithic artifacts from 5 occupational levels in total. Petroarchaeological analyses have been undertook for 110 flint artifacts, 51 raw material outcrops of flint and chert were studied during special surveys in the region in 2007-2014, and 248 geological samples were analyzed from the raw material sources. Based on the results the author identified 7 flint sources exploited in EUP. Obsidians from Mezmaiskaya cave were analyzed using the trace element analyses [2, 3]. The study shows significant differences in raw material strategies between EUP modern humans and Neanderthals . The EUP humans preferred to exploit high-quality flints transporting from distant sources (20-100 km away from a site) mostly as cores or pre-cores. They started to exploit new raw material sources not used by the Neanderthals. Also, selection of various high-quality flints for tool production is characteristic for the EUP occupants. The obsidian studies suggest that obsidian was transported from two distant sources: Zayukovo (or Baksan) source area located in the Northcentral Caucasus (200-250 km south-eastward) and Chikiani-Paravani source located in the Southern Caucasus (450 km south-eastward). Similarities of EUP industries in the wide region from eastern Mediterranean, southern and northern Black Sea region, and transport of obsidians northward (from Anatolia to Southern Caucasus and from Southern Caucasus to Northern Caucasus point to a possible migration route in that period. The dispersal of EUP in the Caucasus was accompanied with the initial exploitation of new raw material resources.

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Podium Presentation: Session 2, Th (13:00)

Radiocarbon chronology of the Denisova Cave (Russian Altai, Russia)

Katerina Douka[1], **Tom Higham**[1,2], **Anatoly Derevianko**[3], **Michael Shunkov**[3]

1 - Research Laboratory for Archaeology and the History of Art, University of Oxford · 2 - Oxford Radiocarbon Accelerator Unit · 3 – Institute of Archaeology and Ethnography of the Siberian Branch of the Russian Academy of Sciences

Denisova Cave, the key site in the Russian Altai, became well known for furnishing the only known fossil of Denisovans, identified as a sister-species of Neanderthals based on a nuclear genome sequence from a finger phalanx recovered in layer 11.1 of the East Gallery in 2008. Layer 11 is a key level in the site because it contains evidence not only for Denisovans, but also for Neanderthals. A toe phalanx found in 2010 also yielded a full genome (Prüfer et al., 2014) which provided the basis of a possible model of gene flow events according to which several such events occurred among Neanderthals, Denisovans and early modern humans. In addition, there is material culture in this locus that appears Upper Palaeolithic in terms of lithic technology, and includes bone points and pierced animal tooth pendants. Several radiocarbon dates were previously reported for this stratum showing a great deal of variability. For example, in addition to several very old AMS determinations (>50,000 BP) there were some much younger ones, possibly suggesting a complex depositional sequence.

In order to provide a more robust chronology for the inferred undisturbed sections of the site in both principal galleries (Central and East) we have undertaken a new and comprehensive AMS dating programme. We dated 15 new samples from layers 9-11 from both Galleries, mainly focusing on material coming form recent excavations (2008-2014).

We obtained 16 new AMS dates, amongst which are the first direct dates of ornaments, dates on the bone point industry, as well as on charcoal and humanly-modified bones. In this paper we will report on these results and interpret the chronological implications for the fossil remains in Layer 11, and the wider Early Upper Palaeolithic archaeological sequence of the Altai. In addition, we will compare the dates of the diagnostic Upper Palaeolithic artefacts from Denisova, such as the bone point and teeth ornaments, to material typologically similar from across Eurasia.

Finally, we will briefly mention recent discoveries at Denisova using molecular fingerprinting with the method ZooMS, for the species identification of fragmented bone specimens that are no longer morphologically informative.

Poster Presentation Number 75, Fr (12:20-13:50)

New isotopic insights into palaeoecology and palaeoenvironment over 2 Million years from Wonderwerk Cave, South Africa

Michaela Ecker[1], James Brink[2,3], Louis Scott[4], Michael Chazan[5], Liora Kolska Horwitz[6], Julia A. Lee-Thorp [1]

1 - Research Laboratory for Archaeology and the History of Art, University of Oxford, UK · 2 - Florisbad Quaternary Research Dept., National Museum, Bloemfontein, South Africa · 3 - Centre for Environmental Management, University of the Free State, Bloemfontein, South Africa · 4 - Department of Plant Sciences, University of the Free State, Bloemfontein, South Africa · 5 - Department of Anthropology, University of Toronto, Canada · 6 - National Natural History Collections, Faculty of Life Sciences, The Hebrew University, Jerusalem, Israel

Wonderwerk Cave is an enormous dolomitic cavity located at the edge of the Kalahari in the arid interior of southern Africa. It is an exceptional site containing archaeological deposits with Earlier, Middle and Later Stone Age remains spanning ~2.0 Ma years of prehistory. Notably, it has yielded the earliest evidence for hominin cave use and the use of fire [1, 2]. It also provides a unique long-term record of environmental and climatic changes in a region where terrestrial proxy records are rare. While most recent environmental work in the context of human evolution has focused on East Africa, it is timely to explore how these trends manifest in the southern part of the continent and what the regional drivers of environmental change are. We present results of carbon and oxygen stable light isotope analysis on fossil herbivore enamel and ostrich eggshell from the Pleistocene and Holocene sequence of Excavation 1. With these two independent proxy datasets we are able to explore the local ecology of an extensive list of species, including bovids, equids, rodents and suids, and how they develop through time. The oxygen isotope data from several strata suggests fluctuating moisture conditions, especially at one million years ago, and again in the Late Pleistocene and mid-Holocene. We find clear differences in local resource availability between the Early and Mid-Pleistocene, and then between the Pleistocene and Holocene with an overall trend of increasing aridity. In particular, we document the onset of specialization in grazers that occurs after ~0.8 Ma linked to expanding C4 grasslands. Further niche specialization of grazers and browsing species continues during the Holocene. A combination of changes in vegetation and moisture availability from stable isotope data, and existing micro- and macro-mammalian abundance, pollen and phytolith proxies from the same strata, shows consistent and significant differences between the Holocene and Pleistocene strata at Wonderwerk Cave.
Acknowledgements: We thank the whole Wonderwerk team for their support and insightful discussions and Andy Gledhill (University Bradford) for assistance with isotopic analysis. Funding to ME during her DPhil was provided by the German Academic Exchange Service (DAAD), the Quaternary Research Association (QRA) and the Boise Fund, University of Oxford.

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Poster Presentation Number 31, Th (17:00-19:00)

Optically stimulated luminescence dating of the Palaeolithic 'Super Site' Woodgreen, in the Avon Valley, Hampshire (UK)

Ella Egberts[1], Laura Basell[2], Kate Welham[1], Anthony Brown[3], Phil Toms[4]

1 - Faculty of Science and Technology, Bournemouth University · 2 - School of Geography, Archaeology and Palaeoecology, Queen's University Belfast · 3 - Palaeoenvironmental Laboratory, University of Southampton · 4 - Luminescence Dating Laboratory, University of Gloucestershire

This paper presents the first optically stimulated luminescence (OSL) dating results from the Palaeolithic 'super site' Woodgreen in the Avon Valley, Hampshire. Only nineteen 'super sites', with exceptionally large concentrations of Palaeolithic artefacts are known in Britain of which two, Woodgreen and Milford Hill, are found in the valley of the River Avon [1, 2]. This area is of interest as it is the main northern tributary to the now submerged Solent River [3]. The large quantity of Palaeolithic artefacts found in these areas strongly suggest that floodplains of the Solent River system formed important dispersal routes from Europe into peninsula Britain during Pleistocene low sea-level stands [1, 4]. However, the Palaeolithic record from the Avon Valley, in contrast to that from the Solent catchment, remains poorly studied. There have been two principal impediments to a full appreciation of this significant record. Firstly, the majority of the Palaeolithic archaeology is derived from Pleistocene fluvial terraces, presenting a complex depositional environment that has been minimally studied. Secondly, an absence of age markers has limited the chronological understanding of the archaeological record hindering its wider contextualisation. The geoarchaeological method applied in this research addresses these issues and incorporates:

1) A study of the fluvial geomorphology of the Avon Valley through: analysis of LiDAR data, terrace exposures and excavations with special attention to the depositional context of sites with high artefact concentrations. 2) A programme of dating the sequence of river terraces in the area in order to understand the timing and nature of the terrace formation and Quaternary landscape change, as well as the age of the fluvial deposits from which artefacts are derived. 3) A study of the Palaeolithic material from Woodgreen and Milford Hill in the Avon Valley, and an additional large artefact concentration found at Bemerton, located by the River Nadder, a major tributary of the Avon. This will allow intra-site comparisons within the valley and beyond.

This approach is being applied to develop a much-improved understanding of these sites and hominin behaviour in the context of Quaternary landscape change. It provides the first dating framework for the Palaeolithic record of this catchment and will allow integration of the Avon record into the wider context of hominin presence in Britain.

Acknowledgements: We are grateful to the Arts and Humanities Research Council, Bournemouth University and the Hampshire Field Club for their support.

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Poster Presentation Number 18, Th (17:00-19:00)

Using metrology to benefit refitting and microwear; Novel approaches to two powerful interpretative tools

Adrian Evans[1], Randolph Donahue[1], Andrew Wilson[1], Nick Ashton[2], Thomas Sparrow[1], Robert Davis [1], Danielle Macdonald[1], Andreu Olle[3]

1 - University of Bradford · 2 - British Museum · 3 - IHEPS, Spain

Refitting is a technique with significant interpretive scope when applied to understanding social and technological organisation at sites with good spatial integrity. The same can be said for lithic microwear analysis, the go-to technique for assessing if and how stone tools were used, and one of only a few techniques in Palaeolithic archaeology that can identify the direct actions of individuals. When combined, these techniques can be a 'tour de force' in understanding the range of behaviours enacted at a site, where activities were occurring, and how these activities are linked to tool production. This information gives us a glimpse into the structure of social units and cognitive organisation within species. These are, however, not techniques without complications. Refitting large assemblages is often attempted, but rarely is it considered completed. This is because refitting requires an exponentially increasing number of person-hours as assemblage size increases. This can create a limitation in confidence with data presented at the 'end' of analysis as being representative of overall site behaviours. Similarly, microwear analysis has been under critique since its inception. This critique has centred on the observational, and arguably subjective, nature of the methods involved. This situation has not been helped by the way microwear has presented under blind-test scrutiny. The 'Fragmented Heritage' project aims to help these situations using a related set of techniques from the field of high precision engineering: optical metrology. With refitting, efforts are focused on using medium scale (millimetre to micrometre) high precision, and rapid, 3d scanning to produce digital models of tools, cores, and debitage. These models are then processed using a set of algorithms which dissect and compare flaked surfaces within a given assemblage of material. This outputs probability matrices from which refitting surfaces can be derived. This effectively automates the refitting process and affords the researcher more time to evaluate the significance of the resulting patterns of material organisation at the analysed sites. With microwear, efforts are focused at presenting quantified and standardised data using 3d optical metrology microscopes (micrometre to nanometre). This approach has been shown to quantifiably differentiate wear traces in experimental settings. Application to archaeological material illustrates that this can provide additional confidence to autoptic analyses and extract, unobservable, information which can expand the interpretive envelope provided by microwear data. Each of these novel approaches are presented using new case studies of material studied by the Fragmented Heritage Project from different Palaeolithic periods and from different continents to illustrate the diversity of applications and the potential impact that optical metrology can have on understanding past societies.

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Poster Presentation Number 55, Th (17:00-19:00)

The association between craniofacial form and climate in North East Europe differs from that in North Asia

Andrej Evteev[1]

1 - Lomonosov Moscow State University

Northern Asian populations are usually considered as a model for inferring fossil hominin adaptation to the glacial conditions of the Ice Age of Europe. But what is a suitable climatic model and what is a suitable human model? The climate of Northern Asia in winter is much colder but much drier than that of Northern Europe. The mean January temperature in Northern Karelia (64-66° North) is -12° C and mean precipitation is as high as 25 mm in that month. In the area surrounding Lake Baikal (52-58° N) the same climatic parameters are -25-30° C and 5-6 mm, respectively. Many previous studies have shown that humidity and precipitation are as relevant as air temperature in driving adaptation and may drive it in different ways. Thus it is important to compare possible adaptive changes in the mid-face in populations of North East Europe where climate is both cold and relatively humid with those of Northern Asia.

Here we sampled nine populations from North East Europe: Finns, Karels (two samples), Komi, Letts, Mordvins, Russians (two samples) and Northern Ukrainians. For comparison eight groups from warmer regions of Europe were sampled: Armenians, Bulgarians, Italians, Norse, Ossetians, Romanians, Shapsugs and Turks. All the populations represent similar "Caucasoid" facial morphology but strongly differ in terms of language and origin. The total sample included 411 skulls.

A set of 24 linear measurements was compiled to sample the different functional components of the facial skeleton. Nine environmental covariates were employed including air temperature, precipitation, vapor pressure and cloud fraction. Two-block partial least squares (PLS) analysis was used as an exploratory technique and univariate Spearman correlations and Mantel tests were used to assess the strength and significance of associations between climate and morphology. To compare patterns of association between North Europe and North Asia the same analyses were carried out using previously published data.

The PLS revealed that overall squared covariance between form and climate was approximately twice as high among Asians (21.45%) as among Europeans (9.6%). Further, among Asians the matrix of morphological Euclidean distances among the populations was significantly correlated with the matrix based on all 9 climatic variables (0.66, p=0,03). This was not the case among Europeans and only matrices based on 14 measurements and the 6 climatic variables with the highest PLS loadings were significantly correlated (0.49, p=0.0012). That association is apparently driven by nine North East European groups.

Loadings of the climatic variables on SV1 were generally similar for both Europeans and Asian with the biggest differences in the loadings of measures of precipitation and cloud cover. The presumably cold-adapted populations in both Europe and Asia tend to have a slightly wider piriform aperture in combination with a slightly narrower anterior part of the nasal cavity, broader and antero-posteriorly longer maxilla (and thus longer nasal cavity) compared to the groups from milder climate. But in contrast to the cold climate Asian populations, North East Europeans demonstrate a strong reduction in the length and protrusion of nasal bones as well as in facial protrusion in general and reduction of the piriform aperture and orbital heights.

These differences could be either a result of adaptation to different climatic conditions or of marked differences in craniofacial morphology between Europeans and Asians. For instance, the facial skeleton in East and North Asian populations is generally very flat and thus it is difficult to expect it to get even flatter. But other features such as reduction of height of the nasal aperture in North East Europeans can hardly be explained by general morphological pattern alone.

We discuss our findings in the context of published data on craniofacial morphology of Upper Palaeolithic *H. sapiens*.

Poster Presentation Number 87, Fr (12:20-13:50)

The Earliest Ceramics: interregional comparisons and implications for the study of non-traditional Palaeolithic material culture and technologies

Rebecca Farbstein[1], **William Davies**[1]

1 - University of Southampton

This paper presents and compares the records of the world's earliest ceramic technologies, which were used to make figurative "art" rather than functional vessels. Two key regions and periods will be the focus of our discussion: Gravettian Czech Republic and Epigravettian Croatia . First, we will consider the origins of this innovative material in both areas. In Gravettian Czech Republic, ceramic materials were used to make figurines at a cluster of broadly contemporaneous, large, open-air, "Pavlovian" sites, including Dolní Věstonice I and Pavlov I, which are dated to between 31-27 kya. In Croatia, ceramic figurines were found in several archaeological horizons at a single cave site, Vela Spila, with dates between 17.5-15 kya. Comparing the records from these two regions, we will consider if there is any evidence of continuity or if the archaeological records suggest independent invention in both regions. Subsequently, we will discuss and compare the impact of this new ceramic material on representational traditions and styles in both regions, with special consideration of the broader socio-technical transformations that may be linked to the introduction of ceramics. We will examine the limitations of familiar approaches to the study of Palaeolithic imagery, which tend to privilege iconographic and stylistic characteristics of representational art. The ceramic figurines demonstrate the social importance of Palaeolithic "art" beyond the most iconic "Venus" figurines and animal statuettes; the large and diverse oeuvre of less iconographically striking ceramic "art" offers important insight into the social role of art-making in diverse Palaeolithic contexts.

Additionally, this paper explores the potential of building and applying integrated and contextualised *chaînes opératoires*-based methodologies to study Palaeolithic art [3-5]. The results from our research demonstrate that these kinds of methodologies offer robust and rewarding ways of engaging with this challenging dataset. Furthermore, Palaeolithic ceramics are a valuable case study in the importance of studying non-lithic and non-osseous Palaeolithic material culture. Our results provide a robust foundation for exploring and discussing some of the biases and limitations of past research that has often focused on the stone and bone artefacts, which survive in greater number in most contexts.

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Poster Presentation Number 37, Th (17:00-19:00)

The functional role of Carabelli trait in early and late hominins

Luca Fiorenza[1,2], **John Kaidonis**[3], **Ottmar Kullmer**[4], **Jacopo Moggi-Cecchi**[5], **Grant Townsend**[3]

1 - Department of Anatomy and Developmental Biology, Monash University, Australia · 2 - Earth Sciences, University of New England, Australia · 3 - School of Dentistry, University of Adelaide, Australia · 4 - Senckenberg Research Institute, Frankfurt, Germany · 5 - Laboratori di Antropologia, Dipartimento di Biologia, Università di Firenze, Italy

Carabelli trait is an accessory dental feature that forms along the lingual margin of the protocone of deciduous and permanent maxillary molars [1, 2]. It is variably expressed, ranging from a small pit or furrow to a large cusp, and its development, at least in *Homo sapiens*, is associated with crown size and intercuspal distance. This, nevertheless, seems to differ systematically between hominin taxa, and the variation in frequency and degree of expression of Carabelli trait has been used extensively for phylogenetic analysis. However, its functional implications remain unclear [3, 4]. In this preliminary study, we analyze the dental wear pattern of maxillary molars of early (*Australopithecus afarensis, Australopithecus africanus, Paranthropus robustus and Paranthropus boisei*) and late hominins (Neanderthal, Middle Paleolithic *Homo sapiens* and recent modern humans) using the Occlusal Fingerprint Analysis method, an approach based on digital models of teeth. We only selected one molar for each species with a clearly visible Carabelli cusp that showed signs of wear. We manually outlined each wear facet onto the polygonal surface, measuring their dip directions (the angle between the projected and the reference vectors). The resulting occlusal movements were described using the occlusal compass, a circular space that ranges from 0° to 360°. In tooth crowns with a small Carabelli cusp, a large facet 5 was generally noticeable which extended cervically, while in teeth characterized by a large Carabelli cusp, two new facets, a mesial 5.1 and a distal 6.1, could be identified. These facets are created by lateroretrusive and/or lateroprotrusive movements, occluding with the lingual groove of the lower molars, between the metaconid and entoconid cusps. It has been suggested that Carabelli cusp provides an additional surface area that extends the molar's functional life in highly abrasive environments [1, 3]. The facets observed in this study increase occlusal shearing area and this may be useful for a diet rich in tough and fibrous foods.
Acknowledgements: This study was supported by the University of New England (UNE Research Seed Grant 2015).

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Poster Presentation Number 32, Th (17:00-19:00)

Functional equivalence during development within a hard-object feeding primate (*Cercocebus atys*)

Laura C. Fitton[1], Edwin Dickinson[2], Karen R. Swan[2], Samuel N. Cobb[1]

1 - Centre for Anatomical and Human Sciences, Department of Archaeology and Hull York Medical School, University of York · 2 - Centre for Anatomical and Human Sciences, Hull York Medical School

During development, the masticatory apparatus undergoes significant change; including changes in muscle size and orientation, and in dental form due to replacement and wear. As overall body size increases during development, absolute masticatory forces are predicted to increase. However the effects of simultaneous changes to muscle lever mechanics and dental topography upon masticatory performance are currently unknown. Understanding how primates adapt to mechanically demanding diets during development is of interest not only to further our understanding of masticatory form and function, but also in order make dietary and life history inferences for fossil hominins.

Cercocebus atys (the sooty mangabey) provides an ideal opportunity to examine functional ontogeny and equivalence. This species represents a committed durophagous feeder, whose diet among adults and all juveniles of post-weaning ages, is centred upon exploiting the mechanically stress-resistant seed *Sacoglottis gabonensis*. Given this dietary consistency, it may be expected that the masticatory system will be functionally integrated and equivalent across development; such that individuals of all ages, with different craniofacial forms and levels of dental wear, are capable of processing this mechanically challenging food item.

In order to test this 3D virtual models of a developmental series of *C. atys* were reconstructed from Micro CT scans. Using virtual modelling techniques, changes in muscle cross-sectional area, mechanical advantage of the main masticatory muscles, bite force, estimated tooth contact surface area and bite pressure at the postcanine dental functional complex were predicted at various stages of development.

Results indicate that, as expected, maximum muscle force production increases with age; with adults predicted to generate significantly higher muscle forces than juveniles. However in juveniles the mechanical advantage of masticatory muscles is higher than those recorded for older individuals. Furthermore, due to lower levels of wear, the predicted tooth contact surface area is much smaller in juveniles compared to adults. As a result, even though the juveniles have smaller absolute muscle forces, the overall bite pressure is relatively invariant across all age groups.

Functional equivalence appears to be maintained across development within *C. atys*, as a result of integration between soft and hard tissue structures within the masticatory apparatus. As such *C. atys* appears suited for its stress resistant diet throughout development, but how difference in tooth form affect the efficiency of food breakdown still needs to be investigated further.

Podium Presentation: Session 7A, Fr (16:20)

Re-assessing morphometric affinities of MH1 (*Au. sediba*): The impact of ontogeny

Martin Friess[1], **Marie Iché-Antier**[2], **Francis Thackeray**[3]

1 - MNHN & CNRS UMR 7206 · 2 - MNHN · 3 - Evolutionary Studies Institute, University of the Witwatersrand

The origin and phylogenetic relationships of early representatives of the genus *Homo* remain a controversial issue in paleoanthropology. The discovery of the 1.97MA old hominin MH1 (*Au. sediba*) has raised questions about the degree of early hominin craniofacial variation. While a first morphometric comparison of MH1 and Plio-Pleistocene hominins [1] indicated marked affinities with representatives of the genus *Homo* rather than with either *Australopithecus* or *Paranthropus*, further quantitative analyses suggested its overall morphology, once completed, to be more akin to *Australopithecus africanus* [2, 3]. Subsequent re-evaluation of its age at death has accentuated the issue of comparing its morphology to fully adult specimens. Here we present new data on *Au. sediba* that provide further insight into Plio-Pleistocene craniofacial variation by including an extant ontogenetic series. Linear measurements from the MH1 cranium, 12 fossil crania representing *Homo*, *Australopithecus* and *Paranthropus*, and 34 extant subadult skulls of *H. sapiens* and *P. troglodytes* were used for this study. These data were transformed to obtain log-shape ratios [4]. The method of log-shape ratios is comparable to Geometric Morphometric approaches in that it yields variables that are independent of isometric size. Allometry, however can still occur. The common growth trajectory of humans and chimps was used to eliminate any remaining allometric effects from the data. The results are consistent with our previous findings and show MH1 to be phenetically more similar to representatives of *Homo* than to australopiths, even when growth allometry is taken into account. Given the retention of plesiomorphic traits in the postcranium of *Au. sediba*, evidencing non-obligate bipedalism, a possible explanation would be to recognize widespread craniofacial homoplasy during hominin radiation around 2MA BP, and to reconsider the relevance of craniofacial proportions as apomorphies of the genus *Homo*.

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Poster Presentation Number 130, Sa (12:20-13:50)

Dating of La Quina site: a multi-analytical approach

Marine Frouin[1], Christelle Lahaye[2], Norbert Mercier[2], Hélène Valladas[3], Thomas Higham[1], Katerina Douka [1], André Debénath[4]

1 - RLAHA, University of Oxford, UK · 2 - IRAMAT-CRP2A, UMR 5060, Université de Bordeaux Montaigne, France · 3 - Centre de faibles radioactivités LSCE/IPSL - UMR CEA-CNRS-UVSQ, Gif-sur-Yvette, France · 4 - HNHP, UMR 7194, Université de Perpignan, France

The site of La Quina (Charente, France) has been known for about a century for the quantity and the exceptional preservation of their Middle Palaeolithic occupations. The wealth of the site has significantly contributed to enhance our knowledge of Neanderthal morphology - with the discovery of many scattered bones and a complete adult skeleton - as well as their activities thanks to the quantity of faunal remains and lithic tools. The site gives his name to a large scraper industry identified elsewhere as the Quina Mousterian. The concentration of artifacts, directly under the highest promontory of the cliff, has been interpreted as the result of hunting successful practices repeated and managed by Neanderthal groups, at the beginning of the last glacial period.

In order to specify the context in which these traditions or behaviours have been developed, we have contributed to establish a chronological framework for La Quina deposit. Recent developments in Optically Stimulated Luminescence (OSL) techniques provided a promising opportunity to date this important sedimentary succession. In 2011, seventeen sediment samples were collected in the entire sequence. Minerals were dated using different luminescence protocols: OSL for quartz grains and IRSL/post-IR IRSL for feldspar grains contained in polymineral fraction. For the upper part of the sequence, newly developed radiocarbon methods were applied for dating of bones up to 50 000 years old.

In the present study, OSL ages will be presented and critically discussed with regard to radiocarbon dates and thermoluminescence on burned flints. The combination of these results using a Bayesian modeling approach allow, for the first time, a more precise timing for the La Quina occupation and a better understanding of Middle Palaeolithic cultures in this region.

Poster Presentation Number 61, Th (17:00-19:00)

Advances in virtual morphometrics: a new approach to generate 2D and 3D surface outlines on virtual specimens

Lorenza Gagliardi[1], Alessio Veneziano[2], Antonio Profico[1]

1 - Department of Environmental Biology, Faculty of Matemathical Physical and Natural Sciences, Sapienza University of Rome, Italy · 2 - Research Centre in Evolutionary Anthropology and Palaeoecology, School of Natural Sciences and Psychology, John Moores University, Liverpool, United Kingdom

Palaeoanthropology and Bioarchaeology make extensive use of outline-based morphometrics and this approach can be used to extract information from several sources. 2D outlines are usually generated from teeth or lithic tools, as well as from skulls or long bones profiles, and this method is widespread in the study of human evolution [1, 2]. In many cases, the generation of outlines is a valuable alternative to traditional linear measurements or 2D landmark-based geometric morphometrics. 2D outlines are conventionally acquired through photography, a procedure prone to parallax errors . In recent years, the use of virtual collections increased remarkably due to the availability of novel imaging techniques, such as CT-scanning, laser scanning and photogrammetry. Thanks to these new virtual environments, current methodological approaches can be improved and new techniques can be developed. We present here a method to generate 2D and 3D outlines of complex specimens from a 3D surface model. The 3D contours recreate the patterns of maximal breadth of the object outline. The procedure has been developed in the R statistical environment and uses α-shape approach and Bézier curves to generate the outlines. α-shape formalises the concept of "shape" for spatial point sets in computational geometry : a α-shape is built by connecting all the pairs of points lying on a circle which is not touching or overlapping any other point of the set. Bézier curves are used to approximate curves by generating a set of points through a polynomial fitting. Only three landmarks are needed to apply the method: these points define a reference plane to project all the vertices of the 3D model onto. A α-shape is then obtained from the projected vertices and a Bézier approximation is used to generate evenly spaced landmarks lying on the outline. The 3D outline is generated by bringing each point of the α-shape back on the surface model; a Bézier curve is then calculated. This method allows high precision and reproducibility in outline generation and can be applied on both skeletal and lithic material. 3D contours generated with this method consent to address new questions on functional trends in skeletal morphology or in material culture, enhancing the morphometric approach on the study of human evolution.

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Poster Presentation Number 40, Th (17:00-19:00)

11,000 years of cranial and mandibular variation in Lower Nubia

Manon Galland[1], Noreen von Cramon-Taubadel[2], Ron Pinhasi[1]

1 - University College Dublin, School of Archaeology · 2 - University at Buffalo SUNY, Department of Anthropology

The shift to agriculture was one of the most important events in modern human history. The extant to which this major cultural event is associated with biological changes in in different world regions remains highly debated. Here we investigated the 3D geometric morphometric patterns of craniofacial and mandibular variation in Lower Nubia from Mesolithic hunting-gathering to late farming, a period spanning 11 000 years. Our study aimed to assess morphological changes associated with subsistence changes and/or population movements. We analyzed 102 adult specimens from Lower Nubia including 5 chrono-cultural groups: Mesolithic (8000 - 11000 BC), A-group (3300 - 2800 BC), C-group (2300 - 1800 BC), Pharaonic (1800 – 1200 BC) and Meroitic (0 – 350 AD). All individuals were surface-scanned, and then 32 and 29 three dimensional landmarks were respectively extracted on skulls and mandibles of each specimen. Landmark configurations were subjected to generalized Procrustes analysis, tangent space projection, principal component analysis, discriminant analysis, MANOVA and hierarchical classification (clusters). Both cranial and mandibular variations highlight strong differences between Mesolithic and the remaining samples. Our results support that Mesolithic Nubians tend to have lower and wider vaults and wider and prognathic faces and that hunters tend to present longer and narrower mandibles than farmers. Craniofacial variation also shows a gradual temporal pattern of morphological changes from the A-group to the Meroitic individuals. While skull variation tends to detect significant differences between chrono-cultural groups, mandibular variation only detects differences between hunters-gatherers and farmers. This study corroborates a major biological change during the transition from hunting to farming plus a regional continuity in later Nubians. It also confirms that the mandible, in contrast to the skull, significantly reflects subsistence strategy rather than neutral evolutionary forces.

Poster Presentation Number 97, Fr (12:20-13:50)

Neanderthal lumbar lordosis assessed by 3D geometric morphometrics of vertebral morphology

Daniel García-Martínez[1,2], **Sandra Martelli**[3], **Markus Bastir**[1,2], **Paul O´Higgins**[4]

1 - Paleobiology Dept., Paleoanthropology Group, Museo Nacional De Ciencias Naturales (Mncn-Csic) · 2 - Faculty Of Sciences, Dept. Of Biology, University Autónoma De Madrid · 3 - Department Of Cell And Developmental Biology, UCL · 4 - Dept. of Archaeology, Hull York Medical School, The University of York

A lumbar lordosis develops in response to biomechanical modifications of the lumbar spine during habitual bipedal walking and is indicative of locomotor and postural behaviour in fossil hominins. Additionally the degree of lordosis is influenced by age, body size and the orientation and position of the pelvis, sacrum and thorax as well as sex. Thus, among modern humans, females have a larger lordotic angle than males, possibly related to posture and changes of the centre of gravity during pregnancy [1], and males have larger vertebral bodies related to their greater body mass [2]. The extent to which Neandertals share similar lordosis and vertebral morphology with modern humans is debated. Lordosis has commonly been studied by relating anterior to posterior vertebral body heights as a way of characterising vertebral wedging. On the basis of such studies, it has been hypothesized that the Neanderthal lumbar spine is kyphotic [3] while other workers [4] have proposed that the Neanderthal lumbar spine is lordotic, but less so than in modern humans. With regard to size and shape differences between Neandertals and modern humans, both have similar sizes of the vertebral bodies [4] but little is known about how and to what degree the lumbar vertebrae differ morphologically. Here we revisit these issues, comparing vertebral centroid sizes and shapes throughout the lumbar vertebral column among human males, females and Neanderthals, addressing hypotheses of no difference and, where falsified, describing those differences. We relate our findings with regard to differences in lumbar vertebral morphology to the likelihood that Neandertals shared a similar degree and pattern of lordosis. Size and shape data were obtained from 62 3D landmarks of 105 modern human female and 130 male vertebrae (L1 to L5) and from the well-preserved male Neanderthal lumbar spines: Kebara 2 (L1-L5), Shanidar 3 (L1-L5) and La Chapelle aux Saints (L1, L3-L5). The centroid size of male modern human vertebral bodies was significantly greater than that of females at every level. The mean centroid size of Neanderthal vertebral bodies was significantly larger than that of modern human males at all levels, except L2. Mean shape comparisons showed that in females there is greater posterior wedging than in males at every vertebral level. This feature suggests that lordosis is more pronounced in females. Posterior wedging of Neandertals and modern human males is of a similar degree at levels L1-L3. However, L4 and L5 mean shape comparisons show shape differences including relatively increased anterior vertebral height in Neanderthals, and so greater lordotic wedging. The superior plate of the vertebral body is shifted dorsally relative to the inferior plate in Neandertals, which gives it a very different overall shape that complicates the assessment of wedging by the usual approach. Our analyses suggest differences in upper and lower lumbar spine vertebral wedging in Neandertals. The upper may be similar to that of modern humans, while the lower shows a greater degree of posterior wedging, implying greater lordosis in this region. Different spatial relations between superior and inferior vertebral plates and different vertebral process form may imply a difference in the spatial relationships among lower lumbar vertebrae in Neanderthals [5]. However, lumbar lordosis is not entirely determined by vertebral form, rather it is also dependent on intervertebral disc morphology. Future studies should address the functional and potential adaptive significance of any differences in morphology. To these ends better understanding is required of the geometric relationships between vertebral and intervertebral disc morphology, and of the relationships between the form of the sacrum, pelvis and lumbar spine during human evolution.

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Pecha Kucha Presentation: Session 4, Fr (9:15-9:40)

Modelling the spatiality of seasonality. Integrating seasonal data into the spatial analysis of Neumark-Nord 2/2B (Germany)

Alejandro Garcia-Moreno[1], Geoff Smith[1], Lutz Kindler[1], Sabine Gaudzinski-Windheuser[1], Wil Roebroeks[2]

1 - MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution, RGZM · 2 - Faculty of Archaeology, University of Leiden

INTRODUCTION Seasonality is essential for understanding Neanderthals' settlement patterns and subsistence strategies. Studying the seasonal pattern of occupation of a site provides information regarding land use strategies and mobility, type of occupation (i.e. short, sporadic occupations vs. repeated, year-round use) as well as planning and strategic behaviour . Seasonality is usually regarded as a temporal parameter (in terms of the season(s) a site is used along a yearly cycle), but it has also a spatial component, since different areas of a site can have been used in different periods of the year. Combining both the temporal and the spatial aspects of seasonality is thus essential for a complete understanding of settlement dynamics.

MATERIAL AND METHODS The Eemian site of Neumark-Nord 2 (Germany) provides an excellent case study to analyse the seasonality of Neanderthal occupations there, thanks to its large archaeological assemblage, its high resolution and the excellent state of preservation of the faunal remains . Around 120.000 bones were recovered across an excavated surface of about 500 m2, corresponding to the shore of a shallow pond within an interglacial, mosaic environment. Archaeozoological studies indicate that subsistence focused mainly on three kinds of ungulates (horses, large bovids and cevids), and that Neanderthals were the main (almost exclusive) agent on accumulation . Studying seasonality at such a locality is essential to understand Neanderthal adaptations to interglacial forested environments, as well as to assess the role these kind of lacustrine sites played in hominins' settlement patterns. Seasonality was calculated based on more than 50 foetal to sub-adult faunal remains, corresponding to four different taxa: horse, large bovid, cervid and bear. Identification of the season of death was based on ontogenetic development of tooth and on bone specimens by biometric assessments and observations of fusing stages of growth sutures in bones. Two different ranges of season of death were used: a four season and eight seasons range, which took into account the transition between seasons. Each season was given a value, depending on its estimated temperature, from 1 for full winter to 4 (or 8) for full summer. Finally, a continuous surface was interpolated, representing whether seasonal data clustered in the same season or if seasonal variability could be identified in specific areas of the site.

CONCLUSIONS The study of the age of death of different specimens from NN2/2B indicates that material was discarded on a year-round basis, since all seasons all broadly represented in the assemblage. Moreover, evidence for the absence of a carnivore contribution in the assemblage formation suggest that Neanderthals presence around the pond could have been almost continuous. Regarding spatiality, some areas of the site might have been used preferentially during specific seasons, but the central area, where the main concentration of archaeological material was documented, shows a high variability, suggesting that this area was used during the (almost) entire year.

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Podium Presentation: Session 8, Sa (9:50)

A comparison of two hypotheses of the domestication of the dog

Mietje Germonpré[1], **Martina Lázničková-Galetová**[2], **Mikhail Sablin**[3], **Hervé Bocherens**[4]

1 - Royal Belgian Institute of Natural Sciences · 2 - Pilzen University, Czech Republic · 3 - Zoological Institute RAS, Saint-Petersburg, Russian · 4 - Tübingen University, Germany

One of the central controversies in understanding the domestication of the dog, the oldest domesticated animal, is how and why this domestication came about. Most scientists agree that the wolf is the ancestor of the dog and that the origin of the dog dates from the Pleistocene, when Upper Palaeolithic people still lived as hunter-gatherers. In this contribution we will compare two domestication hypotheses of the origin of the dog.

These two hypotheses can be summarized as follows:

1)"Self-domestication" by wolves: Some wolves scavenged on the remains of prey animals left by prehistoric people at human settlements. Those wolves that were less anxious and aggressive thrived, and colonized the human dominated environments, resulting in a commensal relationship. Gradually, the first primitive dogs emerged from this group. Analyses of the diet of some Pleistocene wolves and Palaeolithic dogs suggest, however, that the first dogs were not scavengers.

2)"Social domestication" by prehistoric people: The Upper Palaeolithic people actively selected wolf pups; the most docile ones were kept alive into adulthood, and could reproduce . After several generations of selection, the first dogs emerged. This hypothesis is being tested in Novosibirsk since 1959 where foxes are being bred for "tameability" . Probably, just as for the Novosibirsk foxes, only a small number of the captive wolf pups kept by Upper Palaeolithic people could grow up and reproduce. This suggests that many wolf pups must have been brought to a large number of camps, implying that the keeping of young animals was probably a cultural tradition among the Upper Palaeolithic humans [cf. 4]. The tamed animals would then be available when needed for ritual/ceremonial purposes or for practical reasons. General comparative analogies about the keeping of young animals, including mammals such as bear cubs, fox and wolf puppies, can be found in the anthropological literature on arctic and subarctic peoples [e.g.: *ongon* : cf: 5]. One of the incentives for the domestication of the dog could have been the ritual significance of large canids. This viewpoint is supported by several indications of artificial modifications of canid skulls by Upper Palaeolithic people from the Gravettian Předmostí site (Czech Republic) and the Epigravettian Eliseevichi site (Russia).

We will present critiques and contra-indications on the "self-domestication" hypothesis and provide further arguments to support the "social domestication" hypothesis.

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Poster Presentation Number 21, Th (17:00-19:00)

The diversity of culture among the Upper Palaeolithic in the Iranian Plateau: A comparative study of three core areas of Northern, West Central and Southern Zagros Mountains

Elham Ghasidian[1]

1 - Institut für Ur-und Frühgeschichte, Universität Tübingen

It is accepted that the anatomically modern human (AMH) have first left Africa 80-120 kya based on skeletal remains at Skhul, Tabun, Qafzeh and Manot Caves in the Levant, where they replaced and mixed with endemic populations of archaic humans and populated the new regions more intensively. Recent discoveries of AMH skeletons in East Asia older than 40 kya and the discovery of genetic evidence for a recently known species of archaic hominin in southern Siberia, Denisovan [4], suggest that the demographic history of Eurasia was much more complicated than previously assumed. The diversity of culture is considered as an essential part in the study of human evolution [2]. This study becomes more specifically important when the AMH dispersed out of Africa during MIS 4 and evolved in new environments and improved their way of adaptation. Locating in western Eurasia at the crossroads of human migrations out of Africa during the Pleistocene, the Iranian Plateau, stands at the centre of most models of AMH dispersals [1]. To test the idea of diversity of cultural traditions among the Upper Palaeolithic (UP) populations on the Iranian Plateau, this research deals with the lithic assemblages from the three UP habitat areas of the Zagros Mountains at the western most of the Iranian Plateau. Two caves and a rockshelter sites are selected among the few stratified sites in three regions with different latitudes including Shanidar Cave in the Zawi Chemi Plain of Northern, Warwasi in the Kermanshah Plains of West Central Zagros Mountains [5] and Ghār-e Boof Cave in the Dasht-e Rostam Basht Region of Southern Zagros Mountains [3]. Based on the data from these sites, this research investigates processes of cultural diversification through behavioural adaptations that are reflected in the lithic records during time span of ca. 40 to 33 kya in the Zagros Mountains of Iran. It will examine whether we are dealing with a single cultural tradition and/or the differences are the results of the diversity of cultures [2] among the UP populations of the entire Zagros after the successful AMHs dispersals into the Iranian Plateau.

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Podium Presentation: Session 3A, Th (16:20)

Bite force efficiency in *Homo heidelbergensis* vs *Homo sapiens*

Ricardo Miguel Godinho[1], **Laura C. Fitton**[1], **Paul O'Higgins**[1]

1 - HYMS, Department of Archaeology, University of York

The face and masticatory muscles in modern humans are reduced relative to middle Pleistocene *Homo*. Several studies have shown that this reduction is associated with an increase in biting efficiency in modern humans, relative to *Homo neanderthalensis*. Further, it has been argued that the facial skeleton of modern humans is less able to resist masticatory loads than that of Neanderthals. In the present study we extend this prior work by comparing biting efficiency and facial skeletal load resistance between *Homo sapiens* and its hypothesised ancestral species, *Homo heidelbergensis*. We compare these species in terms of (1) mechanical advantage, (2) force production efficiency, (3) strains experienced in the facial skeleton and (4) modes of large scale deformation during simulated biting tasks. 3D reconstructions from medical CT scans of *H. heidelbergensis* (Kabwe 1) and modern *H. sapiens* were used to measure lever arm lengths and compute mechanical advantage during different bites. Finite Element (FE) models of both individuals were loaded with the same (modern human) muscle forces and constrained to simulate bites on incisors and postcanine teeth. For each simulated bite, joint reaction forces, bite forces and force production efficiency were calculated and contour plots of principal strains compared. Quantification of differences was based on strain magnitudes from 41 points over the cranium, scaled to account for differences in bite force and size among models. To compare modes and magnitudes of global deformation landmark coordinates on the unloaded and loaded models were submitted to GPA then rescaled to their original centroid sizes before computing size and shape distances and extracting principal components that describe deformations due to biting. These deformations were compared before and after accounting for differences in bite force and centroid size among the models. Results show that the modern human is approximately 165% more efficient at converting muscle forces into biting force than *H. heidelbergensis*. *H. sapiens* generates higher bite forces and lower joint reaction forces than *H. heidelbergensis*. As expected, Kabwe 1 experiences lower strains than *H. sapiens* under the same muscle loading. After scaling strains in Kabwe to correct for size and bite force differences from modern humans they are still of generally lower magnitude than in modern humans. When considering modes and magnitudes of global deformation *H. heidelbergensis* and *H. sapiens* present different vectors of deformation with less deformation in *H. heidelbergensis*, that remains less after accounting for centroid size and bite force differences. Our findings reflect the results of previous studies of Neanderthals vs. *H. sapiens* [1-2]; *H. sapiens* are also more efficient than *H. heidelbergensis* at converting muscle force into bite force, yet differences in strains and global deformations indicate that Kabwe is more efficient at withstanding these loads. For Kabwe to produce the same maximum bite force as humans it would need muscle forces 180% to 200% greater, larger than those estimated in this study for this specimen. This raises the question of why an increase in *H. sapiens* biting efficiency occurred. Was this adaptive or does it reflect the loss of a constraint on craniofacial, and particularly masticatory system form, that was present in both Neanderthals and *Homo heidelbergensis*?

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Podium Presentation: Session 3A, Th (15:40)

3D virtual reconstruction of the Kebara 2 thorax

Asier Gómez-Olivencia[1,2,3,4], **Alon Barash**[5], **Mikel Arlegi**[1], **Daniel García Martínez**[6], **Patricia A. Kramer**[7,8], **Markus Bastir**[6], **Ella Been**[9,10]

1 - Dept. Estratigrafía y Paleontología, Euskal Herriko Unibertsitatea, Spain · 2 - IKERBASQUE. Basque Foundation for Science · 3 - Équipe de Paléontologie Humaine, UMR 7194, CNRS, Paris, France · 4 - Centro UCM-ISCIII de Investigación sobre Evolución y Comportamiento Humanos, Spain · 5 - Faculty of Medicine in the Galilee, Bar Ilan University, Israel · 6 - Paleoanthropology group. Museo Nacional de Ciencias Naturales (CSIC), Spain · 7 - Department of Anthropology, University of Washington, USA · 8 - Department of Orthopaedics and Sports Medicine, University of Washington, USA · 9 - Department of Anatomy and Anthropology, Sackler Faculty of Medicine, Tel Aviv University, Israel · 10 - Physical Therapy Department, Ono Academic College, Israel

Kebara 2 (K2) preserves the most complete vertebral column and thorax of the adult Neandertal record [1]. Based on individual ribs, K2 displays a thorax shape different when compared to modern humans [4]. Moreover the recent analysis of the first ribs of the El Sidrón Neandertals confirmed the perception that Neandertal first ribs are straighter, which was related to the general shape differences between the Neandertal thorax and modern human thoraces through a partial least squares (PLS) analysis of the first ribs and the rest of the rib cage in modern humans [2].

Sawyer and Maley [5] published a reconstruction of the Neandertal thorax performed in plaster which adapted the K2 spine and ribs to a the larger Neandertal individual La Ferrassie 1. This reconstruction resulted in a "bell-shaped" thorax with a flaring lower rib area. Since then, we have a more precise knowledge of the individual Neandertal vertebrae and ribs and the spinal posture in this species [3]. The objective of this work is to virtually reconstruct the adult Neandertal thorax of the K2 individual taking into consideration the distinct Neandertal spinal and costal morphology in order to fully assess the general Neandertal thorax shape.

First, all the K2 individual vertebrae and ribs were CT-scanned and 3D models of each element were created using Amira/Avizo software. We aligned the 3D models starting with the sacrum and adding one vertebra at a time, until the complete spine (T1-S5) was completed. The degree of lumbar lordosis of K2 was calculated based on both the pelvic incidence and the orientation of the inferior articular processes [3] and the thoracic kyphosis was calculated based on the difference in height of the thoracic vertebral bodies. This resulted in a vertebral column that, when compared with modern humans, shows a significant lower degree of lordosis and a thoracic kyphosis within the normal range, but slightly smaller than the average of modern human kyphosis.

Before adding the ribs to this vertebral column, certain reconstruction errors were corrected and the most complete and less taphonomically distorted ribs were mirror imaged in order to complete the thorax. The K2 3D reconstruction shows a more invaginated vertebral column into a caudally wider thorax which is consistent with the postural reconstruction of Neandertals with a somewhat different spinal posture than that of modern humans. It also shows a more barrel-shaped like thorax different from that proposed by Sawyer and Maley [5].

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Poster Presentation Number 108, Fr (12:20-13:50)

Evaluating missing- and complete-data techniques for estimating size variation in the fossil record

Adam D. Gordon[1]

1 - University at Albany (SUNY)

Sexual size dimorphism (SSD), i.e., variation in size between adult males and females within a taxon, is linked to various selection pressures in extant animals and is often invoked in various scenarios in human evolution. Measuring SSD in the fossil record is not straight-forward, however, because the sex of individual specimens is often unknown, and individual specimens are often incomplete. A variety of methods have been developed to calculate a measure of relative size variation within a single variable (e.g., femoral head size), which may then be compared among extant and extinct taxa. These methods include the coefficient of variation method (CVM), the mean method (MM), the method of moments (MoM), the binomial dimorphism method (BDI), and the finite mixture model method (FMM); previous work has evaluated the relative performance of these methods for univariate data sets [1, 2]. More recently, two different methods have been developed to analyze relative size variation in multivariate data sets with missing data (which are common in the hominin fossil record): the template method (TM) and the geometric mean method (GMM), both of which are techniques for addressing missing data but which express size variation using one of the five univariate methods. These two multivariate methods differ substantially in their approach to dealing with missing data, with dramatically different results: the TM approach finds that *Australopithecus afarensis* did not differ significantly is SSD from modern humans [3], while the GMM method finds that *A. afarensis* was significantly more dimorphic than modern humans and chimpanzees [4] in keeping with nearly all univariate analyses of postcranial SSD in *A. afarensis* [e.g., 5].

This study evaluates the performance of these various methods using multivariate postcranial data sets drawn from four extant hominoid species spanning a wide range of SSD (*Hylobates lar*, *Pan troglodytes*, *Homo sapiens*, and *Gorilla gorilla*). In all species, 16 postcranial variables were measured on 40 adult females and 40 adult males. For each method, known values of postcranial SSD for each extant sample are compared against those generated when the following sample attributes are varied: (1) sample size, (2) proportion of males to females in a sample, (3) patterns of missing data, and (4) patterns of isometric versus allometric scaling among included variables in a multivariate data set.

As expected, all methods perform better with larger sample sizes, equal numbers of males and females, and more dimorphic taxa. Among univariate methods, small sample size affects MoM and FMM results the most, while MM and BDI are less affected; unequal numbers of males and females affects BDI results the most, while MM results are least affected. In the case of multivariate methods, methods perform better when there is no missing data and there is isometric scaling among all variables. The TM approach is more restrictive in that it requires at least one relatively complete specimen, and it is also less reproducible in that any given data set may produce multiple estimates of dimorphism depending on which specimen is selected to be a template and which variables are used as estimators. In contrast, the GMM approach can include any variable that has at least two observation, and there is always a single estimate of dimorphism that is produced. In general, the GMM approach is more robust than the TM approach to both a high proportion of missing data and deviations from isometric scaling among variables. Taken together, these results suggest that the MM approach is generally best for estimating dimorphism in univariate data sets, and a GMM approach using MM is generally best for multivariate data sets with missing data.

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Pecha Kucha Presentation: Session 4, Fr (9:15-9:40)

The Early Upper Palaeolithic assemblage from Havrincourt (North of France): new data and interpretations

Emilie Goval[1], Clément Paris[2], David Hérisson[3]

1 - Inrap Nord-Picardie, Amiens, France. UMR 7194, Département de Préhistoire du Muséum National d'Histoire Naturelle, Paris · 2 - Inrap Nord-Picardie, Amiens, France. UMR 7041, Arscan, Paris. · 3 - UMR 7194, Département de Préhistoire du Muséum National d'Histoire Naturelle, Paris.

The Canal Seine-North Europe Project is part of the French government's major works policy to link the Seine Basin in Paris to the Escaut Basin, in the North of France. Due to this project, an area of 4,100 square meters was excavated at Havrincourt. In 2011, this site was excavated by E. Goval and a team of the National Institute for Preventive Archaeological Research (Inrap).

During the excavation three Middle Palaeolithic levels and one Early Upper Palaeolithic level have been found. We propose during this presentation to talk exclusively about this last level.

The topographic position of the site coinciding with a gently sloping northeast facing hillside favoured the trapping of loess, allowing for rapid artefact burial. The occurrence of a well-preserved stratigraphic sequence of soils and loess deposits was discovered and finely studied. Chronostratigraphic and paleoenvironmental investigations were based on systematic and continuous high resolution sampling of the main profiles for sedimentology, micromophology, malacology, magnetic susceptibility and soil geochemistry. The radiocarbon dating placed the occupation between 28,000 BP and 27,000 BP uncalibrated and converged with other proxy results [1].

All in all, 6 400 lithic artefacts and 238 faunal remains were discovered in the Upper Palaeolithic level, called Hav.2-N2. All these remains were mainly located in four concentrations on 620 square meters. The typo-technological analysis of Upper Palaeolithic level showed an immediate need for raw blades indicating a short-term occupation. The archaeozoological and use-wear studies led by P. Auguste and E. Claud have shown that a little part of area was dedicated to the exploitation of portions of carcasses. The taxonomic diversity of faunal remains is relatively high with at least ten species identified.

Regionally, the discovery of this Early Upper Palaeolithic occupation in a developed stratigraphic context is exceptional. Indeed, until the early 2010's, this period was particularly poorly represented in the North of France with only a few sites not in primary context or with reduced quantitatively series. This lack of data has long ruled with the many sites discovered in neighbouring countries such as Belgium and Britain made since the nineteenth century. In North of France, the discoveries of Early Upper Palaeolithic sites have multiplied in recent years thanks to preventive archaeology, with excavations sites like Amiens-Renancourt 1 and 2 (Somme), Catigny (Oise) and Havrincourt Hav.2 -N2 (Pas-de- Calais). Today, ten sites can be compared with this period, to the simple clues of surface collections in well-preserved deposits and stratigraphic context

The Early Upper Palaeolithic level of Havrincourt complete our knowledge and appears today as an exceptional site combining absolute dating, developed stratigraphy, good preservation of lithic and faunal remains. The excavation of this site provides an impotant basis of analysis for discussing the function and the settlement dynamics of occupations in a model of territorial exploitation.

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Poster Presentation Number 3, Th (17:00-19:00)

One-hundred years after Peyrony: New excavations at Le Moustier (Dordogne, France)

Brad Gravina[1], Emmanuel Discamps[1,2], Jean-Pierre Chadelle[1], Christophe Falguères[3], Guillaume Guérin[4], Christelle Lahaye [4], Bruno Maureille[1], Jean-Pierre Texier[1], Aurélien Royer[1,7], Alain Turq[1,5], Hélène Valladas[6]

1 - UMR 5199 PACEA, Université de Bordeaux, France · 2 - AHKR Institute, University of Bergen · 3 - UMR 7194, Département de Préhistoire du MNHN · 4 - IRAMAT-CRP2A, Université Bordeaux-Montaigne · 5 - Musée national de préhistoire, Les Eyzies de Tayac Sireuil · 6 - Centre de faibles radaioactivités, LSCE/IPSL - UMR CEA-CNRS-UVSQ · 7 - Laboratoire de Géologie de Lyon, UMR CNRS 5276, Université Lyon 1 et Ecole Normale Supérieure de Lyon, France

The eponymous site of Le Moustier (Dordogne, France), critical to debates surrounding the nature of Mousterian industrial variability, continues to play a crucial role in both archaeological and anthropological models for the end of the Middle Palaeolithic as well as the emergence of the Upper Palaeolithic in southwestern France. Initially explored by O. Hauser at the turn of the last century and then excavated for several years before the First World War by Denis Peyrony, Le Moustier's long archeao-stratigraphic sequence documents a succession of different lithic techno-complexes and produced at least two potential Neanderthal burials. More recently, the site's archaeological record has been mobilised in both demographic and chronological models for the Middle-to-Upper Palaeolithic transition not only in southwestern France but Western Europe more generally.

The ongoing revision of archaeological material collected during subsequent small-scale excavations by J.-M. Geneste and J.-P. Chadelle in 1982 and a straightening of the sections by J.-P. Rigaud and H. Laville at the end of the 1960s produced a new vision of this 'classic' sequence. This reassessment reveals independent changes in lithic technology and subsistence strategies that not only have important ramifications for models of Neanderthal technological flexibility, raw material use and mobility patterns but also broader issues underlying the definition of Middle Palaeolithic techno-complexes [1].

Building on this revision and given the clear importance of the Le Moustier sequence for technological, chronological and demographic models, we began new, multi-disciplinary excavations at the site in 2014 in order to (a) collect new, unbiased samples of both lithic and faunal material, (b) re-investigate site formation processes, and (c) refine the site's chronology using a combination of absolute dating techniques. Here we present preliminary results from our new work at this important site and discuss their implications for the end of the Mousterian in south-western France.

Acknowledgements: This project is supported by the Service régional d'archéologie d'Aquitaine, the Conseil Général de Dordogne, the PACEA laboratory of the Université de Bordeaux and the Némo Project (Dirs. J.-P. Faivre, C. Lahaye and B. Maureille). We are also grateful to Jean-Jacques Cleyet-Merle, director of the Musée national de préhistoire.

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Podium Presentation: Session 3B, Th (16:20)

Rethinking the dispersal of *Homo sapiens* out of Africa

Huw Groucutt[1], **Eleanor M.L. Scerri**[1], **Aylwyn Scally**[2], **Michael D. Petraglia**[1]

1 - University of Oxford · 2 - University of Cambridge

Understanding the origin and dispersal of our species has been a central theme in palaeoanthropology. Fossil, genetic and archaeological data are consistent with a late Middle Pleistocene origin of *Homo sapiens* . However, factors such as the paucity of hominin fossil evidence in southern Asia and the limitations of interpretations based on single locus gene trees have meant that a precise understanding of the spatial and temporal character of subsequent dispersal into Asia has remained elusive. In this paper we present new archaeological data from the Saharo-Arabian belt [see also 2, 3] and genetic models and use them to evaluate a range of dispersal models. First, we argue that current hominin fossil evidence is not strongly supportive of any particular 'early' or 'late' model for the dispersal of our species out of Africa. We also highlight considerable ambiguities with genetic data, particularly that of single locus systems, such as mitochondrial DNA, arguing against a simple connection between the structure of gene trees and hominin demographic history. Complex processes of population expansion/contraction and breeding between hominin populations generates considerable equifinality in the structure of particular gene trees, that is only just starting to be understood with whole genome sequencing and ancient DNA. We then present new genetic simulations to show that there are alternative possibilities to the frequently cited notion of a single dispersal out of Africa at around 60-50 ka . We also present the results of new interdisciplinary archaeological fieldwork and research across the Saharo-Arabian belt. We report new archaeological findings from Arabia, including the discovery of the first Marine Isotope Stage 3 site (Al-Marrat 3) from Saudi Arabia and the first stratified and dated Palaeolithic archaeological site (Mundafan Al-Buhayrah) from the Empty Quarter, the largest sand sea in the world, which dates to the later part of MIS 5. In the case of the Levant, our reanalysis of a sample of the lithic assemblage from Mugharet Es Skhul, and a consideration of the age and context of the site, suggest that the MIS 5 occupation of the Levant may have been both longer and more complex than previously believed. Our data does not support the hypothesis that the human occupation of the Levant was a single and short-lived 'expansion of Africa'. Archaeological and genetic evidence for structured populations by at least MIS 5 may explain these results and explain the emerging complexity of the various records. In summary, we hypothesise that the most parsimonious model at present is one where small human populations dispersed outside Africa in MIS 5, but the legacy of those populations were subsequently swamped by later (MIS 3) demographic expansions. Multiple dispersals and expansion events across the Saharo-Arabian belt are closely connected with climatic ameliorations of generally arid regions from MIS 5 to 3.
Acknowledgements: We thank the European Research Council for funding (295719) and members of the PALAEODESERTS Project for discussions and their role in fieldwork and and the members of the DISPERSE Project, Mark G. Thomas, and James Blinkhorn for discussions.

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Poster Presentation Number 133, Sa (12:20-13:50)

First chronometric ages for La Ferrassie Neanderthals LF1 and LF8 and a comparison with the age of LF2

Guillaume Guérin[1], Marine Frouin[2], Christelle Lahaye[1], Norbert Mercier[1], Paul Goldberg[3], Vera Aldeias [4], Alain Turq[5], Harold L. Dibble[6], Shannon P. McPherron[4], Dennis Sandgathe[7], Jean-Jacques Hublin[4], Bruno Maureille[8], Antoine Balzeau[9], Isabelle Crèvecoeur[8], Asier Gómez-Olivencia[9], Sahra Talamo[4]

1 - IRAMAT-CRP2A, UMR 5060 CNRS - Université Bordeaux Montaigne, France · 2 - Research Laboratory for Archaeology and the History of Art, Oxford, UK · 3 - Department of Archaeology, Boston University, USA. · 4 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 5 - Musée national de Préhistoire, France · 6 - Department of Anthropology, University of Pennsylvania, Philadelphia, USA · 7 – Human Evolution Studies Program and Department of Archaeology, Simon Fraser University, Burnaby, Canada · 8 – CNRS, Univ. Bordeaux, MCC, PACEA, UMR 5199 · 9 – Équipe de Paléontologie Humaine, UMR 7194, CNRS, Département de Préhistoire, Muséum national d'Histoire naturelle, France · 10 – Dept. Estratigrafía y Paleontología, Euskal Herriko Unibertsitatea, UPV-EHU, Leioa, Spain

The *Grand Abri* of La Ferrassie (Dordogne) has an important Middle and Upper Paleolithic stratigraphic sequence which has yielded the remains of seven Neanderthal skeletons, as well as several isolated human remains. Recent excavations (2010-2014) by a multi-disciplinary team have provided new information about the lithic technology, the human remains and their sedimentary context, the site formation processes and the chronology of human occupations at the site. Based on radiocarbon and OSL dating and on sedimentological analyses, an age of ~43-45 ka was proposed for LF2 .

Here we present new, luminescence-based ages for the previously undated LF1 and LF8 individuals. LF1 was discovered by Peyrony and Capitan in 1909 , extracted as a block, and subsequently excavated in Paris. We sampled for OSL some more or less consolidated sediments coming from this excavation and preserved at the Musée de l'Homme in Paris. Additionally, a separate re-analysis of material coming from Delporte's 1970s excavations resulted in the discovery of additional bones from the LF8 individual he had previously discovered. Based on field work by the two teams in 2014 at the find location, we can report new observations on the stratigraphic sequence immediately adjacent to LF8 and a set of OSL ages on this sequence.

Micromorphological and sedimentological observations provide elements to correlate part of the LF8 sequence in the eastern portion of the site to the new and recently dated sequence coming from the western portion of the site. Additionally, we measured and studied the quartz OSL and K-feldspar IRSL signals coming from 4 samples following the approach taken in our previous study . As a result, new OSL ages are reported for LF1 and LF8 and compared with the age of LF2. OSL signal resetting (so-called bleaching) problems required the use of quartz single-grain OSL measurements and adequate statistical analysis. These data allow a better understanding of the different sediment depositional events and context for several of the Neanderthal remains from La Ferrassie.

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Podium Presentation: Session 6B, Fr (14:10)

Seasonal foraging in Early Pleistocene Olduvai Gorge, Tanzania

Alia Gurtov[1]

1 - University of Wisconsin - Madison

Hominin foraging strategies are central to hypotheses about the evolution of the modern human body plan, behavioral flexibility, and modern life history. Each of these hypotheses presume the substantial inclusion of meat in the diet of early *Homo*, but how this meat was acquired remains a controversial issue. The earliest evidence for hominin meat-eating appears in the Early Pleistocene of eastern Africa, a time of increasing aridity and seasonality. Seasonal climatic changes can dramatically alter the temporal and spatial distribution of food and water, which intensifies the selective pressure to modify behaviors on a seasonal scale. This study is the first to use dental microwear texture analysis (DMTA) to evaluate the role of seasonality in hominin foraging at Olduvai Gorge, Tanzania. Olduvai is among the best-studied eastern African localities dating to 1.9 –1.2 million years ago, when evidence suggests that meat-eating became a more integral part of the hominin foraging strategy. As such, Olduvai is at the center of debates about the evolution of hominin hunting and landscape use. Two of the most prolific sites, anthropogenic FLK Zinj and carnivore-generated FLK North, are located within 200 meters of contemporaneous freshwater, and from each other, suggesting a functional relationship between foraging activities and freshwater in an otherwise arid habitat. Moreover, the similarity of the sites suggests that hominins and carnivores competed for the same resources. Olduvai is therefore ideal to answer questions about seasonal foraging and landscape use by early hominins in a highly seasonal environment. Here I present the preliminary dental microwear results from hominin and carnivore prey at FLK Zinj and FLK North, respectively. These sites existed during comparable climatic phases, contain large samples of the same prey species, and provide strong stratigraphic and taphonomic evidence for confined phases of carcass deposition. With these natural controls in place, it is possible to compare the dental microwear signatures to those of modern analogues to determine the predominant season of death for each taxon at each site. Because of taphonomic evidence for butchery that links hominins to carcasses at FLK Zinj, the microwear acts as a proxy for hominin occupation at the site. The results indicate the preferred seasons of operation for both hominins and carnivores at watering holes in the paleo-savanna, characterize the nature of competition between these taxa, and contribute to the discussion of the significance of meat in times of low precipitation and relative resource scarcity.

Podium Presentation: Session 11A, Sa (16:20)

Are musculoskeletal disorders evolutionary trade-offs of bipedalism?

Martin Haeusler[1], Nakita Frater[1], Sandra Mathews[1], Sabine Landis[1], Thomas Boeni[2], Bernhard Zipfel [3], Frank Ruehli[1]

1 - Institute of Evolutionary Medicine, University of Zürich · 2 - Orthopaedic University Clinic Balgrist, University of Zürich · 3 - Evolutionary Studies Institute, University of the Witwatersrand, South Africa

Habitual bipedal posture and locomotion is the hallmark of modern humans and our hominid ancestors since the phylogenetic split from the chimpanzee lineage some 4 to 7 million years ago. Bipedalism is likely the key adaptation that eventually enabled early hominids to develop sophisticated tool making and thus paved the way for brain enlargement in later *Homo*. Associated with the transition to bipedalism are a host of musculoskeletal modifications, including the adoption of the lumbar lordosis, and a reorganisation of the pelvic and shoulder girdles, knee joint and foot. However, the evolution of bipedalism also created a novel biomechanical environment, which is often made responsible for the ubiquitous musculoskeletal disorders of modern people . Thus, various studies attributed low back problems , hip and knee osteoarthritis and shoulder impingement syndrome [4-5] to trade-offs of bipedalism and modern daily behaviour. In fact, these musculoskeletal disorders are surprisingly uncommon among non-human primates. Here, we test the hypothesis that these disorders can be explained as evolutionary trade-offs of bipedalism. Our approach includes a thorough analysis of the hominid fossil record and comparison of presumed anatomical risk factors for musculoskeletal disorders in modern humans to the morphological variation of fossil hominids and great apes. Based on a Micro-CT analysis, we demonstrate that the only case of hip osteoarthritis in a pre-Neanderthal fossil, MLD 46 (*Australopithecus africanus*) from Makapansgat, South Africa, can be attributed to sickle cell disease or a related haemoglobinopathy suggesting adaptation to malaria. Moreover, a 3D morphometric analysis refutes that modern humans possess a narrower subacromial space and weaker supraspinatus muscle relative to the size of the upper extremity than apes. These factors have been considered important in the aetiology of subacromial impingement syndrome, which represents the leading cause of shoulder dysfunction. We therefore find no evidence that human hip pathologies and subacromial impingement syndrome are aetiologically linked to the reorganization of the pelvic and shoulder girdle during the evolution of bipedalism. On the other hand, there is a remarkably high prevalence of vertebral pathologies in early hominids, including Scheuermann's disease, juvenile disc herniation and isthmic spondylolisthesis that all are associated with biomechanical stress on the vertebral column during adolescence. In conclusion, of all musculoskeletal disorders only our back problems are clearly related to bipedalism, whereas no such relationship can be demonstrated for hip osteoarthritis and shoulder impingement syndrome. Crucially, modern human vertebrae have a biomechanically advantageous, larger cross-sectional area relative to body size in comparison to earlier hominids. We therefore deduce that the modern human spinal column has been shaped by natural selection to become less vulnerable than that of our ancestors, resulting in an optimized compromise between mobility and stability.

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Podium Presentation: Session 5, Fr (11:00)

An early modern human with a recent Neandertal ancestor

Mateja Hajdinjak[1], Qiaomei Fu[1,2,3], Oana Teodora Moldovan[4], Silviu Constantin[5], Swapan Mallick[3,6,7], Pontus Skoglund[3], Nick Patterson[6], Nadin Rohland[3], Birgit Nickel[1], Bence Viola[1], Kay Prüfer[1], Matthias Meyer[1], Janet Kelso[1], David Reich[3,6,7], Svante Pääbo[1]

1 - Department of Evolutionary Genetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 2 - Key Laboratory of Vertebrate Evolution and Human Origins of Chinese Academy of Sciences, IVPP, CAS, Beijing, China · 3 - Department of Genetics, Harvard Medical School, Boston, USA · 4 - "Emil Racovita" Institute of Speleology, Cluj, Romania · 5 - "Emil Racovita" Institute of Speleology, Bucharest, Romania · 6 – Broad Institute of MIT and Harvard, Cambridge, Massachusetts 02142, USA · 7 – Howard Hughes Medical Institute, Harvard Medical School, Boston, USA

Neandertals are thought to have become extinct in Europe around 40,000 years ago but have contributed between one and three percent of the genome of all people living today outside sub-Saharan Africa. This suggests that an early modern human population ancestral to all non-Africans admixed with Neandertals. However, where, when and how often Neandertals and modern humans interbred is not well understood. A better insight into the interactions between modern and archaic humans can be obtained by studying the genomes of modern humans who lived at a time and place when encounters with Neandertals were feasible. Such a specimen is "Oase 1", a 37,000-42,000-year-old human mandible from Peştera cu Oase (Romania).

We prepared two DNA extracts from 35 mg of bone powder removed from the inferior right ramus of Oase 1, where samples had previously been taken for radiocarbon dating. Five DNA libraries were produced using a single-stranded library preparation protocol and sequenced on Illumina platforms. As preliminary analyses revealed that the specimen contains very small amounts of endogenous DNA, we used an enrichment strategy to isolate mitochondrial DNA (mtDNA) fragments, as well as nuclear DNA fragments overlapping genomic positions that are informative about the relationship to Neandertals and present-day humans.

We were able to reconstruct the complete mitochondrial genome of the Oase 1 individual. The Oase1 mtDNA belongs to haplogroup N, a large group of present-day Euroasian mtDNAs, but had diverged from them before they started to diverge from each other. It carries a few private mutations based on which its age can be estimated to ∼36,000 years before present. The fractions of nuclear sequences aligned to the X and Y chromosomes are similar, indicating that Oase 1 was a male, an observation consistent with the specimen's morphology. The identified Y chromosome haplotype belongs to haplogroup F, the most common Y-chromosome haplogroup in Euroasian males today.

We found that the Oase 1 individual shared more genetic variants with present-day East Asians and Native Americans than with present-day Europeans, opposite to our expectations for the genome of an ancient individual from Europe. The observation that Oase 1 does not share more genetic variants with pre-agricultural Europeans than with Eastern non-Africans is consistent with him belonging to a population that did not contribute much of the genetic material to later European populations.

We estimate that between six to nine percent of the Oase 1 genome is derived from Neandertals, significantly more than any other modern human sequenced to date. The size of genomic segments of Neandertal ancestry in Oase 1 indicates that the Neandertal contribution occurred four to six generations before the Oase 1 individual lived, i.e. less than 200 years before his time. This shows that interbreeding with Neandertals was not limited to the common ancestors of humans outside Africa nor to the Near East, but that it occurred also in Europe.

Poster Presentation Number 80, Fr (12:20-13:50)

A landscape perspective on Middle Stone Age behaviour from the Tankwa Karoo, Northern Cape, South Africa

Emily Hallinan[1], **Matthew Shaw**[2]

1 - University of Cambridge · 2 - University of Cape Town

Southern Africa is a critical location for understanding the origins of modern human behaviour in the Middle Stone Age (MSA), about 300 to 40 ka. Current evidence from excavated – often coastal – cave sites indicates the emergence of complex technological, social and symbolic behaviours at least 100 ka. However, cave sites considered alone give a spatially and temporally restricted picture of MSA lifeways. In order to address this imbalance, this research has targeted the open-air site record of the inland, marginal environment of the Tankwa Karoo. Our work aims to establish the pattern of landscape use for past humans occupying the understudied Doring River catchment zone, to the east of the Cederberg Mountains extending across the Tankwa Karoo. Today, this region receives some of the lowest annual rainfall levels in South Africa, classified as semi-arid desert, which stands in contrast to the fynbos ecozone of the mountains immediately to the west. This paper presents the results of surveys in the Tankwa Karoo which have mapped the location of stone artefacts across the landscape. Artefacts lie on a deflated 'desert pavement' land surface, forming a rich palimpsest of evidence for past occupation of the region. These assemblages provide information on lithic technology, provisioning and site use, which can be dated on a relative techno-typological basis and used to track change through time and across environmental zones. The survey area bisects three geological zones which create specific topographies and offer different stone raw materials suitable for tool-making. Our results show distinct patterns of raw material transport in the MSA, together with preferences for certain landscape locations leaving variable lithic signatures. Whilst there is an ephemeral scatter of expediently produced MSA artefacts across the general landscape, sites located on prominent ridges have revealed artefact scatters that are notably different to the typical MSA assemblage compositions observed in the Cederberg to the west, in terms of raw materials and technology as well as site location. Particularly, this concerns the absence of caves and rock shelters as site foci, and the transport of Karoo-derived hornfels and chert from the east, and silcrete from the west. This paper highlights one such site, Tweefontein, which contains the largest MSA unifacial point assemblage reported from either cave or open-air sites in the Northern and Western Cape regions [1]. The specific Levallois strategy used for point production, together with the unusually high use of non-local silcrete, marks this as a site of particular importance for understanding MSA technological adaptations to this marginal desert environment. As the assemblage at Tweefontein demonstrates, there is potential technological variability that is still unrecognised in the currently patchily-investigated MSA record of South Africa, which this research in the Tankwa Karoo aims to address.
Acknowledgements: This research is funded by an AHRC Doctoral Studentship awarded to Emily Hallinan, and Masters funding from the Centre of Excellence (NRF, South Africa) and PAST awarded to Matthew Shaw. Additional funding for fieldwork was granted by the AHRC, St Catharine's College (Cambridge), University of Cambridge Fieldwork Fund, Dorothy Garrod Memorial Trust Fund (Cambridge), UAC of Nigeria Travel Fund (Cambridge) and the Tweedie Exploration Fellowship (University of Edinburgh).

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Poster Presentation Number 101, Fr (12:20-13:50)

Assessing fossil hominin medial longitudinal arch structure using a multiple element approach

William Harcourt-Smith[1], **Aylin Woodward**[2]

1 - CUNY/AMNH · 2 - Dartmouth College

The medial longitudinal arch is a defining feature of the modern human foot, and has long been linked to obligate bipedality in hominins (and possibly even specialized running behaviours). Detecting the presence of a medial arch has thus become a central part of studying the evolution of upright locomotion in hominins. However, most studies have focused on individual skeletal elements to infer medial arch presence or absence, which has resulted in considerable debate concerning the pedal form and function of taxa such as *Au. afarensis*, *Au. africanus* and *H. habilis*. Given that the medial arch is made up of a minimum of six skeletal elements and four joint complexes, not to mention numerous soft-tissue components, we argue that an integrated approach is likely to yield more useful results. In this study we used six measurements that have been argued to directly relate to medial arch presence and/or a human-like medial column with an efficient toe-off: sustentaculum tali orientation, talar head inclination, navicular wedging, navicular lateral cuneiform facet orientation, medial cuneiform hallucial facet orientation and 1st metatarsal relative head size. Our samples consisted of the associated foot bones of *Pan* (n=34) *Gorilla* (25) *Pongo* (10) *Homo sapiens* (35), and a fossil hominin sample including OH8, StW 573, Skhul IV, La Ferrassie, Spy and two "composite" feet made up of *Au. afarensis* specimens from the AL 288 and 333 localities at Hadar, Ethiopia. Measurements were taken from laser surface scans using engineering software, which outputs precise best-fit planes for curved facets, facet areas and volumes, and angles between chosen planes and axes. Multivariate analyses of all variables show that there is very distinct separation between modern humans and the great apes, and no confounding effects of allometry. Two separate configurations of the *Au. afarensis* foot fall with the great apes and well outside the modern human range of variation. The OH8 foot falls with modern humans, as do those of the Neanderthals, while that of StW 573 is intermediate between great apes and modern humans, despite having an adducted hallux. These results therefore show that: 1). a "combined" technique using multiple variables from associated foot bones is a powerful way of analysing the medial longitudinal arch; 2). *Au. afarensis* clearly lacked a medial longitudinal arch, which is at odds with several recent analyses of isolated Hadar pedal elements; 3). There are several different medial arch configurations in potentially contemporary fossil taxa, lending further support to locomotor diversity in Plio-Pleistocene hominins.

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Podium Presentation: Session 11A, Sa (15:40)

Diet, medicines, raw materials or palaeoenvironment? A broad approach to materials extracted from palaeolithic dental calculus

Karen Hardy[1], **Anita Radini**[2,3], **Stephen Buckley**[2]

1 – Catalan Institution for Research and Advanced Studies (ICREA) at Universitat Autònoma de Barcelona · 2 - BioArCh, University of York · 3 - University of Leicester Archaeological Services (ULAS), School of Archaeology and Ancient History, University of Leicester, UK

Dental plaque is formed by bacteria and calcium phosphate salts which combine to create calculus. Recent studies have shown that dental calculus can act as a store for inhaled and ingested material, The recognition that ancient dental calculus can retain material entrapped during life has resulted in a new avenue of research which has focused principally on the extraction of microfossils for palaeolithic dietary reconstruction. However, there are many ways in which material can reach the mouth, including through breathing, eating, oral hygiene activities, dirty hands and raw material processing. Once material is in the oral cavity, it can become embedded in dental calculus, whatever its origin. We apply a combined approach to the study of material found in dental calculus; we extract microfossils which we analyse using optical microscopy, and chemical compounds, which we analyse using the dual techniques of sequential thermal desorption-gas chromatography-mass spectrometry (TD-GC-MS) and pyrolysis-gas chromatography mass spectrometry (Py-GC-MS).The chemical compounds can at times be reconstructed to provide detailed identification, sometimes to plant species. By combining these methods, we are able to differentiate between dietary plants, those with only medicinal value, and non-edible fibrous material that is linked to use of the mouth as a third hand as well as obtaining direct paleoenvironmental information. Here we offer examples from several of our studies [1-3] including a Neanderthal from the site of el Sidrón that had a non-edible wood fibre entrapped in its calculus, inhaled environmental material including the scale of an insect wing, pollen, several species of fungi, and plant fibres, as well as direct evidence for the use of specific dietary components containing the essential linoleic and linolenic polyunsaturated fatty acids, from the Lower Palaeolithic site of Qesem Cave, Israel. On some occasions, the chemical compounds can provide a sufficiently characteristic and detailed 'biomolecular fingerprint' for the original plant species to be identified [4]. Taken together, these results provide a context within which to evaluate the scope for obtaining information from dental calculus and its potential to reconstruct a wide range of hitherto inaccessible biographical and environmental detail.

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Podium Presentation: Session 1, Th (10:20)

Before the Oldowan: 3.3-million-year-old stone tools from West Turkana, Kenya

Sonia Harmand[1,2], Jason Lewis[1], Craig Feibel[3], Christopher Lepre[3], Sandrine Prat[4], Arnaud Lenoble [5], Xavier Boes[4], Rhonda Quinn[6], Michel Brenet[7], Adrian Arroyo[2], Nicholas Taylor[2], Sophie Clément[7], Guillaume Daver[8], Jean-Philip Brugal[9], Louise Leakey[1], Richard Mortlock[10], James Wright[10], Dennis Kent[10], Hélène Roche[2]

1 – Turkana Basin Institute - Department of Anthropology, Stony Brook University · 2 - CNRS, UMR 7055, Université Paris Ouest-Nanterre La Défense · 3 - Department of Anthropology and Center for Human Evolutionary Studies, Rutgers University · 4 - CNRS, UPR 2147 · 5 - CNRS, UMR 5199 · 6 - Department of Sociology, Anthropology and Social Work, Seton Hall University · 7 – INRAP · 8 – IPHEP, Institut de Paléoprimatologie, Paléontologie Humaine : Évolution et Paléoenvironnements, CNRS, UMR 7262, Université de Poitiers · 9 – Aix-Marseille Université, CNRS, MCC, UMR 7269, LAMPEA · 10 – Department of Earth and Planetary Sciences, Rutgers University

It is now eighty years since Louis Leakey first used the term "Oldowan", and fifty years since he and Mary Leakey found early *Homo* fossils in association with those tools at Olduvai Gorge in Tanzania. This association directly resulted in the fossils being assigned to the new species *Homo habilis*. The origin of stone knapping was linked to the rise of the genus *Homo*, in response to climate change and the spread of savannah grasslands; a conventional view that has been questioned by paleoanthropologists for the last few decades. Since the early 1980s, there has been increasing openness in Paleoanthropology to the possibility of hominin tool manufacture before 2.6 million years (Ma), following several discoveries and advances in our understanding of the first stages of stone knapping. The earliest Oldowan artefacts from Gona, Hadar and Omo in Ethiopia, and Lokalalei in Kenya, show varied but already significant technical skill. In 2010, the publication of cut-marked bones from Dikika hinted at an earlier date of 3.4 Ma for hominin tool use. Moreover, it is increasingly acknowledged that percussion processes apart from knapping, such as pounding and battering activities, could have been also very important in the earliest stages of stone tool making. In this research context, the West Turkana Archaeological Project (WTAP) initiated in 2011 new surveys in the Lomekwi member (3.44-2.53 Ma) of the Nachukui Formation in Kenya, to search for evidence of pre-2.6 Ma hominin lithic behavior. We present the discovery of Lomekwi 3 (LOM3), the world's oldest archaeological site dated at 3.3 Ma, where stone artefacts have been found in situ in spatiotemporal association with Pliocene hominin fossils in a wooded environmental setting. Given the implications that the LOM3 assemblage holds for models aiming to converge environmental change, hominin evolution, and technological origins, we propose for it the new name "Lomekwian", which predates the Oldowan by 700,000 years and marks a new beginning to the known archaeological record.

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Poster Presentation Number 110, Sa (12:20-13:50)

Archaeological survey and recovery of wild capuchin stone tools

Michael Haslam[1], **Lydia Luncz**[1], **Tiago Falotico**[1]

1 - University of Oxford

Members of four primate genera habitually use stone tools in the wild: *Macaca* in Thailand and Myanmar, *Sapajus* in Brazil, *Homo* worldwide and *Pan* in West Africa. Only one of these is indigenous to the New World – the capuchin monkey (*Sapajus* spp). Wild capuchin lithic tool use is widespread in the drier *caatinga* and *cerrado* environments of central and northeast Brazil, regions that until comparatively recently were free of humans . Archaeological analysis of the tools and sites used by capuchins therefore allows a unique insight into the independent emergence of a primate technological tradition . *Sapajus* stone tool behaviours currently focus on pounding encased fruits and seeds, with both hammer stones and food typically brought to a wood or stone anvil. However, some capuchin groups at Serra da Capivara National Park (SCNP), Piauí, also use stones for digging and social communication activities . Here, we report on recent surveys and excavation of cashew nut (*Anacardium* sp.) processing sites created by wild bearded capuchins (*S. libidinosus*) at SCNP. We have identified distinctive cashew processing areas marked by stone tool accumulations and residue deposition on tool surfaces, with the latter confirmed as cashew via GC-MS analysis. These sites are localized around cashew trees, which we used as a guide to conduct exploratory excavations in the Baixão da Pedra Furada at SCNP. In these excavations we have found the remains of multi-generational capuchin tool use, including recovery of buried cashew-processing tools, identified through use-wear and spatial patterning. Comparison of the sedimentological record at our sites with nearby research targeting human cultural remains indicates that the recovered capuchin stone tools are likely decades to hundreds of years old. On this basis, we suggest that our findings may constitute the first direct evidence of long-term stone tool use in a non-ape species.
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Podium Presentation: Session 7A, Fr (16:00)

Diet and resource space of *Paranthropus boisei* and *"Meganthropus palaeojavanicus"*

Susanne Haupt[1,2], **Christine Hertler**[1,2], **Michael Westaway**[3], **Ottmar Kullmer**[4]

1 - Research Centre 'The role of culture in early expansions of humans (ROCEEH)' Senckenberg Research Institute, Frankfurt, Germany · 2 – ROCEEH Research Centre, Heidelberg Academy of Sciences and Humanities, Heidelberg, Germany· 3 - Cultures and Histories Program, Queensland Museum, Brisbane, Australia · 4 - Department of Palaeoanthropology and Messel Research, Senckenberg Research Institute, Frankfurt, Germany

Resource space determines which habitats are selected by hominins as living spaces. Thereby many factors are decisive, such as water or raw material supply or food resources. The study focuses on the latter and attempts to integrate results from three different approaches (molar macrowear and microwear texture analyses, and stable isotope analyses) to examine the link between environment and diet in early Pleistocene robust hominid *"Meganthropus palaeojavanicus"* from the Sangiran dome on Java, Indonesia. The data will be compared with data of megadont *Paranthropus* dental specimens from Eastern African sites. The resemblance between the dental and gnathic apparatus of both taxa indicates similarities in the properties of their respective diets. Moreover, for both taxa similar habitats were reconstructed on the basis of specialized herbivores. Such ecological reconstructions are frequently based on recent reference models for hominin habitats. In a second step, indicative parameters are used to classify fossil habitats. Some of these reference habitats are analyzed with respect to their spectrum of available food resources, e.g. seasonally flooded grasslands. This analysis includes all edible terrestrial and aquatic resources and their characteristics, for instance the δ13C signal, mechanical properties and seasonal availability. For an integrative assessment of diet it is also required to identify the properties of the food to predict their potential micro- and macrowear and isotope signals. Therefore published data about mechanical properties and isotope data of resources are used, e.g. [1, 2]. In order to illustrate the approach an example will be introduced in the presentation. The following information about the diet of *Paranthropus boisei* is available. According to published microwear texture data no extremely hard or extremely tough food was consumed shortly before death . The carbon isotope signal is about -1,3‰ and represents a diet dominated by C4 resources . Molar macrowear studies are not yet performed on *Paranthropus boisei*. In their environment for instance papyrus (*Cyperus cristatus*) and antelopes (*Kobus kob*) are available resources. *C. cristatus* is a C4 plant with hard-brittle corms and soft piths. *Kobus kob* is a grazer, and therefore a C4 resource . Eating of hard and brittle corms in the days before death of the studied individuals is unlikely, because this is not supported by microwear texture data, but it could represent a seasonal resource or fallback food. The consumption of papyrus piths is supported by the diet signals, and *Kobus* meat could be also part of the diet. Frequent meat eating could be reflected in the macrowear pattern, assuming the toughness of raw meat, it is likely that the chewing mode is differing from eating e.g. Papyrus particles . Not every resource occurring in a particular environment is accessible. Another crucial factor in diet is technological performance of a group of hominids. Hunting antelopes usually requires for instance sophisticated equipment such as spears. There is, however, no evidence for the application of these techniques in the Lower Paleolithic. For this reason hunting is considered unlikely. The example illustrates how the classification approach works and in which way various methods for the reconstruction of diet are integrated. This permits to link diet signals with specific features in the environment and the technological performance of hominids. Our further work will focus on the diet of *"Meganthropus palaeojavanicus"* to determine if this taxon has a similar specialized diet, such as *Paranthropus boisei*.

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Podium Presentation: Session 10B, Sa (14:50)

Neandertal's Presence during the Eemian Interglacial in North-western Europe: a New Site at Waziers (Northern France)

David Hérisson[1], Jean-Luc Locht[2], Luc Vallin[3], Laurent Deschodt[2], Pierre Antoine[4], Patrick Auguste [5], Nicole Limondin-Lozouet[4], Sophie Lefèbvre[6], Guillaume Hulin[7], Bertrand Masson[3], Bassam Ghaleb[8]

1 - UMR 7194, CNRS · 2 - INRAP; UMR-CNRS 8591, CNRS · 3 - SRA Nord-Pas-de-Calais · 4 - UMR-CNRS 8591 · 5 - UMR-CNRS 8198 · 6 – CADDAP · 7 - GEOTOP, Université du Québec à Montréal

At the end of the 1980's, C. Gamble launched a debate on the ability of Early hominids to colonize northern latitudes of Europe during Middle and Late Pleistocene Interglacial periods. At that time, the Eemian (MIS 5e) was characterised by a total absence of human occupation in Northern France, Belgium, Netherlands, Germany and Great Britain. Since the 1990's, a few sites with human occupation attributed to the Eemian have been discovered and excavated in north-west Europe, particularly in Germany. After these discoveries some authors like Roebroeks et al. [2, 3] rejected Gamble's model. In northern France, several Middle Palaeolithic levels were discovered at the base of the Eemian tufa of Caours (Somme basin) in 2006. They represent the first record of Human occupation during the Last Interglacial in the area.

Recently, in 2012 an archaeological diagnostic conducted at Waziers (North, France) before the building of a Do-it-Yourself shop, led to the discovery of a peat layer at 3,2 metres deep in some test pits, overlying fluvial silts and sands. Complementary observations made in 2013 allowed to propose an Eemian age for the fluvial sequence. This interpretation relies on geomorphological and palaeontological observations: (1) the presence of loess covering the fluvial deposits and the peat, and (2) the occurrence of both Interglacial Pleistocene mammals (aurochs and red deer) and Pleistocene aquatic mollusc species (*Belgrandia marginata, Anisus septemgyratus*) that no longer exist in this area, in the fluvial deposits and in the peat. Moreover, a minimum age of 103 +3.5/-3.4 ka was obtained by U/Th dating of small CacO3 nodules (oogons of characeae) extracted from a fine grained tufa layer directly underlying the peat (GEOTOP Montreal). This result reinforces the allocation of the the Waziers interglacial sequence to the Eemian (a radiocarbon measurement undertaken earlier on the peat logically gave an age prior to 43 500 BP). The presence of lithic artefacts and aurochs bones with anthropic fractures lead to design an extended archaeological excavation in order to confirm the existence of a second site with Eemian human occupation in Northern France.

In 2013, a complete overview of the geomorphology of the valley has been carried out by geophysical research using two different methods. An EM31 connected to a GPS was used to record the mean electrical conductivity of soils (continuous, 4-6 m deep) and to obtain a map with the location of the Eemian channel. Two electric panels were made perpendicularly to the palaeochannel in order to observe the morphology of the valley and the fluvial deposits. Based on this information, a series of core drillings allowed to build five transects.

In 2014, during a first campaign, 41 m^2 were excavated. The geomorphology of the site was investigated and continuous sampling columns of the stratigraphical sequence were undertaken for paleontological studies on mollusc, pollen and mammal assemblages (presently in progress). The palaeoenvironmental reconstruction will be completed by the study of the rich corpus of wood and other organic remains such as hazelnuts or insects preserved in the peat. Thanks to the discovery of some lithic artefacts and human activity traces on faunal remains (cut maks on beaver tibia, burnt bones, aurochs bones typical breakage patterns) found in situ in fluvial deposit, the presence of human occupation during the Eemian at Waziers has been definitively demonstrated. Datings (OSL) are in progress and a second field campaign will take place this summer.

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Podium Presentation: Session 9, Sa (11:40)

Manot 1 and its relevancy for comprehending modern human evolution

Israel Hershkovitz[1], **Ofer Marder**[2], **Omry Barzilai**[3]

1 - Tel Aviv University · 2 - Ben Gurion University · 3 - Israel Antiquities Authority

Owing to the scarcity of AMH fossils dated to the Late Middle Palaeolithic/ Early Upper Palaeolithic, the origins of Levantine populations and their phylogenetic relationships with populations outside the region remained obscure for a long time. Now, the discovery of a 55 thousand years old fossil at Manot Cave (Manot 1), Upper Galilee, Israel, provides new data that may shed light on some key issues relating to modern human evolution. Taking all discrete and metric anthropological data into account, the Manot 1 calvaria can be classified as a modern human. As such, the Manot calvaria represents the first fossil evidence that modern humans inhabited the Levantine corridor between 65-45 kyr, a critical time period when genetic and archaeological models predict African modern humans to successfully migrate out of Africa and colonize Eurasia. Manot 1 proves that the Levant during the late Middle Palaeolithic was occupied not just by Neanderthals (e.g., Kebara/Amud) but also by modern humans, thus providing important clues about the morphology of modern humans close in the time to a likely interbreeding event with Neanderthals. The shape analysis of Manot 1 links its morphology to recent African skulls as well as to some European Upper Paleolithic fossils (e.g., Mladeč 1). The morphological features of Manot 1 (for example: suprainiac fossa, bunning) foreshadow those of later UP humans in central Europe, whilst also manifesting some "archaic" traits like many European UP fossils. This suggests that Manot 1 belongs to a population which had recently migrated out of Africa, established itself in the Levantine corridor during the late MP- Middle /Upper Palaeolithic interface, to later move into the European continent. The appearance of Manot 1 in the Levant at 65-45 kyr is not surprising considering the abundant evidence to suggest that this time span was favorable for human migration "out of Africa", i.e., warmer and wetter climate events over Northern Sahara and the Mediterranean.
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Poster Presentation Number 57, Th (17:00-19:00)

Is nasal cavity a good proxy for the study of functional nasal airways?

Yann Heuzé[1]

1 - Université de Bordeaux, UMR5199 PACEA, Bordeaux Archaeological Sciences Cluster of Excellence

Studies focusing on the evolution and adaptation of the nasal cavity (NC) shape and/or size and its relationship with facial skeletal form or climatic variation sometimes offer perspectives on functional nasal airways (NA), air conditioning (i.e. humidity level and temperature), and respiratory energetics [e.g. 1, 2, 3]. Though NC is a structure in which NA fit, the latter are not delimited by bone but by cartilage and soft tissue for which minimal information is available through the study of dry skull. Surprisingly enough, it appears that no studies aimed at characterizing the relationship existing between those two negative spaces were published so far. The goal of the present study is to fill this gap by analyzing anonymized head computed tomography images from 30 adult individuals living in France balanced for sex and age (18 - 50+ years) for whom the NC and NA were measured. The NA were defined by segmenting the lumen corresponding to the functional volume and were delimited anteriorly by the nasal aperture and posteriorly by the choana. Individuals with obviously obstructed NA (e.g. mucus) were not included in the study. The NC was defined by segmenting the lumen (i.e. NA), soft tissues and cartilage delimited by the bones forming the NC (from anterior nasal aperture to choana). Additionally, 16 tridimensional landmarks were measured on bone to characterize NC form which was analyzed with geometric morphometrics. Our results showed that there is no significant correlation between NC volume and NA volume. The ratio between NC and NA varied from 1.7 to 4.0 (mean = 2.6; sd = 0.6). Multivariate regression of NC shape on NA volume was not significant implying no relationship between NC shape and NA volume. Based on our results, the sometimes assumed or implied correlation between NA and NC volumes is actually irrelevant due to the high level of variation of the ratio between NC and NA. These results should encourage future studies focusing on dry skull and nasal cavity form to be extremely cautious when extrapolating on nasal airways volume, air conditioning, and energetics. Future directions will include the study of a larger human sample including diverse geographic areas, as well as equivalent studies on extant primates.
Acknowledgements: The author is grateful to Pr. Claire Majoufre, Dr. Jacques Treil, Dr. Mathieu Bondaz, and Dr. Quentin Sessiecq for providing the anonymized head computed tomography images.

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Poster Presentation Number 11, Th (17:00-19:00)

Tracking the Middle to Upper Paleolithic transition in the Kermanshah Region, West Central Zagros Mountains of Iran

Saman Heydari-Guran[1]

1 - Institut für Naturwissenschaftliche Archäologie, Universität Tübingen

In the past four decades, a major topic of interest amongst archaeologists and paleoanthropologists has been the Eurasian Middle-Upper Paleolithic transition. Recently, great progress was made in several domains, particularly palaeogenetics, which have revealed the complex ancestry of early Eurasians,. This progress- including identifying a ghost lineage of Eurasians in the Middle East- is beginning to provide important new biogeographical hypotheses that focus on the Middle East. One key region for this is the Iranian Plateau, which has not been subject to intensive research. The Kermanshah Region (on the West of the Plateau) has been recognized as one of the gates into the Iranian Plateau since it is located between the Mesopotamian lowland on the west and the high plateau where many intermountain valleys have provided easy communication routes to the eastern regions.

The long history of Palaeolithic research in the Kermanshah Region has revealed a number of sites associated with Late Pleistocene assemblages including well-known sites of Kobeh, Khar and Bisetun caves and Warwasi Rockshelter . Among these, Warwasi is an exceptional case for the entire region as based on previous research; this site has yielded a long Middle to Epipalaeolithic sequence. Despite these important sites in Kermanshah, our knowledge on Palaeolithic occupation there and even in Iran is suffering from the lack of a clear, up-to-date and scientific work on stratigraphy, settlement systems and accurate absolute dating. To overcome some of these problems, the author has recently conducted a Palaeolithic research project in the Kermanshah Region. This project includes an intensive survey and test excavations around the Warwasi Rockshelter to provide new evidence on the settlement systems, anatomically modern human demography and the process of cultural changes during the Middle and Upper Palaeolithic. This project has resulted into the discovery of 255 Palaeolithic sites and over 7000 Middle to Epipalaeolithic artefacts recovered from the Kermanshah Region. Furthermore, the preliminary excavations in the area uncovered several stratified Middle to Upper Palaeolithic sequences.

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Poster Presentation Number 106, Fr (12:20-13:50)

Energetic comparison between Neandertals and Anatomically Modern Humans: no significant difference due to uncertainty in body mass estimation

Peter Heyes[1], **Katharine MacDonald**[1]

1 - Leiden University

Introduction: Energy dynamics are important for understanding behavioural niches and evolution throughout hominin evolutionary history. Increasing energy requirements (and changes in energy allocation and storage) in early *Homo* and *Homo erectus* had an important role in the evolution of life history, childcare, diet, range expansion, and locomotion. Arguments about the timing and nature of these evolutionary changes are sometimes supported by comparison of basal metabolic rates (BMR) and daily energy expenditure (DEE) values. Several authors have suggested that Neandertals had higher BMR and DEE than anatomically modern humans (AMH), based on their larger body mass (BM) and different shape [reviewed in 1]. These high energy requirements have implications for Neandertal anatomy, life history, demography and competitive ability [e.g. 1], and could explain differences between the archaeological record for late Neandertals and the material cultures of AMH of the Upper Palaeolithic and Middle Stone Age, including the absence of camp structures and lower lithic material transport distances [e.g. 2]. Quantitative estimates provide an opportunity to assess whether Neandertal energy expenditure differed substantially enough from that of AMH to account for differences in morphology, demography, or behaviour. These calculations are primarily based on hominin body mass (BM), which is estimated from the measurement of skeletal remains; however, BM estimation is associated with a high degree of uncertainty which should be taken into account [3]. Here we review the validity of key assumptions underlying Neandertal energy expenditure estimates and suggest that, at present, such explanations are not adequately supported. We explore the assumption that a significant difference can be demonstrated between Neandertal and AMH BMR and DEE, and the effects of taking BM estimation error into account. Data and methods: All analyses were carried out in Statgraphics v5.1. In order to assess whether the differences in BM suggested by skeletal proportions can be robustly demonstrated with the evidence available, we carried out two-sample hypothesis tests (t-tests) using the mean values and sample sizes from Froehle and Churchill [4] and Froehle et al. [1], and a standard error of the estimate (SEE) of 15 kg derived from Ruff et al. [5]. To assess whether the estimated differences in Neandertal and AMH BMR and DEE values are statistically significant, further two-sample hypothesis tests were performed, using the data and equations from Froehle and Churchill [4] and the same SEE. Results: At an α value of 0.05, there is no significant difference in mean BM between Neandertals and AMH or between Middle and Late Upper Palaeolithic populations. None of the predicted differences between Neandertal and AMH BMR or DEE are statistically significant at the 95% confidence level (α=0.05). These results are not changed by using a smaller SEE of 13kg. Conclusions: Neandertals may indeed have had higher energy expenditures than AMH, but the differences in predicted energy expenditures are not statistically significant. This lack of significant difference is based on the substantial error involved in estimating body mass, a problem which applies broadly to different approaches and datasets, as well as the equally substantial errors involved in estimating BMR and DEE. Since both quantitative and qualitative comparisons of the two populations involve judging how much difference is significant, the problems highlighted here are equally relevant to studies that do not carry out an explicit statistical test, but do compare Neandertal and *Homo sapiens* energetics.

Acknowledgements: We are grateful to Clive Orton of University College, London for reviewing the body mass estimation analysis. We are also grateful to Dorota Lorkiewicz-Muszyńska, Agnieszka Przystańska, Wojciech Kociemba, Alicja Sroka and Artur Rewekant from the Poznań University of Medical Sciences, Poland, for permission to use unpublished statistics from their analysis of body mass estimation using computed tomography data from a modern population (Lorkiewicz-Muszynska et al., 2013).

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Podium Presentation: Session 3B, Th (16:40)

The Post-HE4 Expansion of the Aurignacian in Eastern Europe

John Hoffecker[1], **Vance Holliday**[2], **Aleksandr Dudin**[3]

1 - INSTAAR University of Colorado · 2 - University of Arizona · 3 - Kostenki Museum-Preserve

A new series of radiocarbon dates from Kostenki 1 on the Don River in Russia indicate that the diagnostic Aurignacian artifacts recovered from Layer III by A. N. Rogachev [1] in the 1950s date to one or more warm intervals that follow Heinrich Event 4 (HE4). The earliest of these intervals correlates to Greenland Interstadial 8 (GI 8) between roughly 38,000 and 36,000 cal BP. The Layer III assemblage is associated with a buried soil that appears to be similar in age and character to the Bryansk soil, which has been identified at many localities on the East European Plain. Other assemblages containing typical Aurignacian artifacts (e.g., Molodova 5, Layer X) also appear to date to GI 8 or later, while the recently reported assemblage from Vys' (south-central Ukraine), which contains diagnostic Aurignacian tools, is undated but is associated with a buried soil [2].

The Aurignacian assemblage at Vys' also contains small bifacial points that traditionally are assigned to the Strelets industry of the East European Plain. At other sites, these points are often associated with evidence for the killing and butchering of large mammals, especially horse and reindeer (e.g., Kostenki 12, Sungir'). Typical Strelets artifacts, including a small bifacial point, also were found in Layer III at Kostenki 1 [3]. These artifacts conceivably represent the kill-butchery tool kit of the Aurignacian techno-complex on the East European Plain, where many open-air sites dating to the earlier Upper Paleolithic are large-mammal kill-butchery sites [4]. Both the relatively late appearance of the Aurignacian (after HE4) and high percentage of assemblages associated with kill-butchery events (which lack typical Aurignacian types recognized in the habitation sites of southwest Europe) may explain why the Aurignacian, as traditionally defined, remains comparatively rare in Eastern Europe.

The Aurignacian artifacts that appear in Eastern Europe after HE4 presumably are derived from Western Europe, where this industry is established before 40,000 cal BP. Their arrival in Eastern Europe coincides with a major interstadial (GI 8) that follows the extreme cold of HE4. Although the warmer climates of GI 8 generated a rapid rise in net primary production (NPP) and large mammal biomass, the effect would have been significantly greater in Western Europe, due to supply of warm moist air from the North Atlantic. An estimated tenfold increase in the human population of Western Europe at this time [5] conceivably underlies the archaeological evidence for post-HE4 expansion not only to Eastern Europe, but also the Levant. Moreover, large portions of the East European Plain may have been abandoned after the CI eruption and HE4 cold interval. Genetically, the Aurignacian expansion may be related to the distribution of mtDNA haplogroup U in Eastern Europe and the Levant (i.e., the population expansion was not confined to paternal lineages).

Acknowledgements: Research at Kostenki 1 was funded by the National Science Foundation, Leakey Foundation, National Geographic Society, and the Russian Fund for Basic Research.

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Poster Presentation Number 5, Th (17:00-19:00)

Is it all just about size? Traditional and geometric morphometric approaches to Middle Palaeolithic concurrent technological blade strategies

Christian Hoggard[1]

1 - Centre for the Archaeology of Human Origins, University of Southampton

It is now widely established that throughout the Middle Palaeolithic, from the earliest sites of Mesvin IV and Rissori IIIA/IIIB to sites within the *Technocomplexe du Nord-Ouest* [1], and late Bohunician and Châtelperronian toolkits, that Neanderthals utilised a Laminar technological blade strategy, producing elongated material around the circumference of the core. The majority of these sites (n=46) also feature elongated material produced from a Levallois recurrent unidirectional/bidirectional strategy. Whilst an initial literature review has identified this relationship (and compiled the most complete catalogue of known Laminar technological strategies in Europe), this relationship is in need of further investigation to truly understand the nature of Middle Palaeolithic technological diversity on both an inter- and intra-site level. Does the concurrent use of both technological blade strategies (i.e. stereotyped elongated material) represent differing behaviours and activities or do they represent equifinal behaviour? And how does this relationship change over time? If it does, what does this mean with respect to Neanderthal population networks and mobility patterns throughout the Middle Palaeolithic?

This presentation outlines how a refined methodology, grounded on a traditional and geometric-morphometric methods, in conjunction with a technological and experimental framework, is addressing this relationship. Details about the geometric-morphometric method e.g. the adoption of Elliptical Fourier Analysis (EFA), the effectiveness of Closed Outline Analysis, and the archaeological and experimental datasets will be outlined in detail. Results from primary data collection of Belgian and French sites, and the experimental dataset (n= 800 blades), using these methods will also be provided and discussed.

Finally this presentation will outline the future of this doctoral research: what other will be analysed next, what results do we expect, and what do these results mean to our understanding of blade technologies, in isolation and in conjunction.

Acknowledgements: This research would not be made possible without financial support from the Arts and Humanities Research Council.

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Poster Presentation Number 131, Sa (12:20-13:50)

Dispersal, co-existence and extinction? The Middle-Upper Palaeolithic Transition along the Danube

Rachel Hopkins[1], **Tom Higham**[1]

1 - University of Oxford

Recent research has shown the need for a reliable, high resolution chronology to understand the complexity of the spatio-temporal distribution of Neanderthals and anatomically modern humans (AMH) during the transitional period between the Middle to Upper Palaeolithic. One region that has not yet benefited from the developments in dating sciences and the application of Bayesian modelling approaches is eastern Europe. Our research focuses on this region, especially the key area of the Danube fluvial corridor which has been suggested as one of the conduits for early modern humans on their dispersal route into western Europe. We will present new data that will expand the picture that has started to emerge from recent studies conducted in western Europe which showed many sites to be older than previously thought.

This research forms part of a doctoral dissertation within the University of Oxford's PalaeoChron ERC project. It applies recent improvements in radiocarbon dating methodologies such as ultrafiltration and single amino acid dating. On the one hand, key sites with a deep stratigraphic record are targeted (e.g. Istállóskő, Temnata, Kozarnika) to initially establish site specific high resolution chronologies using Bayesian modelling. Luminescence dating is used where necessary to anchor the chronology at the lower end of the time-scale and throughout. On the other hand, type fossils are directly (e.g. antler points from Szeleta Cave, Bivak Cave, Istállóskő, Dzerava Skala) or indirectly dated, to establish regional spatio-temporal boundaries, i.e. dating the appearance and disappearance of an industry or species. Previously published dates from Central and Eastern European sites are re-evaluated. Where deemed reliable, they complement our results and are incorporated into larger regional models.

Together with further analysis on the attribution of transitional industries, we hope to establish a reliable, tight knit chronological framework of the area, thus improving our understanding of both the dispersal of AMH and the disappearance of Neanderthals, as well as exploring aspects of their co-existence.

Poster Presentation Number 136, Sa (12:20-13:50)

Reconstruction of Hominin Habitats from Environmentally Mixed Assemblages

Phil Hopley[1]

1 - Birkbeck, University of London

The environmental context of early hominins in Africa is critical to our understanding of hominin evolution and adaptation. In recent years, carbon isotope analysis has been undertaken on all African early hominin species and has provided new insights into hominin dietary ecology [1]. A distinction can be made between C3 consumers (e.g. *Australopithecus sediba*, *Ardipithecus ramidus*) , C4 consumers (e.g. *Paranthropus boisei*) and mixed C3/C4 consumers (most other species, including *Australopithecus africanus* and early *Homo*) . The specialist feeders are physiologically constrained to their diets, and therefore have narrow isotopic ranges. In contrast, the mixed C3/C4 consumers have the ability to vary their diet depending on environmental conditions or dietary preferences, and therefore have very broad isotopic ranges extending from almost exclusive C3 consumers to almost exclusive C4 consumers. This wide range of carbon isotope values measured for conspecific hominins (both within and between faunal assem-blages) is often interpreted as evidence for dietary flexibility to either seasonal [2] or inter-annual fluctuations in resource availability. However, this interpretation relies on the assumption that the hominin assemblages represent both a short period of time and stable environmental conditions. In this presentation, I present new geological evidence for climatic variability (at inter-annual, millennial and orbital timescales) in the Plio-Pleistocene of Africa [3] to demonstrate that most faunal assemblages formed during a period of changing environmental conditions, from woodland-dominated to savannah-dominated, over a period of 1000s of years [4]. These precessional scale (~ 21,000 years long) vegetation cycles are responsible for the savannah-mosaic habitat reconstructions that are so common in hominin palaeoecology, making it difficult to differentiate the habitat preferences of each hominin species. I will conclude by discussing how best to reconstruct faunal communities and hominin habitats from these environmentally mixed assemblages [5].

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Poster Presentation Number 25, Th (17:00-19:00)

Expedient tools for intensive practices: the bipolar lithic implements from the Upper Paleolithic site of Vale Boi (Southwestern Iberia)

Pedro Horta[1], João Cascalheira[2], Nuno Bicho[2]

1 - Universidade do Algarve · 2 - ICArEHB, Universidade do Algarve

Vale Boi is a multi-component (open-air and rockshelter) site located in Southwestern Iberia that offers one of the most complete Upper Paleolithic sequences in Southern Iberia where most of the traditional techno-complexes are represented. The earliest occupations at the site is represented by a set of Early Gravettian levels dated to c. 32 ka cal BP [1]. Associated with these early occupations and continuing across most of the time-span there are evidence for, together with the broad consumption of marine resources and high-level exploitation of rabbits, an intensification of resource exploitation, mostly represented by the use of grease-rendering techniques [2]. This has been demonstrated at Vale Boi by the presence of impact features on ungulate bones, reduced presence of skeletal portions associated with increased quantities of bone grease and a significant correlation between the fragmentation of red deer remains and the quantities of marrow and bone grease within these portions. Within the lithic assemblages, evidence for the occurrence of grease-rendering processes are represented by the abundant existence of three types of artifacts: (1) the large presence of thermo-altered quartz fragments that may have been associated with activities involving heating, such as stone-boiling in connection with bone-grease rendering; (2) the presence of more than one hundred greywacke slabs with surface wear marks indicative of their use as anvils; (3) and finally, the common presence of bipolar elements, commonly known as scaled pieces ("*pièces esquillées*") that may have been used as wedges for carcass processing, namely for the extraction of ungulate bone marrow. Scaled pieces are a common component of archaeological assemblages worldwide, though it is not always easy to classify them unequivocally as cores or wedges, and most times this type of implement is neglected in lithic technological and functional studies. This poster presents the first approach to a techno-typological analysis of Vale Boi's scaled pieces. We have selected a sample of artifacts coming from one of the site's areas (the Slope) and focused on the comparison between raw materials and chronological horizons. We have applied a large set of both metric and qualitative variables that allowed to compare patterns of metric and type of blank selection, reduction sequences, morphological alterations, among others, and to compare with recent experimental studies on this type of tool [3]. In general, the artifacts analyzed for this study suggest that, despite some expected differences between chert and quartz implements, their use as wedges would have been the primary function of those tools during all phases. Typo-metric analysis also suggests that these artifacts must have been expediently used and did not integrate complex sequences of functional reduction, in clear agreement with the general trends in lithic technology of the site [4,5].

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Pecha Kucha Presentation: Session 4, Fr (10:05-10:30)

Cerebral "Default Asymmetry" in global Occipital Bending and local Sylvian Fissures morphology differentiates between humans and chimpanzees (*pan troglodytes*)

Lewis Hou[1], **Xiang Li**[1], **William Hopkins**[2], **Tim Crow**[3], **Neil Roberts**[1]

1 - University of Edinburgh · 2 - Georgia State University · 3 - POWIC, University of Oxford

Structural asymmetries have been argued to be of evolutionary significance in regards to language and other functional lateralisation in humans for a long time [1]. Here we characterise the global occipital bending (OB; [2]) and local length and morphology asymmetries of the Sylvian Fissures (SF; [3]) in human (n: 27) and chimpanzees (n: 29) MRI using post-imaging analysis techniques to understand if they are related and form a "default" asymmetry in either species [4].

3D T1 weighted images were obtained for 27 humans and for 28 chimpanzees housed at Yerkes National Primate Centre in Atlanta, using the same acquisition protocol on 3T MRI systems. The images were processed using BrainVisa software (www.brainvisa.info) and 3D sulcal graphs were produced, checked, corrected and automatically labeled blind to subject sex and age. The results were inspected to determine whether the SF contains a bifurcation point and measurement of the lengths of the AH-SF and V-SF were obtained. The size of OB was measured for each brain on segmentations obtained using FSL software (http://fmrib.ox.ac.uk/fsl) using analysis routines developed in house.

Humans have an overall rightward OB ($t(26) = 2.889$, $p = 0.008$; Mean: 3.38 degrees, SD: 6.08, n: 27) whilst chimpanzees show limited OB ($t(26) = -0.039$, $p = 0.0969$; Mean OB: -0.266 degrees, SD: 3.53, n: 27), with the between-species significantly different (Independent-Samples Mann-Whitney U Test, $p = 0.012$). There were key morphological differences between species, with the SF bifurcating less often in the chimpanzees, and were more commonly of an Inverted Type compared to Superior Type in humans. Correspondingly, human SF terminated more superiorly and anteriorly on the right inferior parietal region compared to the left that did not occur in chimpanzees.

When analysing the whole cohort, Total-SF length asymmetries did not significantly differ between species ($F(1, 52) = 3.658$, $p = 0.061$, ns). However, when the analysis was constrained to comparable cohorts where the SF could be refined to the anterior-horizontal SF (AH-SF) and vertical SF (V-SF), humans showed the previously found typical pattern of asymmetries (left-lateralised AH-SF; right-lateralised V-SF), whereas chimpanzees did not, and this was significantly different between populations in the AH-SF segment ($F(1,35) = 4.449$, $p = 0.042$).

Finally, correlational analysis suggests that across the population, more rightward the OB, the more typical the SF (i.e. leftward AH-SF, rightward V-SF) and vice-versa (AH-SF length: $r = -0.593$, $p < 0.001$, n: 50; V-SF length: $r = 0.468$, $p = 0.004$, n: 36) suggesting these factors are related. Indeed, in humans, the typical asymmetries of the SF and OB co-occurred within individuals in 10/24 cases (41.7%) but not in any cases of chimpanzees.

To our knowledge, this is the first time such a study has been conducted looking at both OB and SF in detail, suggesting that there are fundamental differences in OB and SF morphology particularly in the inferior parietal lobes between species, which must then be taken into account when measuring SF length and may have functional significance. Additionally, OB and SF asymmetries are related in both species, but only in humans co-occur as a "default asymmetry" which may have a developmental origin, and represent one of the key divergent differences separating chimpanzees from humans.

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Poster Presentation Number 70, Th (17:00-19:00)

Life history, social cognition, and emotion

Daniel Hunt[1]

1 - Centre for the Archaeology of Human Origins, University of Southampton

In modern humans, the developmental period plays a fundamental role in the emergence of social cognition. During infancy, the brain goes through significant changes, not least a three-fold expansion in size caused by an increase in white matter. This is driven by a suite of intricately related developmental processes, including synaptogenesis, the growth of dendrites and axon bundles, and the myelination of nerve fibres. After the initial glut of expansion, the brain goes through a process of fine-tuning, the trimming of superfluous connections. This allows individuals neural circuitry to be adjusted to individual experience and engagement with the world, resulting in many of the higher cognitive abilities found in modern humans.

No other animals have a comparable developmental trajectory for brain growth. Like humans, chimpanzees are born with a less mature brain, and have a more protracted course of neuronal development during puberty, than other non-human primates such as macaques. However, they do not experience the rapid increase in non-neuronal cells and proportional dynamic change in neuronal wiring that occurs during human infancy. Thus, whilst a relatively more protracted course of cerebral development was likely present in the last common ancestors between humans and chimpanzees, the refinement in neuronal circuitry seen during early infancy is likely to have emerged in the human lineage some time after the split between humans and chimpanzees [1].

As such, it is argued that this period of sensitivity in brain development was vital for the emergence of social cognition during human evolution. This will be explored through a consideration of the life history patterns of early human ancestors. Research has indicated that hominins have life history patterns intermediate between humans and chimpanzees. Neonatal brain size may have been smaller than chimpanzees, but bigger than humans [2]. Additionally, the Mojokerto *Homo erectus* infant appears to have been on a developmental pattern unique to its species [3]. This suggests that social cognition will have emerged differently in hominins than modern humans or chimpanzees, accounting for much of the behavioural differences.

Following on from this, a model will be developed to trace the emergence of emotion cognition in early human ancestors. Child development research shows how children progress through a series of cognitive milestone in their acquisition of social and emotion cognition [4]. Synthesising this and the evidence for life history patterns, an interpretive framework will be developed to aid understanding of the changing nature of social and emotion cognition in human evolution. It will be seen that there was a staged acquisition of cognitive milestones during human evolution, with the emergence of objective self-awareness, the ability to evaluate behaviour against external standards, and the development of emotion scripts, affecting the types of emotion cognition attainable. The acquisition of these milestones, constrained by life history patterns, influenced the social behaviour of early human ancestors.

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Poster Presentation Number 115, Sa (12:20-13:50)

Investigating human/animal relationship during the Middle Pleistocene at La Cotte de St. Brelade, Jersey

Marie-Anne Julien[1], Andy Shaw[1], Silvia Bello[2], Leif Isaksen[1], Simon Parfitt[2,3], Matthew Pope [3], Beccy Scott[4], John McNabb[1], Clive Gamble[1]

1 - University of Southampton · 2 - Natural History Museum · 3 - University College London · 4 - The British Museum

In North-Western Europe long Palaeolithic stratigraphic sequences are very rare and bone preservation is usually quite poor. The important archaeological sequence of La Cotte de St. Brelade (Jersey, UK), known for both abundant lithic and faunal material recording human activity and environmental conditions over the last 200,000 years, is an exception in this key region. La Cotte is also famous for the discovery of two late Middle Pleistocene concentrations of mammoth and rhinoceros bone remains, known as the 'bone-heaps' . Different hypothesis have been proposed to explain the formation of these distinctive bone accumulations, which could have resulted either from human or a mix of human and carnivore activities . However, the details of the human/animal interactions and the possible taphonomical or behavioural differences between each different archaeological layer, still needs to be fully clarified [cf. 3]. Here we present the first results of a full re-examination of the bone material from ten Saalian levels in La Cotte, which takes into account taphonomical and zooarchaeological investigation of over 10,000 bone remains. The spatial arrangement of the remains is also considered here, with a special attention for the layers containing the bone-heaps. Our results shows that, like other sites from Northern France, carnivore presence is extremely limited and even absent from some layers of La Cotte. If diagenesis has unevenly affected the faunal material, our analysis points toward an anthropogenic origin of the faunal assemblages from the different Saalian layers of the site, including the famous heaps. Human inflicted damage such as typical cut marks and green bone breakages are present throughout the sequence, attesting to the consumption and processing of different species, notably large bovids, rhinoceros and mammoth. A novel type of deep cut or chop-like-marks, apparently non-related to a species or anatomical element type, has been identified in different layers, including the heaps. It offers the possibility of considering and questioning the redundant presence of peculiar butchery gesture at a site. The results of this multi-proxy analysis allow for a deeper understanding of the processes of formation and modification of the different faunal assemblages from the site. It also offers new possibilities for questioning the apparent uniqueness of the bone heaps and for investigating the different possible behaviours that resulted in these peculiar accumulations. Finally, we will consider the implications of the study of this key prehistoric site for our understanding of the behavioural diversity and subsistence strategies developed by Neanderthals in North-Western Europe.
Acknowledgements: This research is funded by the AHRC project 'Crossing the Threshold: Dynamic transformation in human societies of the Late Middle Pleistocene'

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Pecha Kucha Presentation: Session 4, Fr (9:15-9:40)

Results from the renewed excavations at the Middle to Upper Paleolithic site of Sefunim Cave in Mount Carmel, Israel

Andrew W. Kandel[1], **David Friesem**[2], **Naomi Porat**[3], **Ron Shimelmitz**[4]

1 - Heidelberg Academy of Sciences and Humanities · 2 - University of Cambridge · 3 - Geological Survey of Israel · 4 - University of Haifa

After two seasons of excavation at Sefunim Cave in Mount Carmel, Israel, we present new results about dating, cultural stratigraphy and site formation processes. Our renewed excavations have yielded a large amount of find material which is still under analysis as the excavation continues. The site was originally excavated by Avraham Ronen between 1965 and 1969, but questions remained about the layers attributed to the Middle and Upper Paleolithic. Some of the goals of the renewed efforts include documenting unexcavated areas of the site, performing radiometric dating, examining lithic technology, conducting archaeozoological and taphonomic studies, studying the micromammalian and botanical remains, and understanding the microstratigraphy and site formation processes using geoarchaeological methods. Further excavations planned for the summer of 2015 should produce more information about the timing and nature of the transition from the Middle to Upper Paleolithic.

Ronen obtained radiocarbon ages for the Natufian occupations which ranged between 10.5-12 ka cal BC, but finds from the underlying layers were not dated. New luminescence results using OSL confirm the presence of both early Epipaleolithic and late Upper Paleolithic occupations between about 20-24 ka cal BP in our layers II and III. Further radiocarbon dating of charcoal and shell supports a Levantine Aurignacian occupation between about 28-36 ka cal BP in our layer V. However, the earlier Levantine Aurignacian and deeper layers remain undated for now.

Find materials include a large number of lithics and many well preserved faunal remains, including micromammals which will provide local paleoclimatic information. A few bone tools and large ground ocher pieces were also recovered. A preliminary study of the lithic artifacts suggests that the cultural attributions are appropriate and mesh well with the dating results. In layers II and III, we found a bladelet industry with thin microliths, including backed and obliquely truncated bladelets, as well as various micro-points typical of the early Epipaleolithic. Layer IV represents a blade and bladelet industry with some microlithic elements present. Layer V includes lithics typical of the Levantine Aurignacian, as best reflected by carinated scrapers. The discovery of marine shells from the Upper Paleolithic raises the total number of shells from 28 found by Ronen to 91 in all. Of the six Mediterranean shell species identified thus far, the gastropod *Columbella rustica* appears to be most common with 59, followed by the tusk shell, *Antales* sp., with 24. In fact, most of the new mollusks come from a concentration of 50 shells found in just one quarter meter of the Levantine Aurignacian layer.

Micromorphological studies provide details about site formation. The main sedimentation source is colluvial *terra rosa*, which is abundant in the region and also above the cave, mixed with an aeolian quartz component deriving from the nearby coastal plain. Post-depositional processes at the site are characterized by decalcification in layers II-IV, while layer V shows evidence of dissolution of the limestone and re-precipitation of calcite, both of which increase with depth. Microscopic bones and clay aggregates show evidence of burning in layers III and V, probably due to human activity. Layer IV, on the other hand, does not possess burnt features and has a greater amount of phosphatic grains and carnivore coprolite fragments.

Poster Presentation Number 91, Fr (12:20-13:50)

On relationships between biometric variation and Lower Palaeolithic tool efficiency in differing task-type contexts: implications for the evolution of the human hand and the origin of the Acheulean

Alastair Key[1], **Stephen Lycett**[2]

1 - University of Kent · 2 - University at Buffalo, SUNY

Lower Palaeolithic hominins are thought to have been dependent upon stone tools during the processing of food resources. Hence, it is hypothesized that the evolutionary advantages provided by efficient stone tool use may have selected for anatomical changes observed in the hand during this period. It is not known, however, whether this hypothesized selective pressure is consistent across varying technological and task-type conditions associated with Lower Palaeolithic tool-use contexts. Here, six key biometric parameters of the hand central to discussions on early hominin tool use capabilities are investigated in terms of their statistical relationship with stone tool efficiency. Using both flake cutting tools and handaxes, 60 participants undertook a number of distinct tool-use activities on different materials over extended periods. Statistical relationships with tool efficiency rates were then investigated in light of individual biometric parameters, the type of material being cut, and varying durations of use. Results indicate that (1) both handaxe and flake cutting efficiency is significantly related with biometric variation of individual tool-users, (2) relationships between biometric parameters and efficiency are consistent across extended durations but vary dependent upon task-type conditions, (3) manipulative strength is the most significant biometric trait in terms of predicting flake efficiency, while (4) manual proportions of the hand are the strongest predictor of handaxe cutting efficiency. These results demonstrate the long-term impact that stone tool use likely had up the evolution of the hominin hand, while also highlighting the variable influence of different tool use contexts. Most notably, results indicate that the onset of the Acheulean may have been dependent upon manual proportions that are close to the modern human range, and that prior to the appearance of this anatomy, handaxe use would have been an impractical (i.e. inefficient) tool use behaviour.

Podium Presentation: Session 8, Sa (10:10)

The Eemian Zoo of Neumark-Nord 2 (Germany): Neanderthal adaptations to interglacial environments on the European Plain

Lutz Kindler[1], Geoff Smith[1], Alejandro García-Moreno[1], Sabine Gaudzinski-Windheuser[1], Wil Roebroeks[2]

1 - MONREPOS Archaeological Research Center and Museum for Human Behavioural Evolution · 2 - Faculty of Archaeology, Leiden University

The European Plain – in its broadest sense - stretches from the northwestern foot of the Pyrenees in a long curve to the western foot of the Ural covering the largest part of what would have been the Neanderthal European home range. For most of the Pleistocene this vast area was covered by cool and temperate steppes. During the short Pleistocene interglacials -as today- the European Plain formed part of the temperate broadleaf and mixed forest ecozone. Dense forests are often reconstructed as environments unfavourable to Neanderthal lifeways and subsistence. Thus, the Eemian Interglacial could have posed a significant adaptive problem for Neanderthals in Europe.

The recently excavated Eemian lakeland site of Neumark-Nord 2 (Saxony-Anhalt, Germany) is central for a more comprehensive assessment of Neanderthal subsistence in interglacial forested environments. We have introduced the high resolution record and its potential for our understanding of Neanderthal adaptations to Eemian environments in previous ESHE meetings. In this talk we present – for the first time- the results of faunal analyses from the main accumulation NN2/2B in its spatial and temporal context of the small pond Neumark-Nord 2.

Excavations of NN2/2B from 2004-2008 yielded ca 120.000 heavily fragmented bone specimens exposed on a 500 m2 area along the northern margin of the pond and the adjacent basin slope. The faunal accumulation occurred during a narrow time interval representing the first half of the Corylus-phase of the Eemian vegetational succession. Our faunal analyses aimed to reconstruct the biostratinomic chain during the formation of NN2/2B, guided by GIS-based mapping of zooarchaeological and taphonomical patterns.

We will present the "hardcore" data from our analyses of the faunal material documenting principle patterns of preservation and fragmentation, species composition, minimal number of individuals, skeletal part representation, mortality profiles and seasons of death, alongside patterns of Neanderthal butchery practices and other agents and processes of bone modification. Placing all this zooarchaeological and taphonomical data in context we have constructed a biostratinomic sequence for NN2/2B, which enables us to evaluate the role of Neanderthals in this sequence. Our results suggest year round Neanderthal occupations of the site, with very limited evidence for overprint of the bone accumulation by other taphonomic actors. During this time Neanderthals took advantage of a wide array of species of the "Eemian Zoo" in the Neumark lakeland, with a clear focus on larger ungulates. From here we discuss the function of the site, which goes beyond the ordinary practices of butchery events we witness at other Eemian locales. Finally, we put these results into the wider context of Neanderthal subsistence and ecology on the forested European Plain.

Poster Presentation Number 71, Th (17:00-19:00)

Hominids & humans: Behavioral modernity and the process of becoming human

Marc Kissel[1]

1 - University of Notre Dame

The question of what does it mean to be human is at the heart of anthropological research. Paleoanthropological approaches have focused on locating a specific time, place, and morphology when our ancestors went from archaic *Homo sapiens* to anatomically and behaviorally modern ones but often this work has been undertaken without integrating modern theoretical issues or recognizing the relevance of the archaeological record. Furthermore, recent genetic and archaeological data suggests that complex migrations and gene flow occurred between various populations, suggestion greater interactions between regional groups Archaeologically, there may be specific correlates in the material record of the past that allow us to move beyond the search for a specific time and place to describe how our species began to be like "us," by examining evidence for semiosis, ritual behavior, exchange networks, and aesthetics. By creating a database of more than 300 examples of archaeological indicators for modern human behavior (including ornamentation, ochre use, spatial layout, use of exotic raw materials, engraved objects, and anthropomorphic objects) I show patterns in the archaeological and fossil data that informs on the process of becoming human. The data suggest that, despite attempts to localize modernity to a specific time and place, many of the signifiers of symbolic thought are not limited to a single site or geographic region, but are rather found in multiple places at roughly the same time. For example, the use of ochre, without direct signs of engraving, dates to older than 200 kya in both Africa [1,2] and Europe [3], spanning continents and, perhaps, species. This suggests that either symbolic expression has multiple origins or that information is travelling between regions faster than is often assumed. Using these results I investigate the theoretical underpinnings of the 'behavioral modernity' model, showing how the inclusion of an integrative anthropology, alongside modern evolutionary theory, can help to better understand the role symbol making and information sharing played in the origin and development of the cultural human experience. By engaging in a more theoretically integrative anthropology we can increase our knowledge of human evolutionary histories as well as problematize more simplistic notions of behavioral modernity

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Poster Presentation Number 124, Sa (12:20-13:50)

Neanderthal and Anatomically Modern Human changes in food resources

Monika Knul[1], **Amanda Korstjens**[1], **Phillipa Gillingham** [1], **John Stewart**[1]

1 - Department of Life and Environmental Sciences, Bournemouth University

Neanderthal extinction has been approached from many perspectives in recent years, one of which is the differences in diet between Neanderthals and Anatomically Modern Humans (AMH). Differences in diet between the species may have influenced their ability to respond to climate change, i.e. the ability of AMH to diversify food resources has been suggested to have been advantageous and responsible for increases in population density [1]. Both Neanderthal and AMH relied heavily on meat resources as proven by both zooarchaeological studies and stable isotope studies [2]. It has been claimed that Neanderthals exploited species for food that are often associated with warmer, more forested environments. Meanwhile, AMH apparently exploited a more diverse array of species, however, most of these are associated with more open, cooler habitats [3]. These observed differences in resource exploitation by the different hominins have undergone little statistical testing, thus the aim of this paper is to test if these observations remain probable after statistical testing and interpret the data in more detail, as was previously impossible. We conducted statistical analyses on a database that consists of radiocarbon dates from over 400 archaeological sites and associated fauna, with a geographic range of Europe limited to the East by the Urals and Caucasus and a temporal scope of 60-19 ka BP. The faunal part of the database comprises of mammals that are of medium to large size. The analyses are run on different aspects of the fauna: the herbivore, omnivore and the carnivore guild are tested separately and together. Principal Component Analysis (PCA) is used to study the differences in resource exploitation between Neanderthals and AMH. Improvements in radiocarbon dating allow us to track changes in diet through time and space for both Neanderthals and AMH. We used Cluster Analysis (CA) in a GIS setting, showing that sites cluster according to similar species composition through time and space. The PCA confirms that Neanderthals are indeed more closely associated with species living in forested environments and AMH are more closely associated with species living in open environments. The geographical application of CA shows that there are geographical changes through time and space in species composition of archaeological sites, and this suggests that both Neanderthals and AMH have changed their diets through time and space. These analyses increase our understanding of the hominins adapting to changing climates and the results may be used in modelling Neanderthal extinction.

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Poster Presentation Number 16, Th (17:00-19:00)

Looking for glue: seeking Neandertal sites containing adhesive remains

Paul Kozowyk[1], **Geeske Langejans**[1,2]

1 - Faculty of Archaeology, Leiden University · 2 – Department of Anthropology and Development Studies, University of Johannesburg

We are looking for material and collaborators for our Neandertal adhesive project. The creation of multi-component composite tools, and the glue that held them together, was a significant step in the evolution of human technology and of the human mind. It required the collection of disparate materials and allowed for their combination in a multitude of possible forms for different purposes. Neandertals manufactured the oldest known adhesives about 200,000 years ago by making birch pitch using a complex process known as destructive distillation [1]. This innovative technology required the controlled use of fire, and an intricate knowledge of the material properties of birch bark [2]. Despite the importance of glue when assessing ancient cognition [cf. 3, 4], there are very few known examples of Middle Palaeolithic adhesives. It is unclear if the use of glue was a rare and isolated occurrence among Neandertals, or if we are missing a part of the archaeological evidence and glue was actually an engrained part of their tool technology. In addition, while birch pitch requires a complex production process [cf. 5], there are other natural adhesives, such as pine resin, which may have been simpler to use, but there is no evidence of these in the European record. Were Neandertals only using birch pitch? Were they unaware of alternatives? Or have we simply not found them yet? To assess the extent of Neandertal adhesive technology we are conducting a range of preservation and performance experiments. However, we also need to fully understand the composition of ancient glues by chemically analysing archaeological material. Due to the scarcity of these types of remains from such a remote time period, we need your help to do this. We are looking for unwashed and unhandled artefacts, preferably from in-situ deposits with organic preservation. The identification and analysis of new adhesives or adhesive residues among Neandertal tools will help shed new light on cognitive changes and technological innovations that took place during the Palaeolithic.

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Poster Presentation Number 94, Fr (12:20-13:50)

Cross-sectional Shape of the Humerus in Neanderthals, Mediaeval Population from Europe and Australian Aborigines

Anna Maria Kubicka[1], **Wioletta Nowaczewska**[2], **Janusz Piontek**[1]

1 - Adam Mickiewicz University in Poznan, Poland · 2 - University of Wroclaw, Poland

Experimental research has shown that the diaphyseal cortical and sub-articular trabecular bones can contribute to the exploration of functional adaptation of the humerus to mechanical loading and patterns of habitual behaviour among groups. Previous research on the humeral diaphyses of Neanderthals and anatomically modern humans (AMHs) has revealed differences in shape and robusticity. However, traditional cross-sectional biomechanical analysis does not show precisely in which part of the shaft the differences are. Geometric morphometrics (GM) uses the Cartesian coordinates of anatomical points on a surface and curves, called landmarks, to statistically analyse and visualise variations in shape between and within objects. Thus, the main purposes of our study were: 1) to analyse and visualise cross-sectional shape differences among humeri in Palaeolithic and modern hunter-gatherers and agricultural populations using GM; 2) to compare our results with other research on humerus cross-sectional geometry in which the traditional method was used. We studied the left and right humeri of adult specimens of Neanderthals from the Krapina and Regourdou sites, an agricultural population from Poland from the Mediaeval Ages, and a nineteenth-century group of hunter-gatherers from Australia. For each Computed Tomography (CT) image, a cross section was prepared, using 3D Slicer software, at 35% of the length of the bone from the distal end of humerus. Next, 25 semilandmarks around the external and 15 semilandmarks around the internal cortical bone were evenly distributed and then superimposed. Tests showed that the humeri of Neanderthals and AMHs are the same size but differ in cross-sectional shape. We also found that all groups are characterised by directional asymmetry (DA) in cross-sectional shape. Differences between sides are greatest in Neanderthals, smaller in the mediaeval population, and least in Australian aborigines. Neanderthals are characterised by the most robust humeri and the most developed lateral and anterior ridges, the mediaeval population by pronounced (though slightly weaker) ridges as well, and Australian aborigines by the most gracile humeri. GM showed that the humeri of the agricultural population was characterised by a more robust cross-sectional shape than those of modern hunter-gatherers from Australia, but weaker than those of Neanderthals. The developed ridges in Neanderthals and in the mediaeval population are a result of higher levels of force of the *musculus brachialis* and *musculus extensor radialis longus*, which are responsible for flexing the forearm and extending the hand. More pronounced muscle attachment could be attributed to more extensive physical activity such as transport or the production of tools. However, these results are partially contrary to documented trends whereby decreasing robusticity is associated with increased sedentism. The greater robustness of humerus cross-sections in the mediaeval population compared with Australian aborigines may constitute evidence for repetitive loading in agriculture, but might also have been caused by differences in climate. Our results confirm previous research which shows that Neanderthals exhibit an unusual range of DA compared to modern humans; this may be the result of activities involving the upper right limb to a considerable extent. It is not possible that DA in Neanderthals was caused only by activities such hunting or production of tools, in light of the much weaker DA in modern hunter-gatherers. The ultimate resolution of this issue can be achieved by comprehensive analyses.

Poster Presentation Number 39, Th (17:00-19:00)

Teeth and jaws: getting closer to inferring feeding behaviour from morphometric traits in hominids

Kornelius Kupczik[1], **Viviana Toro-Ibacache**[2,3], **Gabriele A. Macho**[4]

1 - Max Planck Weizmann Center for Integrative Archaeology and Anthropology, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 2 - Facultad de Odontología Universidad de Chile, Chile · 3 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 4 - Research Laboratory for Archaeology, The University of Oxford, UK

Reconstructing the dietary ecology of extinct hominins remains the topic of intense research. In recent years the focus has shifted from an assessment of morphology to analyses of microwear textures and stable isotopes [1]. This is because the latter two aspects directly reflect what an animal ate during its lifetime, whereas morphology does not and is subject to varying degrees of homoplasy. However, interpretation of microwear and isotopes are not straightforward either [2], whilst morphology determines what an animal *could not* have eaten [e.g. 3]. Detailed analyses of morphology can therefore shed light on the overall ecological niche exploited by the species, particularly where omnivorous taxa and/or eclectic feeders, like hominins, are concerned. Not all morphological features may be equally informative however. In this exploratory study, our aim is to assess the predictive power of structures directly involved in food breakdown, i.e. teeth and mandible; we therefore first compare and contrast overall tooth size, upper and lower molar root splay and jaw metrics of relevance to lever arm feeding mechanics (bicondyle and bimolar width; and condyle-M1 distance) in male and female *Gorilla gorilla* (n=10) and *Pan troglodytes* (n=10). These structures were chosen as they are of different embryonic origins and are generally thought to differ in their response to loading over different time-scales, with the jaws being the most plastic and the teeth being the least plastic [4]. We employ landmark-based morphometric analyses to assess molar root splay, crown (cervical) centroid size, lower molar root lengths and compare statistically the variables of jaw-metrics. Additionally the association between both sets of variables is tested. Our results show that (1) upper M1 root splay is more marked in gorillas; (2) more divergent upper M1 roots relate to more divergent lower M1 roots; (3) M1 neck and roots of gorillas are larger than they are in chimpanzees; (4) all jaw metrics help to distinguish gorillas from chimpanzees, except for lower bimolar distance; and (5) none of the jaw-metrics studied relate significantly to root splay. The latter finding may be due to the fact of a developmental independence of both the jaw and the teeth. Although differences due to phylogeny cannot be excluded, variations in root splay are potentially related to the increased lateral excursion of the mandible in hominids [5]. Thus, insights gained from these analyses promise to inform on tooth loading and the dietary niches of extinct hominins.

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Poster Presentation Number 76, Fr (12:20-13:50)

Ten years in a Lime Mine: reflections on research at the Makapansgat Limeworks, 1994-2004

Kevin Kuykendall[1]

1 - Department of Archaeology, University of Sheffield

The Makapansgat Limeworks (MLW) fossil locality is the geologically-oldest of the historic 'Big Five' Plio-Pleistocene hominid sites in South Africa, and has been the focus of intermittent fieldwork since 1947. This paper will reflect on a decade of fieldwork in the Makapansgat Valley ending in 2004, discuss selected aspects of fieldwork activities, and review the outcome of a preliminary fieldwork initiative to develop a new strategy for fossil palaeocave research in South Africa. During the course of the fieldwork at MLW, only two new hominid fossils were recovered – both mandibular fragments missing tooth crowns and from ex-situ dump context. This is a clear reflection that working at South African palaeocave localities involves heavy costs in time and energy without any guarantee of producing fossils. In part due to such factors, our current knowledge of hominid evolution in South Africa remains limited to at most a few sites per hominid species, all of which are restricted to the 'Cradle of Humankind' region (of which Makapansgat is a satellite). However, recent advances in sampling techniques for non-fossil resources have begun to shed new light on questions and issues relevant in palaeoanthropology. The incorporation of such techniques may allow the development of a selective sampling strategy for fieldwork in the South African Plio-Pleistocene context which is not as reliant on producing hominid fossils as a starting point for research. A pilot field survey project was initiated involving GIS-based reconnaissance of historic lime mines as a first attempt to employ such a strategy. A database of lime mine coordinates was extracted from historic South African mining records to conduct a widespread regional survey with the aims to relocate disused lime mines using handheld GPS, to produce a field inventory of potential fossil sites at such mine localities, and to use the resulting GIS database to model geological, geographic, and environmental correlates of mine and fossil site distribution to guide future field activities. In the pilot field season, over 20 previously undocumented potential sites including historic lime mines, sinkholes, and caves were located in an exploratory survey of three broad regions of the Malmani Subgroup dolomitic geological formation. Not all sites present exposed fossil deposits, and a primary consideration for future research is the potential to sample useful resources (cave speleothem, infill deposits) from such sites irrespective of the identification of fossil materials. We are currently working to incorporate sampling and test excavation, as well as additional survey methods (e.g., aerial & satellite imagery, remote sensing) to enhance our field reconnaissance technique, and to develop a method to produce site- and regional sampling profiles to address relevant questions in palaeoanthropological research.

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Poster Presentation Number 38, Th (17:00-19:00)

The Etiology of the Horizontal-Oval Form of the Mandibular Foramen and a Reassessment of its Usefulness for Paleoanthropological Studies

Katherine Lacy[1], **Fred Smith**[2]

1 - Binghamton University · 2 - Illinois State University

The lingula, located on the medial mandibular ramus, is a highly variable osteological feature of uncertain functional significance. The horizontal-oval form of the mandibular foramen (HOMF) is a morphological variant of the hominin mandibular lingula, located on the medial aspect of the ascending ramus of the mandible. The HOMF appears at a high frequency in Neandertals, a moderate frequency in early modern humans, and a low frequency in recent humans. No etiology is known for this trait, and it has been assumed to represent a discrete, genetically controlled Neandertal autapomorphy; thus its presence in anatomically modern humans has been used to infer admixture between Neandertals and early modern humans. Due to the uncertainty of its etiology, however, the appropriateness of its use for this type of inference is questionable. The goal of this study is to test the assumptions behind the previous use of the HOMF as a discrete genetic marker in paleoanthropological population studies, particularly those concerning modern human origins. We present a new hypothesis that the morphology of the lingula is at least partially developed as a plastic response to heavy use of the masticatory apparatus. Our analysis includes mandibles from three recent modern human samples, an archaic *Homo sapiens* sample, and a Neandertal sample. Our results show a significant correlation between the posterior extension of the lingular bridge and severity of dental attrition, indicating that the morphology of the lingula is at least partially influenced by pressure placed on the masticatory apparatus. Still, the frequency of the trait is significantly higher in Neandertal samples, which suggests that there may also be a genetic influence on the rate and intensity of osteological growth in this anatomical region. However, due to the apparently significant influence of behavior on its morphology, we conclude that this trait should be used in studies of genetic relationships among paleontological samples only with caution.

Pecha Kucha Presentation: Session 4, Fr (9:40-10:05)

On the use and context of Middle Stone Age scrapers from Sibudu Cave (South Africa)

Geeske Langejans[1,2], **Lyn Wadley**[3]

1 - Leiden University · 2 - University of Johannesburg · 3 - University of the Witwatersrand

In southern African archaeology, scrapers have commonly been interpreted as hide-working tools. However, this hypothesis has not been tested for the Middle Stone Age. Therefore, we analysed a scraper assemblage from Sibudu Cave (KwaZulu-Natal, South Africa); this site has a long Middle Stone Age sequence, with a number of dated occupation pulses [1]. One of these pulses comprising of voluminous sediments is dated to around 58,000 years ago. We focus on one single layer of this pulse, SS. This layer has been assigned to the post-Howiesons Poort technocomplex, which is generally characterised by macrolithic retouched tools, of which unifacial points and scrapers are the most common. This contrasts with the preceding Howiesons Poort period, where backed geometric tools are most abundant [1]. The layer contains large combustion features, at least one post hole, and many scrapers clustered around these features. In addition, there is a positive spatial correlation between densities of scrapers and utilised ochre. At Sibudu we identified endscrapers (13), convex sidescrapers and straight sidescrapers (10), convergent sidescrapers (20), déjeté (4) and double sidescrapers (4). The scrapers are made from dolerite or hornfels and they vary considerably in the extent to which they were used. Of the six excavated squares containing layer SS, three are evidently richer in scrapers (96%, N total=51) and utilised ochre pieces (93%, N total=60) (C4-6) compared to the other three squares (B4-6), containing 4% and 7% respectively [1]. Residue analysis of the scrapers reveals traces of ochre on them and micro-wear analysis of 20 scrapers indicates that the scrapers were in contact with a variety of materials: mineral (7), hide (4), muscle tissue (1), bone (1) and plant (3); three pieces showed traces of hafting. Southern African ethnographic accounts record the use of ochre as a tanning agent [1, 2]. Other evidence implies that ochre may also have been used to preserve and perhaps colour hides during the Middle Stone Age [3]. This analysis demonstrates that the scrapers from the post-Howiesons Poort at Sibudu were employed for a variety of tasks. In addition to evidence of hide working, plant and, more unexpectedly, mineral matter were also worked.

Acknowledgements: Geeske Langejans's research is sponsored by Netherlands Organisation for Scientific Research (NOW) with a Veni grant. Lyn Wadley is funded by the National Research Foundation (South Africa).

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Poster Presentation Number 34, Th (17:00-19:00)

Morphological variation and covariation in the South African australopith masticatory apparatus

Julie Lawrence[1]

1 - LCHES, University of Cambridge

This paper outlines a holistic and quantitative description of the morphology of the australopith masticatory apparatus, which has been made possible by the continuing advances in shape analysis. The analysis of 3D data with geometric morphometric methods (GMM) has enhanced our ability to understand morphological variation and covariation beyond the use of traditional linear measurements [1]. However, such analyses do not readily lend themselves to studies with missing data. South African australopith morphology is commonly represented in GMM studies by a few key specimens such as Sts5, MLD37/38, Sts71, and SK12. This study combines GMM (111 landmarks) and linear analysis (80 measurements) to include a broad range of *A. africanus* (n=69, 3D data for 28) and *A. robustus* (n=78, 3D data for 33) original fossil specimens. Morphological units within the preserved maxillomandibular complex are compared to homologous regions in extant genera (Gorilla, n= 33; Chimpanzee, n=30; Homo, n=52). The novelty of this work lies in examining morphological variation on three different levels, size only, shape only, and a combination of size and shape, to investigate variability and covariation in the craniofacial regions that are most often preserved in the fossil record and that relate to the functioning of the masticatory system. The joint use of multiple analytical techniques allows for a detailed study that is specifically tailored to address the fragmentary fossil material, and which exploits the advantages of each method. With GMM, this means the preservation of geometric relationships within the dataset, the ability to examine size and shape independently, and the visualisation of shape variation. At the same time, linear measurements allow the extraction of corroborating information from the more fragmentary specimens. The results describe and quantify the relationship between variability (for which South African australopiths are renowned [2]), covariation, morphological distinctiveness and taxonomy across the masticatory apparatus. Overall, morphological regions within the masticatory system showed differential patterns of variation that could not be explained by size or variation in other functionally or spatially related regions. These findings will be discussed in light of morphological modularity and integration with implications for the fossil record.

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Podium Presentation: Session 6A, Fr (13:50)

Characterizing the Dental Development and Enamel Microstructure of the *Anapithecus hernyaki* Holotype RUD09 by Synchrotron Virtual Histology

Adeline Le Cabec[1,2], Paul Tafforeau[2], David R. Begun[3]

1 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 2 - Beamline ID 19, ESRF, Grenoble, France · 3 - Department of Anthropology, University of Toronto, Toronto, Canada

Anapithecus hernyaki is a medium-sized stem catarrhine. It is best known from the Late Miocene (~10 Myr) R. II site at Rudabánya (Hungary) [1]. Its diet is still the matter of debate: the most recent study characterizes its dentition as adapted primarily to frugivory, with folivory as a possible seasonal fallback strategy [2]. The dental development of *Anapithecus* has been described overall as very fast[3]. However, the earlier study [3], which is based on external incremental features, summarized the developmental information from several individuals and important parameters such as long-period line periodicity, cuspal enamel daily secretion rates, cusp initiation time and prenatal period were estimated.

Here, we present the results of the dental developmental study of the holotype of *Anapithecus hernyaki*, RUD09. This specimen consists of a juvenile male mandible and associated teeth recovered in 1972 at the R. II locality, now in the collections of the Hungarian Museum of Natural History. We use multi-scale propagation phase contrast synchrotron micro-tomography (ID19 beamline at the ESRF, France) to non-destructively retrieve a maximal amount of developmental information from this single individual and to obtain quantitative results not relying on parameter estimations.

We report a periodicity of 3 days, which is lower than the value of 4 days estimated by Nargolwalla *et al.*[3]. RUD09 died at a much younger age than would be expected following the developmental model previously proposed [3]. As observed from the position of the neonatal line, the mandibular first molar and the canine initiate about 60 days and 40 days before birth, which is much earlier than previous estimates [3]. The RUD09 canine reaches crown completion in a shorter time (by 33%), and its mandibular third molar develops two to three times faster and initiates about 3 months earlier than estimated. We have built a developmental chart of the RUD09 permanent dentition to compare with previous findings on *Anapithecus* [3]. We also report that the RUD09 enamel microstructure shows several peculiarities, the significance of which remains mostly unexplained. These include seam prisms, thick aprismatic enamel near the EDJ, and a high occurrence of enamel tubules in continuity with the dentine tubules. We also observe strong ubiquitous decussations (both in cuspal and lateral enamel and no radial enamel). Decussations are considered as a crack-stopping mechanism [4]. They are commonly observed in all primates with a body mass above 2 kg, although they are most frequently covered by a layer of radial enamel, which is more adapted to resist abrasion. This cover of radial enamel is absent in RUD09. We report relatively thick molar enamel for a non-hominoid primate (RET = 11.43 for the mesial virtual section of the second permanent molar). Combined with the omnipresence of a wavy pattern of decussations, this leads to question the proposed diet for *Anapithecus*. Since the combination of features of enamel microstructure observed in *Anapithecus* are only found in pitheciin primates that are sclerocarpic foragers, these enamel features are suggestive of a diet consisting of relatively hard items, and involving multiple loading directions, which is typical of these pitheciins [5]. We discuss the hypothesis of sclerocarp foraging as a possible dietary strategy of *Anapithecus* in the context of the paleoecology of R. II, both in terms of food availability and competition with the other catarrhine from the site, *Rudapithecus*.

Acknowledgements: We are grateful to Ildikó Pap, Head of Department, and Sándor Évinger, assistant curator, Department of Anthropology, The Hungarian Museum of Natural History and to the excavation team of the R.II site, as well as to the ID19 staff at the ESRF. We thank Tanya M. Smith for her involvement in the initiation of this project. Funding: Max Planck Society, ESRF and NSERC.

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Poster Presentation Number 81, Fr (12:20-13:50)

A Late Pleistocene aridity and vegetation record from stable light isotope ratios of ostrich eggshell at Pinnacle Point, Mossel Bay, South Africa

Julia Lee-Thorp[1], **Kirsty Penkman**[2], **Curtis Marean**[3]

1 - University of Oxford · 2 - York University · 3 - Arizona State University

The emergence of fully modern behaviour, including complex lithic technology and subsistence broadening, occurred during a period of profound global climate and environmental change from the last Interglacial into the glacial period. In southern Africa, while these temperature shifts were muted, interior regions experienced greater aridity to the extent that widespread depopulation occurred. The southern Cape coast however, remained attractive to Middle Stone hunter-gatherers for millennia. Although this region experiences modest rainfall receipts, its generally less seasonally extreme climate may have contributed to its appeal and it possibly acted as a refugium in OIS 4 and 3. Changing conditions are of course still observed; they include marine regression that opened up a large coastal plain, and shifts in temperature and vegetation cover. A marine sediment record several hundred km to the east has pointed to marked shifts in continental runoff including an increase early in OIS4. At the Pinnacle Point sites rainfall seasonality and vegetation shifts have been observed from the nearby Crevice Cave stalagmite isotope record, but indications for shifts in moisture availability/aridity are few. In order to address the question of aridity, and to provide an independent view of vegetation patterns in the site's vicinity, we report oxygen (δ18O) and carbon (δ13C) isotope ratio analysis of a sequence of plotted ostrich (Struthio camelus) eggshell (OES) fragments from the PP5-6 site. The sequence spans a period from late OIS 5 to 3. Ostrich eggshells are sturdy biominerals, abundant in archaeological and palaeontological sites in arid regions. The relationship between the isotopic composition of the eggshell, and the ostriches' food and water, is broadly similar to that for mammalian biominerals but there are differences. Ostriches are arid-adapted birds that rely strongly on plant and metabolic water, and, unlike most herbivorous mammals, their main criterion for their plantfoods is tenderness, so they may select plants using all three photosynthetic pathways. Also, eggshell composition reflects the limited seasonal window in which wild ostriches breed near the onset of the rainy season. We tested isotopic responses of eggshell to humidity and vegetation along a rainfall (MAP) and humidity gradient from the southern Cape coast to the Central Namib, a transect that shows marked differences in floral composition and a steep rainfall gradient. The results show that OES carbonate δ13C reflects regionally varying proportions of C3, C4 and CAM plants, while δ18O is strongly correlated with MAP, suggesting that when δ18O of meteoric water is held constant, evapotranspiration in plants is a dominant influence. The PP5-6 OES δ13C and δ18O trends are generally coherent suggesting that over the entire sequence, small shifts in the proportions of C3 and C4 plants accompany changes in summer or winter rainfall as is also observed in the Crevice cave stalagmite. However, the OES δ18O and δ13C data are not always coherent through the sequence itself. The δ13C record is far more muted than that of the stalagmite, suggesting that if CAM and/or warm-growing season C4 grasses were present as indicated in the stalagmite data, ostriches found them unpalatable or they were unavailable in the breeding season. OES δ18O is offset by 4-5o/oo compared to the stalagmite and moreover shows a more marked positive shift in mid-sequence, indicating a shift to more arid conditions from 80Ka to 60Ka, and more mesic conditions thereafter. The latter stages of the arid shift correspond to the occurrence of the microlithic Howieson's Poort assemblages in the PP 5-6 sequence so it is tempting to consider the implications, ie. that more arid conditions led to shifts in procurement strategies, which are reflected in the increasing emphasis on microlithic technology.
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Poster Presentation Number 27, Th (17:00-19:00)

Technical diversity in the Nile Valley and the southern Levant at the end of the Pleistocene (25-15ka): evidence for contacts?

Alice Leplongeon[1,2], **A. Nigel Goring-Morris**[2]

1 - UMR CNRS 7194, Département de Préhistoire, MNHN · 2 - Hebrew University of Jerusalem

Terminal Pleistocene (ca 25-15ka) lithic assemblages from the Nile Valley and the southern Levant are compared in order to test the hypothesis of contacts between populations in these two regions, including possible "Back-to-Africa" migrations, as indicated by genetic studies , e.g. [1].

The study focuses on Late Palaeolithic chipped stone industries of the Idfu/Esna area in Upper Egypt [2], and Epipalaeolithic industries in the western Negev Desert in Israel [3]. Both regions display a high diversity of lithic assemblages with numerous industries defined for the terminal Pleistocene. These industries are characterised by bladelet production associated with microliths, some systematically manufactured using the microburin technique and others without. Lithic assemblages are compared using a typo-technological approach, in order to reconstruct the *chaînes opératoires* of their production that enable the identification of common technical features between the different regions. The study of lithic artefacts has the potential of indicating technical diffusions, indicating contacts between human groups whether by the movement of ideas or actual human groups.

First, the chrono-stratigraphic context of the sites was critically reviewed. Lithic assemblages from six Early (Azariq XIII – Masraqan; Azariq IV – Kebaran; Hamifgash IV - Nizzanan) and Middle (Azariq XVI – Geometric Kebaran; Azariq XII – Mushabian; Shunera XXI – Ramonian) Epipalaeolithic sites in the Negev have been studied, covering a time range between ~23-14.5 ka cal BP [4]. Most are short-term occupation sites, associated with one or two hearths, some in situ and others on deflated surfaces, although the material is fresh and an extensive refitting program was accomplished previously [5]. The two Nile Valley sites discussed in this study, E71K18 (Afian) and E71K20 (Silsilian), were not directly dated, but rather by geological correlations based on radiocarbon dating elsewhere; the lithic material shows evidence for long-term surface exposure. The contemporaneity of these sites with the Early and Middle Epipalaeolithic of the Negev cannot therefore be securely confirmed, although an attribution to the end of the Pleistocene may be indicated by comparable material in dated sites from Middle Egypt (Makhadma area) and Wadi Kubbaniya.

Notwithstanding these limitations, comparisons of the Nile Valley and the Negev lithic assemblages indicate the presence of three technical complexes, i.e. two in the Levant (Masraqan/Kebaran/Geometric Kebaran vs Nizzanan/Mushabian/Ramonian) and one in the Nile Valley, which are highly distinct from one another from a technological point of view. This includes: preparation of core striking platforms, techniques of percussion, direction of debitage, presence and modalities of the application of the microburin technique. They also differ from a typological point of view (one or two standardised microlithic morphotypes in the Levant vs atypical geometric microliths or truncations in the Nile Valley). The assemblages of the Negev and Nile Valley probably reflect two distinct cultural spheres with little, if any contact between each other. Rather than supporting the hypothesis of contacts between human groups at the end of the Pleistocene, our results support a hypothesis of isolation between the two regions during this period. However, this needs to be further investigated by studying other assemblages from the Nile Valley with more secure chrono-stratigraphic contexts.

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Poster Presentation Number 50, Th (17:00-19:00)

Laterality distinguishes the brain of *Homo sapiens* from that of *Pan troglodytes*

Xiang Li[1], Timothy Crow[2], William Hopkins[3], Alan Evans[4], A. Qong[5], Neil Roberts [1]

1 - University of Edinburgh · 2 - University of Oxford · 3 - Yerkes Primate Center, Atlanta, GA · 4 - Montreal Neurological Institute · 5 - West China Hospital, Cheng-du

Introduction. The nature of species differences and the mechanism by which they are established is obscure. This is particularly apparent in the case of *Homo sapiens* with the evolution of the capacity for language. Broca [1] proposed that lateralization distinguishes the human brain from that of other animals. Here we have investigated this hypothesis with a technique for analysing positional asymmetry in the brain of Man and that of his closest primate relative.

Method: Brain laterality of the two species was studied by comparing aspects of cortical surface symmetry/asymmetry in MRI scan images of 223 *Homo sapiens* and 70 *Pan troglodytes*. Positional differences between the two cerebral hemispheres were estimated on a vertex basis to assess displacements (along Left-Right, Antero-Posterior and Dorso-Ventral axes) with respect to a best fitting mid-sagittal plane (MSP) between corresponding vertices in the right and left cerebral hemisphere within and between cohorts. Sex differences were explored in an average asymmetry map for each gender of the two species. Beside comparisons for positional asymmetry between corresponding cortical folds, asymmetries of overall brain dimensions were computed from the smallest orthogonal parallelpiped box that just covered the surface with the edges of the bounding box parallel to the three axes in Talairach space.

Results: In Man leftward deviation of the superior temporal sulcus was accompanied by backward displacement, elongation and clockwise rotation of the cortex in the posterior left hemisphere. These asymmetries were accompanied by a 0.5% increase in length (p=3.6e-12) and 0.45% loss of height (p=1.9e-3) of the left hemisphere relative to the right. Both the asymmetries of the cortical surface and of the linear dimensions of the hemispheres were absent in *Pan troglodytes*. A sex difference in asymmetry was observed in the orbital surface of the left frontal lobe in Man that was absent in *Pan troglodytes*. Furthermore we found that Man has a significantly elongated (p=1.73e-10) and narrower left ventricle (p=4.7e-05) compared to its right counterpart, and this asymmetry was absent in *Pan troglodytes*. We conclude that the brain in *Homo sapiens* is more lateralized/asymmetrical in structure than that of *Pan troglodytes*. We speculate that asymmetry of the ventricle plays a primary role in determining brain hemispheric laterality in Man.

Conclusion: the findings are consistent with Broca's hypothesis. They suggest approaches to the genetic mechanism of speciation in the hominin lineage and to the neural basis of language. They reflect a possible role of sexual selection in speciation.

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Poster Presentation Number 121, Sa (12:20-13:50)

Modern humans technological breakthrough: maximizing plant foods greater dietary contribution

Laura Longo[1], Natalia Skakun[2], Gennady Klopachev[3], Sorin Hermon[4], Vera Terekhina[2], Vera Moitinho de Almeida[4]

1 - Nanyang Technological University - Singapore · 2 - Institute for the History of Material Culture of the RAS - St. Petersburg, Russia · 3 - Kunstkamera, Peter the Great Museum of Anthropology and Ethnography, St. Petersburg - Russia · 4 - Cyprus Institute - Cyprus

The systematic practice for plant food processing is documented by use-wear traces and plant residues found on Upper Palaeolithic grinding tools across Europe, proving to have repercussions on the ability of modern humans to address the harsh climatic condition of post CI-HE4 (Heinrich Event 4). The first study was carried out on material from the sites of Bilancino (Italy) and then of Kostienki 16 (Russia) and Pavlov VI (Czech Republic), dating to Gravettian and Gorotsovian around 28,000-30,000 cal B.C. The Early Gravettian grinders from Grotta Paglicci (layer 23) was used to process acorn in order to produce flour dating back to about 32 ka BP. Systematic technology devoted to maximizing plant foods greater dietary contribution that satisfy the subsistence needs was though a common practice in a vast geographical area (from southern Europe to Russia) and was a component of the food economy of modern human who was just colonizing Eurasia. This behaviour is even more strategic when hunting became less reliable and contributes less to the overall diet, and according to the dating available is to be considered one of the components of modern humans technological breakthrough. Flour production and its consumption - a high-energy food indeed - imply multi-step processing from harvesting to cooking to obtain a suitable and digestible food. Moreover the contribution of nutrients of vegetable origin to *Homo sapiens* diet can be estimated around 60%. Maximizing plant foods contribution might have helped AMHs species outcompete Neanderthals, who went extinct few millennia after the newcomers modern humans waves rich Europe, bringing in new toolkits and technological enhancements.

In this paper we present new data on Palaeolithic grinding stones. The data are resulting from the analysis of the grinding stones of EUP sites from the collections of the Kunstkamera of St. Petersburg, analysed by means of an innovative research approach based on a multi-disciplinary characterisation and analytical measurements.

According to recent enhancements in gathering and analysing "hidden evidences" about resources entering in the diet during Palaeolithic, the role played by vegetable food processing and the production of flour was recognised as a common and systematic practice, probably starting from the incoming of modern humans to Europe. In the last few years the reassessment of both radiocarbon dating and biological attribution of the southern European sites together with the evidence for systematic plant food processing and the production of flour, already acknowledged as a common practice among modern humans, open interesting scenarios. On the base of the now available data, the discussion on the key area for the establishment of modern humans technological breakthrough is yet open and quite active, since the strong position supporting Central Europe as the place for it, is questioned by both chronological revision, symbolic behavior, biology, plant food systematic processing, and nutritional data ranging from southern Europe to Russia.

Methodology: The functional analysis includes wear-traces, experimental reproduction and residues analysis of the working surfaces of the grinding tools. Portable scientific equipment – brought in by the Cyprus Institute team – has been used for non-invasive and non-destructive analytical techniques, including a Multi-stripe Laser Triangulation (MLT) scanner for 3D measurement of the morphology and semi-automatic detection of the surface irregularities. The identification and description of use-wear traces was carried out by means of the innovative application to wear-traces analysis of the combined potential of the digital and metallographic microscopy.

Poster Presentation Number 134, Sa (12:20-13:50)

Biochronological data inferred for the first human presence in western Europe (Pirro Nord 13, Apulia, Italy)

Juan Manuel López-García[1], Elisa Luzi[1], Claudio Berto[2], Carlo Peretto[2], Marta Arzarello[2]

1 - IPHES, Institut Català de Paleoecologia Humana i Evolució Social, Tarragona, Spain. · 2 - Sezione di Scienze Preistoriche e Antropologiche, Dipartimento di Studi Umanistici, Università di Ferrara, Italy

Pirro 13 is the only fissure from Pirro Nord where human presence has been documented, on the basis of the finding of Mode 1 lithic tools throughout the quarry [1]. The Pirro 13 deposit constitutes the filling of a karst structure that has developed in the roof of a Mesozoic limestone. The sediments are composed of red sand-clays with frequent limestone pebbles, scattered skeletal remains and sandy lenses of calcarenite. A particularly interesting point for this study is the correlation of Pirro 13 with the sites of Sierra de Atapuerca and Orce, which present complete stratigraphic sequences from the Early Pleistocene and carry the earliest documented records of fossil *Homo* in Western Europe [2, 3]. The Pirro 13 small mammal assemblage includes a total of 114 identified remains (including insectivores, bats and rodents), 53 of which are arvicoline teeth corresponding to a minimum number of 26 individuals and representing only one taxon: *Allophaiomys ruffoi*. The oldest known *Allophaiomys* species recorded in Europe is *Allophaiomys deucalion* from the Early Pleistocene of different sites, such as Kamyk in Poland, Villány 5 in Hungary or Tizdar in Russia with and age i.e. between 2.0 and 1.9 Ma. *A. deucalion* is the ancestor of *A. pliocaenicus*, the oldest *Allophaiomys* species recorded in the Italian Peninsula, coming from Monte la Mesa (ca 1.7 Ma). *A. pliocaenicus* seems to be the ancestor of *A. ruffoi*. *A. ruffoi* has been documented in several Early Pleistocene Italian sites, such as Pietrafitta, Cava Sud and other fissure fillings in northeastern Italy dated to 1.7-1.3 Ma. The *Allophaiomys* teeth recovered from Pirro 13 are morphologically characterized by undifferentiated enamel, abundant cement in the re-entrant angles, lingual salient angles that are more developed and pointed than the labial salient angles, triangles T4 and T5 with confluence but relatively closed, and re-entrant angles BRA4 and LRA4 generally sharp resulting in a relatively narrow neck and a high variability in the morphology of the anterior cusp (AC). The morphological characters shown in our specimens and the taken measurements coincide with those described for the species *A. ruffoi* from Cava Sud. Comparison of our specimens with other arvicoline species with similar morphological features, such as *A. pliocaenicus* and *A. chalinei*, and with the species that appears in the Early Pleistocene sites with the most ancient human remains in Western Europe, i.e. *A. lavocati*, shows differences in particular parameters and characters between the voles identified in Pirro 13 and the other species. The presence of *A. ruffoi* shows that Pirro 13 is older than the other Western European sites with ancient human remains, such as Sima del Elefante (ca 1.22 ± 0.16 Ma;) and Barranco León (ca 1.4 ± 0.38 Ma;), where the evolved vole form *A. lavocati* is present [4; 5]. Taking into account the evolutionary trends of *A. ruffoi* and its presence in other western European Early Pleistocene sites, the relative age obtained for Pirro 13 ranges between 1.3 and 1.6 Ma. Finally, independently of the debate on the chronology of the Early Pleistocene human remains, Pirro 13 seems for the moment to be the most ancient locality in Western Europe with evidence of a human presence.

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Poster Presentation Number 113, Sa (12:20-13:50)

The contribution of paleontological data to the chronological context of hominid occupation in Visogliano Rockshelter

Elisa Luzi[1], Juan Manuel López-García [1], Claudio Berto[2], Giovanni Boschian[3], Carlo Tozzi[4]

1 - IPHES; Universitat Rovira I Virgili · 2 - Dipartimento di Studi Umanistici, Università di Ferrara; LT TekneHub · 3 - Dipartimento di Biologia, Università di Pisa · 4 - Dipartimento di Civiltà e Forme del Sapere, Università di Pisa

The Lower Palaeolithic site of Visogliano is located in North-Eastern Italy, 105m a.s.l., in the Trieste Karst. Archaeological and paleontological remains were unearthed in two distinct loci: a rock shelter (VisA) and an external breccia (VisB), both probably originated by the collapse of a cave. Human remains have been found at both VisA and VisB, in association with lithic industries (Mode 1) and large and small vertebrate fossil fauna [1, 2]. Combined ESR/U-series analysis, carried out on VisA, suggested a relatively rapid deposition, dated between 500 and 350 kya [3]. Taking into account the error range, there will be virtually no age variation throughout the almost 11m thick sequence. On the other hand, the geological characteristics of the sediments and preliminary studies on large and small mammals assemblages pointed out at least two different climatic oscillations: a first intestadial phase (VisB and levels 45-40 of VisA) followed by a stadial one (levels 39-11 of VisA) [1, 2]. Since the lineage *Mimomys savini–Arvicola mosbachensis–Arvicola amphibius* (=*terrestris*) has shown a consistent evolutionary trend during Pleistocene all across Europe, knowing the bio-chronological position of Visogliano population could help refine the chronological range assigned to the sequence. Previous studies exist (i.e. [4], among others) but had taken into account a low number of individuals chosen from several different levels. Morphological and morphometric analyses have been conducted on *Arvicola mosbachensis*. In order to obtain an uniform and coherent sample, the material has been taken from only one level (34 of VisA). The morphology of 113 m1 and 44 M3 has been studied. SDQ and SDQ3 index of respectively 45 and 67 m1 (both right and left) have been calculated. The SDQ index quantifies the difference in enamel thickness between the anterior and the posterior wall of each triangle of the tooth and it has been measured also for the 3 main triangles T1, T2 and T3 of first lower molars (SDQ3) so as to include the maximum number of specimen. The complete lack of roots in all molars, the simple morphology of M3, often presenting a confluence between T3 and T4, the presence of the *Mimomys*-fold and of not deep synclines in the ACC of m1, together with SDQ and SDQ3 values, once compared with other known population of Central and Eastern Europe, allow to position the *Arvicola mosbachensis* of Visogliano between the primitive populations of Mosbach-2 and Miesenheim-1 and the more advanced ones of the Holsteinian Stage [5]. Therefore, it is possible to correlate the level 34 of VisA with the Elsterian Stage, hence to MIS 12, dating between 478 and 424 kya. Although further studies are needed, level 45-40 of VisA and those of VisB could be tentatively related to MIS 13, while the upper sequence could be either part of a single stadial phase (MIS 12) or the succession of two distinct glacial periods, MIS12 and 10, with MIS11 possibly deleted by erosion.

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Podium Presentation: Session 7A, Fr (15:40)

Pliocene *Australopithecus* diversity in light of climatic, taphonomic and geological information - implications for hominin dispersal into Central and Southern Africa

Gabriele A. Macho[1], **Phil Hopley**[2]

1 - University of Oxford · 2 - University of London

Climate undoubtedly influenced the course of hominin evolution, but the mechanisms driving biotic evolution remain poorly understood [1]. Whilst the interval from 2.5-1.8Ma has received considerable attention in discussions about the interactions between global-scale climate change and mammalian evolution [2], the turnover pulse at about 3.5Ma has not. Arguably, interpretations are hampered by the relative paucity of fossil material dating to this time, concerns about taphonomic and preservation biases, and the observation that there apparently existed distinct regional palaeocommunities over relatively short geographic areas. We contend that the latter may be informative, rather than restrictive, when interpreting hominin evolution.

During the short interval from 4Ma to 3.5Ma East Africa experienced intense climatic fluctuations (as it did during other crucial periods in hominin evolution): global changes were exacerbated by tectonic activity; amplifier lakes resulted in rapid openings and closings of corridors; there were periods of sharp increases in the proportion of grass and shrub pollen relative to trees, interspersed by a relatively humid interval lasting only ca. 50-100ka just prior to the Tulu Bor eruption. This dynamic interplay likely led to vicariances and the formation of distinct palaeocommunities, and may explain the palaeobiology of *A. bahrelghazali* and the dispersal of hominins into South Africa.

Australopithecus bahrelghazali is known from only one site in Central Africa [3]. The empirically-derived dates for Koro Toro at 3.65±0.11Ma fall within a dry period in East Africa but, when the timing of dispersal of *A. bahrelghazali* is factored in, the species′ temporal range falls towards the end of the wet phase at ca. ~3.9Ma. Importantly, the tectonically induced circulation changes that triggered aridification and vegetation changes in East Africa had little effect on climate and vegetation in West Africa [4]. As wooded areas continued to expand in West Africa, whilst environmental conditions declined in East Africa, a westward dispersal seems intuitive. Hominins, like other mammals, would have followed the natural corridors established during the Cenozoic, i.e. the Central African fault-basins. Because of the combined effects of increased aridification (and perhaps cooling) and tectonic uplift, the narrow basin structure around the Darfour swells, that now mark the watershed between the Nile, the Congo and the Chad basin, probably became impassable, leaving some populations of Pliocene hominins reproductively isolated [5]. The geological and (ichthyo)faunal evidence, together with *A. bahrelghazali* morphology and dietary ecology , points towards a deep history of this hominin and imply that it probably derived from either *A. anamensis* or Laetoli-like *A. afarensis*.

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Poster Presentation Number 78, Fr (12:20-13:50)

Advances in Microstratigraphic Dissection of Archaeological Palimpsests: The formation of a combustion feature from El Salt Middle Palaeolithic Site (Alicante, Spain)

Carolina Mallol[1], Ainara Sistiaga[1], Dan Cabanes[2], Cristo Hernández[1], Galván Bertila[1]

1 - Universidad de La Laguna · 2 - Universitat de Barcelona

Archaeological investigations at El Salt (Alicante, Spain) Middle Palaeolithic site have yielded numerous well preserved combustion features. Some of these are currently being examined from an interdisciplinary microstratigraphic perspective to shed light on their formation processes and aid in the identification of human occupation surfaces. Here, we focus on the case of Combustion Structure H44 from Stratigraphic Unit X (52.3 ± 4.6 ka), which in the field appeared to represent a complex simple hearth with fine laminations suggestive of relighting episodes. We collected undisturbed samples for soil micromorphology jointly with loose samples for lipid analysis, soil mineralogy and phytolith analysis. Our integrated microstratigraphic data document a sequence of at least three anthropogenic combustion events postdepositionally affected by various biogenic agents. The micromorphology, molecular composition, and phytolith content of the stratified combustion deposit indicates that these combustion events represent three simple hearths made on the same spot on a soil surface containing lithic remains from previous human activity. The fuel used was wood and in one event, bone was tossed in the fire. The three events were separated by periods of time involving sedimentation and development of a renewed soil cover with active soil fauna on a grassy substrate and presence of *Celtis sp.* and mosses. This evidence points to the existence of human occupation gaps in the stratigraphic segment corresponding to Combustion Structure H44 and warn against consideration of the associated lithic and faunal assemblage as synchronous. Further microscopic and molecular analysis of the black layers from the three hearths will elucidate additional paleoenvironmental and behavioral aspects of the different occupations. This study contributes to our knowledge on Neanderthal fire use, settlement dynamics and at a broader level, to our quest for increased temporal resolution and contextualized information in archaeological research.
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Poster Presentation Number 89, Fr (12:20-13:50)

Proximal metacarpal 1 articular surface shape in human and nonhuman hominids: its relationship with locomotion and hand functional capabilities

Damiano Marchi[1], Daniel Proctor[2], Emma Huston[2]

1 - University of Pisa · 2 - Lawrence University

The joint at the base of the thumb, specifically the one between the trapezium and the first metacarpal (MC 1), has been the focus of many studies aiming at testing whether it bears signals that correlate to the different locomotor behaviors and/or to functional capabilities of the hand of extant hominids ([1-5]). This study quantifies the proximal articular surface of MC 1 using three-dimensional morphometrics in extant hominids (*Homo*, n = 18; *Pan*, n = 15; *Gorilla*, n = 15; and *Pongo*, n = 9) and fossil hominins (SK 84, cf. *Paranthropus robustus* and Stw 418, cf. *Australopithecus africanus*) to test the following hypotheses: 1) different modes of locomotion in nonhuman hominids will show different signals in joint surface morphology; 2) humans and nonhuman hominids will have a significantly different articular surface that represents skeletal correlates to greater stability of the human trapeziometacarpal joint and greater mobility of the joint in nonhuman hominids; 3) the fossil specimen SK 84 will most closely resemble *Homo*; and 4) the fossil specimen Stw 418 will most closely resemble nonhuman hominids. A principal components (PC) analysis was used to compare MC 1 proximal surface shape. An ANOVA and Tukey's HSD post-hoc test were conducted to determine whether group principal component scores are significantly different. There is a significant result for PC 1 and an insignificant result for all other PC axes. *Homo* is significantly different from all nonhuman hominids for PC 1, but none of the nonhuman hominids groups are significantly different from one another. Hypothesis 1 is therefore falsified. The shape on the PC 1 axis represents a highly curved joint surface in the radioulnar and dorsovolar aspects in nonhuman hominids, and a relatively flatter surface in both aspects for *Homo*. In addition, *Homo* has a laterally extended surface that is not present in nonhuman hominids. Hypothesis 2 cannot be falsified. Both fossil specimens most closely resemble the nonhuman hominids, and do not overlap *Homo* on the PC 1 axis. Hypothesis 3 is therefore falsified, and hypothesis 4 cannot be falsified. Neither of the fossils demonstrates shape associated with a more stable trapeziometacarpal joint. The specimen Stw 418 occupies a location for PC 1 and PC 2 that shows a relatively shallower surface in the radioulnar and dorsovolar aspects, and lacks lateral extension of the surface associated with *Homo*. SK 84 occupies a similar location to Stw 418 on PC 1, but it is on the opposite side of the axis for PC 2. Its location shows a surface that is shorter in the dorsovolar aspect, and more highly curved in the radioulnar aspect. SK 84 also lacks the lateral extension associated with *Homo*. Overall the three-dimensional characterization of the proximal MC1 articular surface is in agreement with previous studies ([2, 4]) that used different methods to quantify articular curvature; moreover, this study highlights the presence of a trait (a laterally extended surface) present in *Homo* that could be related to human manipulation activities. Both fossils analyzed here shows a primitive MC 1 proximal articular surface shape probably indicating lack of the distinctive human morphology that facilitates forceful precision and power gripping.

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Poster Presentation Number 24, Th (17:00-19:00)

Lithic technology variability and human ecological behavior during the Early Gravettian in Southwestern Iberia

Joao Marreiros[1,2], **Nuno Bicho**[1,2], **Juan Gibaja**[2]

1 – ICArEHB, Universidade do Algarve, Faro, Portugal · 2 - CSIC-IMF, Barcelona, Spain

The Gravettian has been seen as one of the most important phases for the technological and cultural setting of the Upper Paleolithic sequence in Western Europe. In southern Iberia, the Early Upper Paleolithic (EUP) is characterized by the scarcity of Aurignacian remains, while the wide expansion and consolidation of the AMH occupation has been recently attributed to the Gravettian techno-complex c.33 ka cal BP [1]. Traditionally, the expansion of Gravettian industries in Southwestern Iberian Peninsula was described as a uniform process, characterized by minor regional differences and no diachronic technological changes [e.g. 2 & 3]. However, recent data have suggested a new discussion for the Early Gravettian of Southern Iberia [4 & 5]. This research focuses on lithic technological organization; variability and tool design during the Early Gravettian in SW Iberia using case studies from the Mediterranean corridor (Southern Spain) and Atlantic coast (Southern and Central Portugal). Based on the review of the most important chronostratigraphic sequences in this region and lithic technological data, such as technology organization and tool design variability, we argue that the origins and expansion of Gravettian industries in this territory, as well as their geographic and diachronic phases, are associated with major climatic fluctuations, characterized by distinct lithic technological systems and innovation in the archaeological record . Ecology adaptive models, when applied to archaeology, have shown that environmental oscillations had a major impact on hunter-gatherer dynamics. Recently, such impact as been associated with demographic and socio-cultural phenomena and therefore technology organization and variability during the Upper Paleolithic. These data likely represent different social-cultural entities, economic systems and settlement strategies that reflect early human ecological adaptations. Such approach might represent a new insight to interpret human technological and socio-cultural behavior during the onset of Upper Paleolithic in Western Europe.

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Poster Presentation Number 104, Fr (12:20-13:50)

Stability of neurovascular vs. musculoskeletal landmarks on human and chimpanzee (*Pan troglodytes*) cadavers – implications for interpreting fossil hominins

Sandra Martelli[1], **Christopher Dean**[1]

1 - Department of Cell and Developmental Biology, UCL, London, UK

The comparative morphology of the jaws, temporomandibular region and cranial base is central to both the taxonomy and functional interpretation of fossil hominins [1-3]. We used an aged growth series of 20 chimpanzee and 58 human cadavers to describe species-specific differences in postnatal growth patterns. We explored the relative stability of a large number of neurovascular 3D landmarks (n=74) in the cranial base and face with respect to each other and to a selection of key musculoskeletal landmarks (n=54) during growth. We performed statistical analyses (Procrustes General Analysis, Canonical Variant Analysis, ln-centroid size dependent linear regression and permutation tests [4]) to describe growth changes. With two exceptions, all neurovascular landmarks are stable in relation to each other in both humans and chimpanzees and their distinct patterns are established before birth. The postnatal ontogeny of the maxillary and neurocranial neurovascular configuration follows the same growth trajectory in humans and chimpanzees. The two differences are first: In chimpanzees, *Opisthion* rotates superiorly relative to *Basion* and at the same time *Porion* rotates superiorly but counter-clockwise to this. Second: In humans, the *Basion-Opisthion* plane remains stable and horizontal but drops inferiorly. At the same time, the relative distance between the carotid canals widens apparently independently of all the structures surrounding the *Foramen Magnum* (FM). Musculoskeletal landmarks are less stable one-to-another (i.e. their growth trajectories are not scaled). As the face grows anteriorly, both humans and chimpanzees share a strong posterior growth trajectory of the mandibular condyle relative to all neurovascular landmarks. In both, human and chimpanzee neonates, the anterior margins of the occipital condyles lie behind *Basion* but only in humans do they migrate anteriorly. In chimpanzees the biggest distinction from humans is the marked antero-superior rotation of both mandible and maxilla that occurs in concert with a posterior-superior rotation of *Porion* and *FM*. In humans but not chimpanzees, *Staphylion*, like the mandibular condyle, also migrates posteriorly, reducing the relative antero-posterior mid-sagittal dimensions of the nasopharynx. However, statistically the biggest musculoskeletal distinction between humans and chimpanzees is the marked inferior migration of the hyoid complex in humans (PC1, 41.7% total shape variation). These growth trajectories of the vomer and carotid canals in humans suggest a widening and antero-posterior shortening of the pharynx at the cranial base, which appears to be independent of any relative shifts of the *FM*, occipital condyles or any other neurovascular landmarks. Inferior migration of the hyoid in humans increases in the supero-inferior dimensions of the pharynx in the neck. In chimpanzees, it appears that pharyngeal volume is easily achieved by counter-rotation of the face and FM complexes. In humans, our findings suggest the reduced antero-posterior dimension of the pharynx requires a widening at the level of the cranial base to maintain pharyngeal volume. Ontogenetic studies of cadaveric material are important for interpreting adult bony morphology. Our findings demonstrate that stable neurovascular landmarks provide a secure basis for interpreting more variable musculoskeletal complexes. Establishing the species-specific variability of commonalities and of stable landmark relationships during growth also provides a more secure basis for interpreting variation in early hominins.

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Podium Presentation: Session 6A, Fr (14:30)

Dental variability of the Pleistocene hominins from Sierra de Atapuerca. Expression of trigonid crest patterns in *Homo antecessor* and evolutionary inferences

Marina Martínez de Pinillos[1], María Martinón-Torres[2], Laura Martín-Francés[1], Mario Modesto Mata[1], Cecilia García Campos[1], José María Bermúdez de Castro [1]

1 – National Research Centre on Human Evolution (CENIEH) · 2 - Anthropology Department, University College London

Teeth are considered a valuable source of morphological characters with taxonomic and phylogenetic utility [1]. Here we will focus on the dentition of the human fossils recovered from the Gran Dolina-TD6 site, assigned to *Homo antecessor* species [2] and dated to MIS 21 or MIS 25. To date, Gran Dolina-TD6 stratum has provided more than 150 human remains characterized by a unique combination of plesiomorphic and apomorphic traits. This unique combination, as well as new hominin fossil findings in Africa and Eurasia, has helped us to refine the phylogenetic position of *H. antecessor* regarding the Early and Middle Pleistocene hominins from those continents [3, 4]. The main purpose of our study is to contribute to a better understanding of the human evolution in Europe during the Early and Middle Pleistocene transition with the help of the valuable Atapuerca fossil samples. Thus, using micro-computed tomography (microCT) and knowing that the trigonid crest pattern expression bears a significant taxonomic and phylogenetic value, we have analysed the enamel and dentine surfaces of different hominins. Our sample includes *H. antecessor*, Sima de los Huesos (SH), *H. neanderthalensis* and *H. sapiens* specimens. Regarding the trigonid crest pattern, our results confirm that SH and Neanderthal samples share the highest frequencies of the typical continuous middle trigonid crest (MdTC) at both the enamel and the enamel-dentine junction [5], a feature that has been considered as a "Neanderthal feature". The identification of this feature in the *H. antecessor* dental samples means that a continuous MdTC cannot be considered as a Neanderthal apomorphy. However, the lower frequencies of expression suggest that *H. antecessor* is phenetically closer to *H. sapiens* who would have preserved a primitive pattern. Recent studies suggest that *H. antecessor* is at (or close to) the node of divergence of *H. sapiens* and *H. neanderthalensis*, and this would explain that TD6 hominins share features with both the modern humans and the Neanderthal lineages.

Acknowledgements: This research was supported with funding from the Dirección General de Investigación of the Spanish Ministerio de Economía y Competitividad (Project CGL2012-38434-C03-02), Consejería de Educación de la Junta de Castilla y León (Project CEN074A12-1) and Leakey Foundation. M.M-P. has the benefit of a predoctoral contract of the Junta de Castilla y León under the Regional Strategy for Scientific Research, Technological Development and Innovation 2007-2013 co-financed by the European Social Fund (BOCYL-D-20122012-38).

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Podium Presentation: Session 2, Th (14:20)

On the variability of the Late Pleistocene hominins from continental Asia

María Martinón-Torres[1], Song Xing[2], José María Bermúdez de Castro[3], Wu Liu[2]

1- University College London · 2 - Institute of Vertebrate Paleontology and Paleoanthropology, Bejing · 3 - National Research Center on Human Evolution, Burgos

The hominin fossil record from the late Middle to the early Late Pleistocene is crucial for understanding the origins of the best characterized human species, *Homo sapiens* and *Homo neanderthalensis*. It is generally accepted that at this time Europe and Western Asia were occupied by Neanderthals, and anatomically modern humans were present in Africa. However, little is known about the hominins that inhabitated continental Asia during this period. The paucity of the fossil record for this time and region impedes a proper assessment of possible contributions or interactions of the Asian hominins to the evolution of *H. sapiens* and *H. neanderthalensis*. Recently, fieldwork at Central and South China localities have provided human dental fossils from late Middle Pleistocene (Panxian Dadong) and early Late Pleistocene deposits (Huanglong Cave and Zhiren Cave). These samples show affinities to early modern humans [1, 2] but their taxonomic and phylogenetic affiliation is still a matter of debate. The derived state of Panxian Dadong, Huanglong Cave and Zhiren Cave samples, contrasts with the primitive features identified in the Late Pleistocene fossils from Xujiayao, in Northern China [3] and Denisova, in Siberia [4]. Xujiayao hominins are different from archaic and recent modern humans, they present some traits that are common but not exclusive to *H. neanderthalensis* and display some primitive characteristics that are classically found in East Asian Early and Middle Pleistocene hominins. Denisova tooth is also distinct from *H. sapiens* and *H. neanderthalensis* and is characterized by primitive traits despite its recent chronology. These samples, together with other findings such as the recently discovered mandible from Penghu in Taiwan [5] increase the number of hominin samples in East Asia that present an unclear taxonomic status with regard to *H. sapiens*, *H. neanderthalensis* and *H. erectus sensu strictus*. Here, we present a comparative overview of the Late Pleistocene dental samples from continental China. Our study expands the morphological and metric variability known for the early Late Pleistocene hominin fossils. We discuss the possibility that a primitive hominin lineage, different from *H. sapiens* and *H. neanderthalensis*, may have survived late into the Late Pleistocene in China.
Acknowledgements: This work has been supported by the grants from Chinese Academy of Sciences (GJHZ201314, KZZD-EW03, and XDA05130100), National Natural Science Foundation of China (41302016 and 41272034), Dirección General de Investigación of the Spanish Ministerio de Educación y Ciencia (CGL2012-38434-C03-02 and Acción Integrada España Francia HF2007-0115),Consejería de Educación de Junta de Castilla y León(CEN074A12-2), and Leakey Foundation Foundation through the support of Getty Gordon and Wilson Dub Crook.

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Poster Presentation Number 93, Fr (12:20-13:50)

Are rotator cuff lesions of the human shoulder joint related to the evolution of bipedalism?

Sandra Mathews[1], **Martin Haeusler**[1]

1 - Institute of Evolutionary Medicine, University of Zurich

Degenerative lesions of the rotator cuff tendons (supraspinatus, infraspinatus, subscapularis and teres minor) are the leading cause of shoulder dysfunction and disability in modern humans. Yet, they are virtually absent in great apes that habitually use their arms in overhead activities during climbing, even taking age into account. Various anatomical variants of the scapula and the subacromial space affecting the origins, course and insertions of the rotator cuff muscles have been suggested as risk factors for the development of degenerative shoulder disorders including shoulder impingement syndrome. Specifically, a relatively smaller subacromial space in modern humans is thought to facilitate compression of the supraspinatus tendon and bursa, while a smaller supraspinatus muscle is hypothesized to lead to dysbalance of the rotator cuff muscles and overloading of the supraspinatus tendon, thus contributing to the development of shoulder impingement syndrome. However, a modest reliability and significant intraobserver and interobserver variability has been demonstrated when the three-dimensional structures of the shoulder girdle are analysed based on linear measurements and indices or two-dimensional radiographs and MRI sections. Here, we perform a three-dimensional landmark-based geometric morphometric analysis of the scapular morphology in extant great apes, *Hylobates lar* (N = 71), *Pongo sp.* (N = 20), *Gorilla gorilla* (N = 39), *Pan troglodytes* (N = 44), MH2 (*Australopithecus sediba*), KNM-WT 15000 (*Homo erectus*) and a sample of modern humans (*Homo sapiens*, (n=89). We show that the supraspinous fossa and by inference the supraspinatus muscle have the same relative size in all examined species. Also the subacromial space is virtually identical in great apes and humans relative to the size of the upper extremity. This challenges common theories about the pathophysiology of shoulder impingement syndrome. We conclude that the aetiology of subacromial impingement syndrome is probably not related to the reorganization of the shoulder morphology during the evolution bipedalism. Moreover, our study demonstrates that linear measurements and indices do not acknowledge the complex 3D anatomy of the shoulder girdle.

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Poster Presentation Number 45, Th (17:00-19:00)

Subsistence transition and mandible morphology: a case test from the advent of agriculture in the Levant

Hila May[1], Kornelius Kupczik[2], Ellen Schulz-Kornas[2], Rachel Sarig[3]

1 - Dept. of Anatomy & Anthropolgy, Sackler Faculty of Medicine; Dan David Center for Human Evolution & Biohistory, The Steinhardt Museum of Natural History & National Research Center, Tel Aviv University · 2 - Max Planck Institute for Evolutionary Anthropology, Max Planck Weizmann Center for Integrative Archaeology and Anthropology · 3 - Dept. of Orthodontic, Goldschleger School of Dental Medicine; Dan David Center for Human Evolution & Biohistory, The Steinhardt Museum of Natural History & National Research Center, Tel Aviv University

Traditionally, tooth wear and oral health are the leading indicators for deducing dietary changes between archeological populations [1-4]. In the current study we examined the possibility that other elements of the masticatory system, i.e., mandible morphology, may be of use to differentiate between dietary changes through time. Mandibular size and shape is affected by masticatory strains acting on the mandible, resulting from differences in food toughness or fibrousness and food preparation techniques. Our sample included 69 prehistoric mandibles from the southern Levant, 40 from the Natufian period (14,900-11,750 cal BP) and 29 from the Neolithic period (12,175-8,450 cal BP). As a control, additional 61 mandible of a modern population were studied (31 males and 30 females, age ranged between 20 to 45 years). All mandibles underwent CT scanning (slice thickness 0.8 mm, 140 kV, 150mAs, rotation time 0.75 sec, Pitch 0.39 and Matrix 512*512). The measurements utilized were chosen according to their relevancy to the mechanical operation and strains acting on the mandible. They were divided into measurements reflecting the chewing muscles' strength (mainly of the masseter and temporalis muscles) and orientation, as well as spatial 3-D arrangement of the mandibular body and teeth. Our results show some significant differences in mandible architecture between Natufian, Neolithic and modern populations, i.e., the masseters' insertion area and robusticity decrease from Natufian to modern population and the temporalis insertion area (at the coronoid process) of the Natufian and Neolithic mandibles was significantly shorter and wider compared to the modern population. In addition, the mandibular body of the Natufian and Neolithic populations was significantly more lingually inclined compared to the modern population, and the Neolithic mandibular teeth were significantly more lingually inclined compared to the Natufian and modern teeth. Yet, the discrepancy between tooth inclination and mandibular body inclination was significantly greater among Natufian individuals. Following our findings, we conclude that the Natufian and Neolithic mandibles were similar in their general architecture, though the Natufian mandibles demonstrated a slightly more robust appearance that can imply a greater biting force. All this may suggest that the dramatic shift in dietary habits did not occur at the advent of agriculture, but rather later, probably during the 'secondary product revolution' in the Chalcolithic/Early Bronze age.

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Poster Presentation Number 140, Sa (12:20-13:50)

Longer lactation for last-borns: Evidence from modern Maya mother-child pairs

Luseadra McKerracher[1], Pablo Nepomnaschy[2], Rachel Mackay Altman[3], Daniel Sellen[4], Mark Collard[1]

1 - Human Evolutionary Studies Program and Department of Archaeology, Simon Fraser University, Canada · 2 - Human Evolutionary Studies Program and Faculty of Health Sciences, Simon Fraser University, Canada · 3 - Department of Statistics and Actuarial Science, Simon Fraser University, Canada · 4 - Dalla Lana Institute of Public Health and Department of Anthropology, University of Toronto, Canada

We often think of mothers either as being fully committed to providing for the needs of each of their children or at least as striving to divide resources equally among their children. But, there are reasons derived from evolutionary theory to expect maternal and child interests not to be completely aligned [1]. A mother and child share approximately half of their genes, but they also differ in approximately half of their genes, meaning that they have differing fitness interests in the child's survivorship and wellbeing. Offspring fitness generally benefits when offspring can procure as many resources from their mothers for themselves as possible. Maternal fitness, however, benefits from careful divisions of resources among multiple offspring. Such divisions should not necessarily be perfectly equitable but rather should depend on, among other things, what time and energy constraints a mother faces at a given point in her reproductive career. A corollary of this reasoning is that we should expect young mothers to have many remaining opportunities to invest in future children and thus to limit the amount of time and energy they invest in a current child so as to not miss out on those later opportunities. As mothers near reproductive senescence, however, continuing to invest in a particular child is no longer penalized with the cost of losing opportunities to invest in subsequent children [2]. As such, last- or near-to-last born children are predicted to receive more time and energy investments from their mothers relative to their older siblings.

We report a test of this prediction that children born to mothers nearing reproductive senescence receive more time and energy investment than their older sibs. The test was carried out using new, interview-based field data on duration of breastfeeding (a proxy for investment) and maternal age (a proxy for reproductive senescence) from 82 mothers and their 418 children from a predominantly natural fertility population of indigenous Maya from the Guatemalan Highlands. Because the data are clustered within families (breastfeeding durations of children born to the same mother are relatively likely to be more similar to one another than to children born to different mothers) we used linear mixed effects regression that accounts for random familial cluster effects when assessing the impact of maternal age on breastfeeding duration [3].

We found that, as predicted, children born to mothers nearing reproductive senescence are generally breastfed for longer than their older sibs. On average, a latter born child can expect to receive ~5.1 months of additional breastfeeding relative to his/her older siblings ($p<0.000$). In several families, last-born children were breastfed as much as four years longer than earlier-born children.

These results suggest that genetic conflict between mothers and children over maternal resources declines as mothers near reproductive senescence [2, 4]. This finding may have implications for both human demographic evolution and contemporary public health. Regarding demography, we might expect that populations in which mothers are relatively likely to survive to and beyond reproductive senescence are more likely to contain a relatively high number of children that receive long, intense periods of undivided maternal care, with downstream fitness and population structure consequences. Regarding public health, durations of breastfeeding and of other forms of intense maternal investment in infants for earlier-born children may reflect the results of conflict-based negotiations over maternal resources, whereas such durations for latter-born children may more closely resemble optimal programs of investment for infants. These infant optima may point us towards parental investment durations most likely to foster improved child survivorship and quality of life.

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Poster Presentation Number 72, Fr (12:20-13:50)

PaleoCore: Building Data Structures and Technologies for Collecting and Sharing Paleoanthropological Data

Shannon McPherron[1], Denné Reed[2], W. Andrew Barr[3], John Kappelman[2], Tomislav Urban[2]

1 – Max Planck Institute for Evolutionary Anthropology, Department of Human Evolution · 2 - University of Texas at Austin · 3 - George Washington University

Many branches of science and enquiry are entering into a period of "big data" where questions are approached by synthesizing multiple datasets. There are several technological components that make big data possible, but at the core are data standards that let search engines easily access, recognize and understand comparable units of information coming from disparate sources. While paleoanthropologists are increasingly able to produce large digital datasets both in the field and subsequently in collections analysis, these efforts remain independent of one another in part because - paleoanthropology lacks established data standards. In our view, this aspect of the problem can be overcome without being overly prescriptive. PaleoCore, a project funded by the US National Science Foundation, is an example of a system to house data coming from on-going projects including east African Plio-Pleistocence survey as well as excavations of late Middle Paleolithic sites in southwest France. In addition to data standards, PaleoCore is developing tools for data collection and dissemination based on free open-source software and emphasizing cross-platform implementation.

With regard to data standards, we have developed PaleoCore as an implementation of the well established Darwin Core standards for recording biodiversity data. This work involves identifying the Darwin Core terms most useful for paleoanthropological research, documenting the application of these standard terms in paleoanthropological contexts, and, where necessary, proposing new terms to address concepts not covered in the standard as is. Second, with regard to data collection, our efforts are focused on developing tools and workflows to facilitate survey (fossils and artifacts), excavation and analysis of museum collections. For survey, we have developed highly portable software and hardware solutions that allow for the rapid and efficient collection of geospatially referenced observations of paleoanthropological finds. The emphasis here is on low cost solutions (cellular phones as data collectors) running fully configurable software. For excavation, we are in the process of upgrading the software developed by Dibble and McPherron for their Paleolithic excavations to current software standards with the goal of producing an open-source technology that can support multiple platforms (including cellular phones). For museum collections we are working on software for distributed data management (where internet access is not possible) based on software already developed by McPherron and on software for direct entry into a main database. Data managed in PaleoCore is easily managed, disseminated and shared via a web application developed with Python-Django.

This poster presentation will include a live demonstration of the project on laptop and hand-held data collectors.

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Poster Presentation Number 68, Th (17:00-19:00)

A skills transfer hypothesis about word order comprehension

Ciro Medeiros[1]

1 - State University of Campinas (UNICAMP)

Experimental studies made with 18 month-old children suggest a disconnection between the complexity of utterances produced and the capacity to comprehend word order, as if the processing of each symbolic unit's meaning and the comprehension of word order are not made by the same set of cognitive mechanisms [1: 113]. Such idea makes sense with Bickerton's hypothesis about language evolution: the evolution of symbolic units and syntax did not occur together and neither under the same selective pressures. Also, he defends stone tools making contributed decisively or was the main source of selective pressures that led to syntax [2]. If his idea is correct, word order comprehension and the processing of single word's meaning could not have been the result of the same evolutionary pathway. The present article combines theories about language evolution with data about executive control, language development and skills transfer to explain the development of word order comprehension. The hypothesis is the working memory and executive control's skills needed to understand word order would be learned and exercised first in a task domain that is the ontogenetic equivalent of stone tools making domain. The capacity to process sequential units in two meaning's dimensions simultaneously would be the main common cognitive feature between the two cited domains tasks and word order comprehension tasks. Such capacity would have evolved adapted to stone tools making and, posteriorly, exapted to deal with word order producing and comprehension. From the developmental perspective, an analogous process would occur: the cited capacity would develop first in the ontogenetic equivalent of tools making domain and, after that, it would be co-opted by language development through a process of skills transfer. Skills transfer processes could happen when common brain areas and cognitive functions are recruited to deal with different tasks from two different domains. It is easier for children to develop the common skills in one of the domains, and then their performance in the other domain's task is also improved [3]. Recent study's results showed children can present task's performance not expected to their age if they were properly trained according to a skills transfer protocol [4]. Such data opens the possibility to design a skills transfer protocol to investigate word order comprehension. In such protocol, electronic toys would provide the task domain that is ontogenetic equivalent to stone tools making domain. The toy's tasks would familiarize children with the execution of sequences of operations hierarchically organized. By exercising the two meaning's dimension processing, children would made the transition from a holistic perception of operation's sequences to a componential one. Once such transition is made, children would be capable not only to comprehend word order, but also to create their own simple forms of word order – as language isolated deaf children do [5]. If the hypothesis is correct, the mastery of the toy's tasks would predict and anticipate word order comprehension.

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Podium Presentation: Session 3A, Th (16:00)

Altai Neanderthals and their morphological diversity

Maria Mednikova[1]

1 - Institute of archaeology of RAS

Long-term archaeological excavations at caves of Altai highland, by expeditions from the Institute of Archaeology and Ethnology SB RAS (Novosibirsk), have become the focus of worldwide attention, especially after palaeogenetic research led to a major breakthrough in Denisova studies. MtDNA extracted from the distal phalanx of the child from stratum 11 of the cave revealed that the hominid is genetically almost twice further from modern humans than are Neanderthals. After nuclear DNA studies the new sister group of Neanderthals was called Denisovans and seemed to be widely distributed across Asia in the past. But around 50 ka BP the Denisovans were not the only inhabitants of southern Siberia. Neanderthal remains in Altai are identified in locations subdivided by hundreds of kilometers. The purpose of this study is to consider their postcranial morphological patterns. Denisova Cave. A high-quality genome sequence of a woman indicated Neanderthal presence in "home cave" of Denisovans . The proximal pedal phalanx of DNA owner from Denisova Cave is broad relative to its height . This opposes the Denisova individual to most modern members of the genus *Homo*. The specimen is even broader and more robust than the phalanges of Neanderthals or early modern humans. The extraordinary inner robusticity of that bone was atypical even for many Neanderthals. A distal phalanx of the left (?) hand of *Homo*, found in level 12 of Denisova Cave in 2011, resembles Neanderthal phalanges in terms of length, width of apical tuft, and relative flattening, differing from them by a somewhat greater transversal hypertrophy of the shaft . Okladnikov Cave. Several specimens found in 1984 shared a combination of archaic and unique characteristics. While the totality of postcranial morphological traits suggests that those humans were Neanderthals, certain more archaic traits are presented . Okladnikov people were least similar to early anatomically modern humans of the Skhul and Qafzeh group and most similar to Near Eastern Neanderthals such as Tabun C1 and partly Shanidar. Recent finds from Chagyrskaya cave were more "Neanderthal-like". E.g., based on dimensions, proportions, pathological changes, and indicators of habitual activity of ulna its owner was apparently a Neanderthal male . But being compared with Neanderthal finds from Denisova or Okladnikov caves humans from Chagyrskaya have been "lighter-built", especially concerning inner robusticity of their tubular bones. Altai caves became homeland for Neanderthals who demonstrated high individual variability. Neanderthal inhabitants of three sites seemed to be various from morphological point of view. That means different waves of Neanderthal migration or/and their genetic contacts with another inhabitants of Central Asia, like Denisovans.
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Poster Presentation Number 60, Th (17:00-19:00)

Morphological diversification and diet diversity in southern South America

Lumila Paula Menéndez[1]

1 - Universidad Nacional de La Plata. CONICET, Argentina

Evolutionary and ecological processes model the patterns of morphological variation among human populations. Within the ecological dimensions, diet plays a key role in craniofacial variation, due both to the effect of the type and amount of nutrients consumed during skeletal growth and to the localized effect of masticatory forces. In this research, these two dimensions of the diet are evaluated as explanatory variables to assess the morphological diversification of human populations from southern South America (SSA) during the late Holocene. Despite of being the last region of the world to be occupied by human populations (i.e. 11.000 years BP), SSA was characterized by a large morphological variation of the human populations that inhabited it. Considering that both evolutionary and ecological processes depend on the spatial scale analyzed, both diet and morphometric craniofacial variables were surveyed along three geographical scales: macro-regional, regional and micro-regional. A total of 84 coordinates of 3D landmarks and semilandmarks, which described the facial skeleton, vault and cranial base, were registered in 474 adult individuals of both sexes. Shape variables were obtained after the alignment through the generalized Procrustes Superimposition method. The centroid size was used as a measure of the overall size of the skull. Form was described as shape plus centroid size. Diet composition was inferred from Caries Index and δ13C data, while diet hardness was estimated from bite force, which was calculated using measurements of the main masticatory muscles and their lever arms. Principal Component Analysis, boxplots, wireframes and Lynch´s test were done to assess morphological diversification. The distribution of morphometric and environmental variables in space was analyzed, as well as its association was assessed using spatial regressions and MANOVA. The results obtained suggest that diet changes had a relatively rapid impact on craniofacial morphological features. A pattern of morphological craniofacial change characterized by more developed jaws and elongated facial skeletons was found in the south of the three spatial scales analyzed. This allometric pattern could be the product of developmental constraints conserved by different evolutionary and ecological processes during morphological diversification. However, despite the common pattern, the association between morphological variation and ecological dimensions differs considerably across the different spatial scales. While random processes explain an important part of the morphological variation in the smaller spatial scales, non-random processes are responsible for this variation in the major ones. Moreover, considering ecological factors, diet composition was associated with morphometric variables at larger scales, but bite force did not contribute significantly enough to morphological variation. Overall, the results obtained differ from those obtained for other regions worldwide. The influence of systemic factors related to diet composition rather than local factors, such as masticatory loading, are the principal factors that explain morphological diversification of populations from the macro-regional and regional scales. In that scales, characterized by large populations, morphological diversification is the result of phenotypic plasticity that occurs during the ontogenetic time scale. Morphological variation at the micro-regional scale would have resulted from processes such as drift and/or gene flow, which is expected due to the proximity of these populations. The complexity of morphological diversification is evident in the fact that evolutionary and ecological factors involved have shown considerable variation across spatial scales. It follows that the diet is a complex factor that must be addressed comprehensively considering not only its hardness but also its composition, in order to understand more fully its association with craniofacial variation.

Poster Presentation Number 79, Fr (12:20-13:50)

Middle Stone Age combustion features at Klasies River Main Site, South Africa

Susan M. Mentzer[1,2], **Christopher E. Miller**[1,3], **Sarah Wurz**[3,4]

1 - Institute for Archaeological Sciences, University of Tübingen, Germany · 2 - School of Anthropology, University of Arizona, USA · 3 - Senckenberg Centre for Human Evolution and Paleoenvironments · 3 - University of the Witwatersrand, South Africa · 4 - University of Bergen, Norway

Middle Stone Age (MSA) occupations of the Klasies River Main site are preserved in a twenty-one meter sequence of sedimentary deposits that fill two sandstone cave chambers and two cliff-face rockshelters. The earliest occupations – termed MSA I and MSA II – took place within Cave 1, and shelters 1A and 1B. During the 2013 and 2015 field seasons, we collected sediment samples from these archaeologically rich deposits for high resolution morphological and mineralogical analyses. These analyses were one part of a new phase of research at the site. Previous geoarchaeological analyses were conducted at the site- and landscape-scale by K. Butzer [1, 2]. Micromorphological analyses of intact and oriented blocks reveal sequences of intact combustion features in all three areas of the site. These simple hearths contain basal charred layers and ashes that range from well-preserved, to partially recrystallized or phosphatized. The hearths are interbedded with sterile layers, and other types of anthropogenic debris, including fragments of bone and shell. Within Cave 1, intact hearths are more abundant in the central areas of the chamber, while burned materials are present in secondary position along the periphery. Mineralogical analyses using Fourier transform infrared (FTIR) spectroscopy confirm petrographic observations of ash preservation and suggest that bone fragments were deposited independently from the burning events. The samples also contained features and materials that are indicative of the local environment: MSA I combustion features in Cave 1 have been impacted by soft-sediment deformation implying saturated conditions; the samples from Cave 1 and Shelter 1A are particularly rich in marine fossils sourced from nearby waters; and those from both shelters contain sterile layers rich in wind-blown sands and micro-faunal remains. Our current results support many aspects of the stratigraphic descriptions and broad formation sequences for the site that were proposed by Butzer [1, 2] and Deacon and Geleijnse .

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Podium Presentation: Session 2, Th (14:00)

Nuclear DNA sequences from the hominin remains of Sima de los Huesos, Atapuerca, Spain

Matthias Meyer[1], Juan-Luis Arsuaga[2], Sarah Nagel[1], Ignacio Martínez[2], Ana Gracia[2], José María Bermúdez de Castro [3], Eudald Carbonell[4], Janet Kelso[1], Kay Prüfer[1], Svante Pääbo[1]

1 - Department of Evolutionary Genetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 2 - Centro de Investigación Sobre la Evolución y Comportamiento Humanos, Universidad Complutense de Madrid–Instituto de Salud Carlos III, Madrid, Spain · 3 - Centro Nacional de Investigación sobre la Evolución Humana, Burgos, Spain · 4 - Institut Català de Paleoecologia Humana i Evolució Social, Tarragona, Spain

At least two archaic hominin groups, Neanderthals and Denisovans, inhabited Late Pleistocene Eurasia when modern humans arrived from Africa. High-quality ancient genome sequences recovered from both groups indicate that they were more closely related to each other than to modern humans. While Neanderthals are morphologically well characterized based on an abundant fossil record in Europe and Western and Central Asia, Denisovans are only represented by a manual phalanx and three molars, all excavated at Denisova Cave in Southern Siberia. Denisovan ancestry is detected in present-day human populations in mainland Asia and Oceania as well as in Native Americans, suggesting that their geographical range once expanded far into Southeast Asia. Recently, a mitochondrial genome sequence was reconstructed from a ∼430 kyr old hominin femur (femur XIII) from the site of Sima de los Huesos in the Atapuerca Mountains, Spain [1].

Surprisingly, this genome was found to be distantly related to the mitochondrial DNA of Denisovans rather than to that of Neanderthals, establishing an unexpected link between the two groups. The mitochondrial genome sequence from femur XIII, though representing an important technical advance, does not resolve the relationship between the hominins from Sima de los Huesos and other hominin groups, as mitochondrial DNA is inherited as a single unit from mothers to their offspring and does not reflect the complete evolutionary history of populations.

Since the retrieval of nuclear DNA sequences from femur XIII is hampered by the extremely poor state of DNA preservation in the fossil, we removed small samples of material from four additional specimens from Sima de los Huesos: a second femur fragment, an incisor, a molar and a scapula. To minimize the introduction of modern human contamination and to prevent DNA degradation after excavation, all specimens were retained in a partial coating of depositional clay and stored in sterile containers at refrigerated temperatures before and after sampling. DNA was isolated using a silica-based extraction technique optimized for the recovery of extremely short DNA fragments and converted into DNA libraries for sequencing using a single-stranded library preparation method. DNA libraries were sequenced directly to assess the preservation of nuclear DNA, as well as after enrichment for mitochondrial DNA via hybridization capture.

Based on signals of ancient DNA base damage in the sequence alignments, endogenous DNA is present in all four specimens. However, DNA preservation in the sample taken from the scapula is too marginal to allow for the recovery of meaningful genetic data. We were able to match a small number of sequences from two specimens (the incisor and the femur fragment) to positions in the mitochondrial genome that differ between femur XIII, Neanderthals and modern humans. The majority of these sequences match the sequence obtained from femur XIII at these positions, indicating that the mitochondrial DNA of the two specimens is closely related to that of femur XIII. We also investigated between hundred thousand and three million bases of nuclear sequences obtained from the femur fragment, the incisor and the molar. In contrast to the mitochondrial DNA, the nuclear genomes from the three specimens are significantly more similar to Neanderthals than to Denisovans. Our results thus place the Sima de los Huesos hominins on the Neanderthal evolutionary lineage, in congruence with previous morphological analyses [2]. This shows that the Neanderthal/Denisovan population split predates ∼430 kyr, the geological age of the Sima remains.

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Poster Presentation Number 118, Sa (12:20-13:50)

Human performance trials in spear thrusting and throwing: experiments into the mechanics and biomechanics of early weapon systems

Annemieke Milks[1], Debra Carr[2], Stephen Champion[2], Libby Cowper[3], David Parker[4], Matt Pope [1]

1 - UCL Institute of Archaeology · 2 - Cranfield University Defence and Security · 3 - RMIT University · 4 - Loughborough University

Hand-delivered spear technologies, comprising both thrusting spears and hand-thrown spears, are thought to have been some of the earliest weapons systems used by Pleistocene hominins. The identification in the archaeological record of the use of these weapons, whether via damage signatures on potential lithic points, or via potential hunting lesions on zooarchaeological remains is essential to understanding Pleistocene subsistence strategies. Experimental replication is a key methodology in weapon research, and is generally aimed at either replicating the effectiveness of the weapons on animals, or damage signatures to lithic points or animal targets. However, experiments replicating hand-delivered spears have methodological issues, in particular those caused by a lack of data on the human performance behind these weapons. Experimental designs for both thrusting and hand-thrown spears have necessarily relied upon estimates in the literature on impact velocities (thrusting and hand-thrown spears), impact forces (thrusting spears) and effective distances (hand-thrown spears) [e.g. 1, 2].

Two human performance trials have been conducted by researchers from UCL's Institute of Archaeology, Cranfield Defence and Security at the Defence Academy of the United Kingdom, and Loughborough University. Both trials used trained participants and replicas of a Middle Pleistocene untipped wooden spear. The human performance trial for spear thrusting utilised a high-speed video camera to film impact velocities of two-handed spear thrusting, using 11 male participants from the military, trained in bayonet use. Each thrust, into a PermaGel^{TM} target, also captured force profiles using a load cell inserted into a replica spear shaft. Additional data recorded included depth of penetration, participant height and weight, handedness, spear holds and angle of attack.

A separate human performance trial captured effective distances and release and impact velocities of spear replicas when thrown as a javelin. This trial used high speed video cameras to film a sample of 6 male javelin athletes throwing spear replicas at a series of distances, aiming for a target. Athletes also threw spear replicas for maximum distance, with flight trajectories captured on video. Both trials resulted in breakage of the spear replicas along with surface damage to the spear tips and shafts, enabling future comparison with Pleistocene and ethnographic examples of wooden weapons. This collaborative effort between archaeologists, ballistics and impact engineers, sports scientists, athletes and military personnel has provided data on the human performance behind hand-delivered spear use, enabling more accurate modelling of spear delivery in experimental research and a better understanding of the mechanics and biomechanics of these early and persistent weapon systems.

Acknowledgements: UCL Centre for Humanities Interdisciplinary Research Projects, Arts and Humanities Research Council, Bedgebury Pinetum.

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Poster Presentation Number 1, Th (17:00-19:00)

Acheulean technological strategies between lower and upper units at la Noira: shift or regional evolution in situ?

Marie-Helene Moncel[1], Jackie Despriee[2], Pierre Voinchet[2], Jean-Jacques Bahain[2], Gilles Courcimault[2], Christophe Falguères [1], Jean Depont[2]

1 - CNRS-MNHN · 2 - MNHN

Continuity or discontinuity of occupations between 800 and 500 ka is questioned in Europe. While in Northern Europe, current data indicate that hominins were present only during favourable periods, for the South, it is usual to consider continuous occupations. The centre of France displays a significant chronological gap between 700 and 500 ka [1]. No archaeological evidence is recorded in this timespan in this area located beyond the 45th parallel, at the border between Northern and Southern Europe. Can this be considered as evidence of demise of hominin occupations, suggesting a hiatus of occupations and thus dispersals over time? The site of la Noira (Cher Valley) seams a perfect case since the sequence yielded two levels (lower and upper levels) with well-preserved lithic assemblages with bifaces. A coarse slope deposit or diamicton (stratum a or lower archaeological level into the diacmiton) is covered by two sequences of sandy alluvial layers (stratum b), then a rubble level (stratum c, containing at its top the upper archaeological level) and a silty soil (stratum d) [1, 2]. For the lower level, hominins were present during the beginning of the glacial stage, just before the pleniglacial phase (MIS 16/ MIS 15 cycle according with the age of 665 ± 55 ka by ESR Method on stratum b sands). The upper part of the sequence (top of stratum c) is dated to 449 ± 45 ka . This stratum c had overlaid an erosive surface which truncated ice-edges, that suggests those artefacts were probably abandoned during a temperate phase.

Despite the role of the raw materials and the type of site, the lithic series question on the meaning of (1) the common technological features between the two levels indicating a sort of regional "filiation" over time and (2) the innovations v. inventions observed between the two lithic series. The lithic behaviours are tested through several parameters (1) raw materials procurement, (2) core technology and (3) bifacial technology. Some considerations support our discussion: (1) While the lower level attest that hominins only collected local millstone slabs available on the site (workshops), in the upper level, both local and semi-local stones were used (30 to 130 km from their source region), (2)The core technology indicates both common managements between the two series and innovations with more cores-on-flakes with technical criteria close or assimilated to the Levallois-type, (3) Bifacial tools show higher intensity of shaping and the general final use of a soft hammer.

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Podium Presentation: Session 6B, Fr (13:50)

The chronology and archaeology of the Middle Pleistocene in Mieso, a new paleoanthropological sequence in the Ethiopian Rift Valley

Rafael Mora[1], Adrian Arroyo[2], Alfonso Benito-Calvo[3], Ignacio de la Torre[2]

1 - Universidad Autónoma de Barcelona · 2 - Institute of Archaeology, University College London · 3 - Centro Nacional de Investigacion sobre Evolucion Humana (CENIEH)

In recent years, the pace of discovery of new paleoanthropological sequences in East Africa has slowed down, and considerable part of current research is undertaken in areas that have been known to Paleoanthropology for several decades. Here we present the Mieso valley, one of the few new paleoanthropological sequences discovered in recent times. The Mieso valley (Oromia) is located in central-east Ethiopia, in the piedmont connecting the Afar Depression with the Ethiopian Plateau. Outcrops in the Mieso area expose a 24 metre detrital sequence with Middle and Upper Pleistocene deposits, which includes stratified fossils and stone tools attributed to the Acheulean and the Later Stone Age. In this first public presentation of the complete sequence of Mieso we will summarily introduce its entire Stone Age record, but our paper will focus on the discussion of the radiometric ages and archaeological remains within the Middle Pleistocene deposits. 40Ar/39Ar dates of volcanic tuffs suggest ages younger than 212 ka for some of the Acheulean sites [1], which would place Mieso assemblages among the latest examples of this technology in East Africa, and considerably after the Middle Stone Age first emerged in nearby Ethiopian sites (e.g. Gademotta). Apart from its relevance for the discussion of the transition to the Middle Stone Age, the Mieso sequence also provides insights on the technological variability existing during the late Acheulean [2]. Thus, stratified assemblages show a strong fragmentation of chaines operatoires; sites such as Mieso 31 preserve the initial stages of handaxe production, and the entire sequence of reduction can be reconstructed through refit analysis. In others assemblages such as Mieso 7, only final products (bifaces and cleavers with use-wear) are reported, representing the other end of the Mieso Acheulean reduction sequence. Most of the Middle Pleistocene archaeological localities are nonetheless characterized by low density occurrences of handaxes, which suggest an episodic and brief nature for the human occupation of the area. Overall, stratified deposits and outcrop occurrences enable discussions over the landscape distribution of Acheulean materials and the temporal and geographic segregation of technical activities, and demonstrate the variability of technological behaviours during the East African Middle Pleistocene.

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Poster Presentation Number 88, Fr (12:20-13:50)

Reconstructing hominin behavioural and cognitive complexity via decision making in stone knapping

Antoine Muller[1], **Chris Clarkson**[1], **Ceri Shipton**[2]

1 - University of Queensland · 2 - University of Cambridge

Stone tool making, observed archaeologically from 2.5mya, involves complex goal-orientated problem solving and forethought. The decision making involved in stone tool manufacture is here used to model behavioural complexity throughout hominin evolution. Knapping experiments were used to explore the degree of behavioural complexity involved in five different kinds of stone tool manufacture (bipolar, discoidal, bifacial, Levallois and blade) that broadly represent the evolution of lithic core technology from the Oldowan to the Upper Palaeolithic. Determining the level of behavioural complexity involved in each of these reduction sequences using problem-solution distance modelling offers a means of detecting significant transitions in the evolution of human cognitive complexity. This method involved observations and analysis of footage of replicative knapping experiments conducted by an expert knapper (CC) familiar with each reduction strategy. By identifying the minutia of stages involved in these knapping sequences, and analysing these stages through the lens of concepts borrowed from neuroscience and psychology, the complexity of the decision making processes involved in the manufacture of different stone tools was reconstructed. By using concepts such as executive functions, working memory, hierarchical complexity and recursion, hierarchical diagrams were produced showing the organisation of the different actions involved in stone tool knapping.

The results show a consistent pattern of increasingly complex behaviour through the sequence of bipolar, discoidal, bifacial, blade and Levallois knapping, with the latter strategy requiring the most hierarchical and recursive complexity. These findings contribute to the growing body of evidence that situates the period of most significant growth in behavioural complexity at the origins of the Middle Palaeolithic or Middle Stone Age rather than the Upper Palaeolithic or Late Stone Age. The results therefore bring into question any perceived cognitive superiority of *Homo sapiens* over Neanderthals. This study represents the first experimental demonstration of the evolution of stone tool technology in relation to cognitive complexity.

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Podium Presentation: Session 8, Sa (9:10)

Melka Kunture (Upper Awash, Ethiopian plateau): the earliest human settlement of a high mountain system

Margherita Mussi[1], **Raymonde Bonnefille**[2], **Rosalia Gallotti**[1,3]

1 - Dip. Scienze dell'Antichità, Università di Roma La Sapienza · 2 - CNRS, CEREGE, Université Aix Marseille · 3 - Université Bordeaux, UMR 5199 PACEA-PPP

Since the late Miocene, hominins evolved in East Africa as lowlanders. Paleoanthropological and archaeological sites are usually located at relatively low elevations where warm and dry climatic conditions prevail, most notably in the Rift Valley. Vice versa, there has been surprisingly little archaeological research on the plateau itself. In the Ethiopian highlands, Melka Kunture and Gadeb [1] are the only two archaeological sites with long stratigraphic sequences from the Lower Pleistocene onwards, allowing to understand how hominins first developed the capacity of living at higher altitude. Unfortunately, after dam construction, the Gadeb site was flooded and became inaccessible. Detailed information is only available at Melka Kunture, at 2000m asl in the Upper Awash Valley. Many archaeological sites from the Oldowan to the Acheulean, from the Middle Stone Age to the Late Stone Age have been discovered there [2]. Here we report a recent paleoenvironmental reconstruction based on the palynological analysis of pollen samples collected in archaeostratigraphic units ranging from 1.7 to 0.2 Ma. Notwithstanding substantial fluctuations, pollen counts unambiguously and constantly point to the "Dry evergreen afromontane forest and grassland complex" which nowadays still characterizes the vegetation of the Ethiopian mountains. There is simply no evidence whatsoever of the warmer and drier vegetation encountered in the Rift Valley today, and of any savanna tree species. Accordingly, the hominins experienced mountain ecological conditions, with cool nights and warmer daytime. These conditions persisted throughout the whole sequence from 1.7 Ma onwards. This high mountain system has distinctly different ecologies and characteristics when compared to the lowlands of the Rift Valley. Human adaptability to cool mountain environments has implication for the Out of Africa models, hypothesizing hominin expansions into Eurasia fostered by warmer climatic oscillations. The evidence from Melka Kunture also has a number of wider implications. The local fossil record points exclusively to genus *Homo*, i.e. to *Homo erectus sensu lato* during the Lower Pleistocene, and to later species of *Homo* during the Middle Pleistocene [3]. Australopithecines have not been discovered. This possibly suggests that *Homo erectus* was the first and only species of the time able to adapt to mountain environments. However, the Oldowan and early Acheulean technical structures of Melka Kunture do not differ from those of penecontemporaneous East African sites [4, 5]. Accordingly, the assembled biological, cultural and paleoclimatic evidence allows 1) observing the technological changes between Oldowan and Acheulean without having to take into account the hominin species variability which is the rule elsewhere in East Africa; 2) assessing that similar lithic productions were successfully adopted in various contemporary environments.

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Poster Presentation Number 109, Fr (12:20-13:50)

Skeletal development with reference to ontogeny and locomotion; a cross-sectional study of primate limb elements

Jason Nadell[1], **Sarah Elton**[1], **Kris Kovarovic**[1]

1 - Durham University

How primate skeletons achieve their adult form over the course of ontogeny can be ascribed to the influence of two key mechanisms: genetic inheritance (i.e., the phenotypic characters selected for in a population), and plastic adaptation, influenced by mechanical forces generated in response to the physical environment. Though elements of the upper and lower limbs are understood to plastically adapt their dimensions to serve the locomotor requirements of the individual, only a limited amount of published research has considered in tandem, the influence of locomotor behaviour and growth on appendicular skeletal morphology . Here we examine the cross-sectional properties of long bones in an ontogenetic series from five non-human primates that assume markedly different locomotor and positional behaviours. As skeletal deposition is more active during adolescence compared to adulthood , growth trajectory is studied across three developmental stages including infancy, juvenility and adulthood. The primate taxa of interest include male and female skeletal specimens from *Pan* (n = 48), *Gorilla* (n = 40), *Pongo* (n = 41), *Hylobates* (n = 37) and *Macaca* (n = 45). Three-dimensional models of the upper (humerus and ulna) and lower (femur and tibia) limb elements were generated using a portable NextEngine laser scanner and combined with standard metric measurements. The 3D models were cross-sectioned to produce 2D images at the mid-proximal (65% limb length), mid-distal (30%) and midshaft (50%) segments along the diaphyses using the software program, AsciiSection . Measures of geometric properties including shape and rigidity were calculated along the diaphyses to determine how cross-sectional dimensions vary across development and phylogeny. Preliminary metric results indicate that a range of developmental and allometric variation exists across ontogeny, where growth rate appears to fluctuate extensively in some species such as gorillas but remains more static in others, like gibbons and macaques. Inspection of the upper and lower limb elements also reveal that length and breadth do not necessarily scale isometrically or with positive allometry, as growth trajectory fluctuates between stages of ontogeny. Applying cross-sectional methods along the diaphyses will further help to interpret the correspondence between adaptive plasticity and constraint, particularly whether signals pertaining to phylogeny or mechanical loading are distinguishable throughout the appendicular skeleton. An understanding of extant primate growth and adaptation will further aid in deciphering the locomotor morphology of fossil primates and hominins as well as inform how weight bearing bones respond to locomotion and posture in modern human populations.

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Pecha Kucha Presentation: Session 4, Fr (9:40-10:05)

A new approach for predicting the sex of hand stencilers, with incidental insights into creative behaviour

Emma Nelson[1], Jason Hall[2], Patrick Randolph-Quinney[3], Anthony Sinclair[2]

1 - Archaeology, Classics and Egyptology & School of Medicine, Faculty of Health and Life Sciences - University of Liverpool, UK · 2 - Archaeology, Classics and Egyptology - University of Liverpool, UK · 3 - School of Anatomical Sciences & Evolutionary Studies Institute - University of the Witwatersrand, Johannesburg, South Africa

Palaeolithic cave art is the most enigmatic of prehistoric behaviors and its frequent recurrence in the media is testimony to its fascination. Recently published dates suggest that early cave art is older and more widespread than previously believed, and may even have been created by Neanderthals. Understanding more about cave artists would provide a significant step forward in interpreting cave art. Over the past decade several methodologies, mainly based on hand dimensions, have been developed for assessing the sex of makers of Palaeolithic hand stencils, but these approaches provide conflicting results. Here we present a methodologically and statistically robust means of predicting sex using geometric morphometrics to quantify sexually dimorphic shape and size variation reflected in hand stencils. Experimental laboratory-based replication of hand stencils, comparable with Palaeolithic methods, was carried out producing 264 hand outlines (106 males; 158 females). Digital images were captured and 19 landmarks applied to each stencil. Results indicate that when both shape and size are factored into the analysis, successful classification of sex ranges between 85% and 91%. Our technique allows sex-assessment based on stencils of the whole hand, the digits, or the palm, or isolated parts of each. We also show that current methodologies relying heavily on finger lengths can identify male hand stencils as female. This integrated approach offers significantly improved discriminating power when predicting the sex of individuals from hand stencils and provides new insights into weaknesses in current sexing methods. We also noted incidental behaviours in our subjects during our experiments with hand stencils while creating a decorative panel. Taller people tended to position their hands to stencil lower on the panel, while shorter people preferred their hands to be higher. Decisions also appeared to depend on where others placed their hands, with preferences towards clustering stencils together. Mavericks who chose to position their stencils distant from the main group were often criticized. No sexually dimorphic behaviours were observed with regard to positioning. These findings prompted us to construct a simulated cave at the University of Liverpool so that we can study in more depth behaviours associated with creating cave art.

Poster Presentation Number 56, Th (17:00-19:00)

A 3D Geometric Morphometric Analysis of Internal Nasal Fossa Shape Variation in Hot/Cold Climate Populations of Extant Humans

Christina Nicholas[1], Lauren Butaric[2], Andrej Evteev[3]

1 - University of Iowa · 2 - Des Moines University · 3 - Moscow State University

Owing to its importance in respiration and thermoregulation, internal nasal cavity shape variation is arguably one of the primary examples of climatic adaptation/selection. The nasal cavity warms inspired air and recoups moisture from exhaled air—both of which are particularly important in cold climates. This has putatively led to the evolution of taller and narrower nasal apertures in cold climate populations of extant humans, as a tall, narrow nose aids in warming inspired air. In warmer climates, warming inspired air is not necessary and wider nasal cavities predominate. This morphology allows for less air resistance when breathing, presumably allowing for greater ease of nasal respiration. Previous studies of nasal shape have either focused on volumetric measurements or have included only a few landmarks in the internal nasal fossa, and more advanced 3D geometric techniques have yet to be applied. Because of this limitation, we do not have an accurate picture of internal nasal fossa shape variation nor how this covaries with external midfacial morphology. In this study, we quantify internal nasal fossa shape using sliding semilandmarks, thus allowing for a more detailed examination of internal nasal shape than has previously been documented in the literature. In order to evaluate eco-geographic variation in internal nasal morphology, we used CT scans of dry crania of individuals from hot (sub-Saharan Africans) and cold (Buriats, Europeans) climates. While we expected that nasal floor shape would covary with climate based on previous literature, the 3D data collection methodology employed here will illuminate more nuanced patterns of nasal fossa shape variation. As such, one of the goals of this study was to develop a method for landmarking the internal nose. Specifically, semilandmark curves were placed along the right side of the internal nasal capsule on our CT scans in the software program Osirix. We chose which slices to landmark by using the landmarks that lie at the junctions between the teeth (i.e., P3/P4, M1/M2, M2/M3), staphylion, and the lowest point on the nasal aperture margin to define vertical planes, as well as using ala to define a horizontal plane. Following digitization, relative warps analysis (RWA) was run on the internal nasal fossa landmarks. Kruskal-Wallis tests run on this data by climate found statistically significant differences between our hot and cold climate groups, as expected. When compared across climate groups, RW1 did not reach significance ($p=0.1$). However, cold climate populations tend to fall toward the positive end of the range of variation along RW1, showing taller, narrower nasal apertures anteriorly and more horizontally-oriented nasal floors. RW2 shows variation in the superior-inferior positioning of the horizontal landmark curve taken at ala, the relative height/width of the nasal aperture anteriorly, and the region of greatest superior dimensions (whether this point was more anterior or posterior). RW2 was statistically significant ($p=0.004$), with cold climates correlating again with taller, narrower nasal fossae, in addition to a much more inferiorly located alar landmark curve and more horizontal nasal floors. Interestingly, in our current sample, neither RW1 nor RW2 shows much variation in the shape of the lateral wall of the internal nasal fossa posterior to the M1/M2 junction. These results support prior research regarding variation in nasal floor shape and its relationship to climate. However, this study also points to the fact that a small number of internal nasal landmarks may not be sufficient for characterizing nasal cavity shape. The methods developed for landmarking the internal nasal capsule will allow for future analyses comparing a more detailed analysis of nasal fossa shape with the shape of other internal and external structures, such as the surrounding paranasal sinuses.

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Poster Presentation Number 53, Th (17:00-19:00)

The relationship of the craniofacial size and shape with the morphological variation of the supraorbital region in the recent *Homo sapiens* crania

Wioletta Nowaczewska[1], **Przemysław Biecek**[2]

1 - Department of Human Biology, Wrocław University, Wrocław, Poland · 2 - Interdisciplinary Centre for Mathematical and Computational Modeling University of Warsaw, Poland

The main aim of this study was to test the „craniofacial size" model and the „spatial" model concerning the problem of the explanation of the variation of the supraorbital region morphology in human crania. The first of these models has been linked to the mentioned above variation to differences in craniofacial size and the second of them to the differences in the spatial separation between the neurocranium and orbital – upper facial regions. According to the first model, the significant positive relationship was suggested between the overall cranial size and the robusticity of the supraorbital region. According to the second model, it suggested the negative relationship between craniofacial angle (CFA = metopion-nasion-prosthion) and the robusticity of the supraorbital region and the lack of the relationship between facial profile angle (FCA = basion-nasion-prosthion) and the variation in morphology of supraorbital region in modern human crania (e.g. [1, 2]). In this study the sample of recent *Homo sapiens* crania (only adult individuals n = 251) including the populations from Europe, Africa and Australia was examined. The grades of the two elements of the supraorbital region (glabella - GL and supercilliary ridge - ST) expression were assessed separately using two scales. The following variables were analyzed: the size of the whole cranium (the geometric mean of metric traits of the neurocranium and the facial skeleton – GGM), the relative size of the facial skeleton, the relative breadth of the cranium and four angles: the metopion-nasion-bregma angle (m-n-b), CFA, FCA and the basion-staphylion-nasion angle (ba-sta-n). To establish the relationship between the analyzed variables and grades of GL and ST expression, the canonical variate analyses (CVAs) were conducted separately for female (F) and male (M) crania and the partial correlations analyses (PRCs) were performed for several models concerning F and M crania together and separately. The results of CVAs indicated that in the F cranial sample, the m-n-b angle most strongly discriminated the groups of the crania with different grades of GL expression and in M cranial sample the same trait and the relative breadth of the cranium strongest discriminated these cranial groups. The sets of the traits best discriminating the mentioned above groups (in F and M cranial samples) not included GGM. However, GGM and m-n-b angle strongest discriminated the groups of F and M crania with different grades of ST expression. The results of PRCs conducted for all crania, for models with two additional traits - sex and geographic origin, indicated that there was significant partial correlation between the same set of the traits (except ba-sta-n angle in the case of the model with GL; including sex, m-n-b angle, GGM) and the expression of GL and ST. The highest correlation was established between sex and expression of both supraorbital structures. The sex was significantly correlated with GGM - independently from the influence of the other traits. However the significant partial correlation between GGM and GL expression (contrary to ST expression) was not observed in the models for M and F crania considered separately. Contrary to the prediction - CFA was significantly positively (not negatively) correlated with supraorbital structure (GL) in F crania. The results of this study only partially support the craniofacial size and spatial models and suggest that the sex can be considered as a factor which is related with overall cranial size and which significantly has influence on the variation in GL and ST morphology (independently from other analyzed traits).

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Poster Presentation Number 116, Sa (12:20-13:50)

Resilient and resourceful? A transect of Middle Palaeolithic Hominin adaptational strategies in Southwest Asia across bio-geographical zones

Andreas Nymark[1]

1 - Birkbeck, University of London

Much is known about hominin adaptational strategies in the southwest Asian Middle Palaeolithic. Historically, the coastal Levantine region has received most attention, but lately also the arid interior of Syria has seen a well of information brought forth. In contrast, the montane regions of the Zagros to the east are still poorly understood due to more sporadic exploration.

As renewed investigations at Shanidar Cave are currently under way this study intends to re-appreciate the under-researched Zagros region by contextualizing differences in Middle Palaeolithic socio-economic variability, as dictated by different environments through changing climates, between these three distinct bio-geographical zones of southwest Asia.

With three environmentally and topographically diverse zones, dominated by woodland, desert steppe, and mountain forest steppe, respectively, together with associated ecotones connecting them, the response of Middle Palaeolithic hominins to challenges and opportunities across shifting landscapes can be compared.

In order to understand the socio-economic complexity behind the technological decision making processes invested in the production of stone tools, the hugely diverse Pleistocene environments contained within this transect is reconstructed where possible and presented as a background to lithic and faunal assemblages from a number of sites across the three main zones. These assemblages will then be evaluated and contextualised to their specific Pleistocene environment. This is done in an effort to appreciate the differences and/or similarities in technological response to adaptation, observable within and between these zones.

Issues that this study proposes to clarify include questions on hominin site-use, mobility, and seasonality and to what extent these are constrained by faunal and raw material availability. How resilient were Neanderthals and Early Modern Humans to climate change in Southwest Asia, and how resourceful their adaptation?

Poster Presentation Number 105, Fr (12:20-13:50)

The weight of wild Gorillas

Kinsey Oleman-Grace[1]

1 - The University of Sheffield

Regressions are used to study modern primate life history variation and to estimate life histories of extinct hominin and hominoid species. These regressions have been calculated using extant primate means to create data points such as cranial capacity, body mass, and age of emergence of the mandibular first molar [1, 2]. The published means for primate body mass are sometimes derived from large sample sizes, however, for many species these means are often based on very small sample sizes. In the case of wild female Western lowland Gorillas (*Gorilla gorilla gorilla*), this species mean is derived from just three individuals. This poster presents research into which three museum specimens the published wild mean is based. Two of the three appear to be specimens from the Powell-Cotton Museum. The archives staff at the Museum provided assistance through access to their collection's specimen cards and transcriptions of the field notes associated with these collections. These specimens were wild-shot in the early 20th century, and, due to unclear field reporting methods, it is uncertain if their bodies were weighed before or after being gutted and skinned. The small number of female *G. g. gorilla* used to create this mean is important because life history research tends to prefer using female body mass because female bodies evolutionarily bear most of a species' reproductive functions and because of the range of degrees of sexual dimorphism amongst anthropoid species. Additionally, the female body mass means published for other Gorilla subspecies are based on even smaller samples, and the sample sizes for their male counterparts aren't much larger either. Small life history sample sizes and lack of accurate data has meant that *G. g. gorilla* has sometimes been omitted from regression data sets. Species means based on sometimes as little as 1 individual are seen in the published data for extant primate tooth emergence as well. Life history traits such as body mass and tooth emergence can demonstrate wide ranges of intra-species variation. Using small samples or single individuals, especially if the individuals experienced of stress, malnutrition or disease during development could significantly over- or underestimate these means. Because of a lack of information about the range of body mass variation in wild populations, there is debate over the use of captive populations that generally can provide much larger sample sizes. This research highlights the need for studies that ethically document body mass and other life history data of wild *G. g. gorilla* individuals and other extant great apes.

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Poster Presentation Number 43, Th (17:00-19:00)

Earliest evidence of proto-dental treatment in the Late Upper Paleolithic

Gregorio Oxilia[1], Marco Peresani[2], Matteo Romandini[2], Chiara Matteucci[3], Cynthianne Debono Spiteri[4], Amanda Henry[4], Dieter Schulz[5], Will Archer[6], Jacopo Crezzini[7], Francesco Boschin[7], Paolo Boscato[8], Klervia Jaouen[6], Tamara Dogandžić[6], Alberto Broglio[2], Jacopo Moggi-Cecchi[1], Luca Fiorenza[9], Jean-Jacques Hublin[6], Ottmar Kullmer[10], Stefano Benazzi[3]

1 - Department of Biology, University of Florence, Firenze, Italy · 2 - Sezione di Scienze Preistoriche e Antropologiche, Dipartimento di Studi Umanistici, Università di Ferrara · 3 - Department of Cultural Heritage, University of Bologna · 4 - Plant Foods in Hominin Dietary Ecology Research Group, Max Planck Institute for Evolutionary Anthropology · 5 - Dental Workshop Bensheim, Private Laboratory for Training, Research and Methods · 6 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology · 7 – CeSQ, Centro Studi sul Quaternario ONLUS · 8 – Università degli Studi di Siena, Dipartimento di Scienze Fisiche · 9 – Department of Anatomy and Developmental Biology, Monash University, Australia · 10 – Senckenberg Research Institute

Prehistoric dental treatments have been known from the Neolithic 9,000-7,500 years before present (BP) [1], when the adoption of early farming culture caused an increase of carious lesions [2]. Only a few early cases have been documented [3], some were characterized by *in vivo* perforation of the crown surface made by a drilling tool [1]. Here we document the earliest evidence of proto-dental therapeutic intervention on a Late Upper Paleolithic modern human lower right third molar (RM^3) from a burial in Northern Italy [4]. The RM^3 belongs to a young male individual (ca. 25 years old) unearthed in 1988 from the Epigravettian deposit of Riparo Villabruna (Sovramonte – Belluno, Italy), and dated around 14,160-13,820 BP. This tooth presents a large occlusal cavity, with a polished internal surface and extensive enamel chipping traces on the steep mesial wall. Within the cavity four caries are present. The cavity is sub-squared on the lingual and mesial sides but rounded on the buccal and distal sides. Using Scanning Electron Microscopy (SEM) we show the presence of striations within the cavity, which fade out towards the occlusal surface probably as a consequence of tooth wear. The striations have a "V" shaped transverse section and microstriations at the bottom, sharply defined, with a high apex, steep sides, narrow cross-sections and well-defined parallel ancillary ridging, as typically displayed by cutmarks on teeth [5]. Based on *in vitro* experimental replication and a complete functional reconstruction of the Villabruna dental arches, we confirm that the identified striations and the associated extensive enamel chipping on the mesial wall of the cavity were produced ante-mortem by pointed flint tools during scratching and chiseling activities. The Villabruna specimen is therefore the oldest known evidence of dental caries intervention, suggesting rudimentary knowledge of disease treatment well before the Neolithic. This study also suggests that primitive forms of carious treatment in human evolution entail an adaptation of the well-known toothpickings for levering and scratching rather than drilling practices.

Acknowledgements: The fieldwork at the Villabruna Rockshelter was granted by the Ministry of Culture, the Veneto Region and the Sovramonte Village Public Administration and supported by the Belluno Museum Association. Veneto Archaeological Heritage gave permission for non-destructive analyses and the micro-sampling of the Villabruna specimen. We thank U. Menz, C. Hemm, S. Freidline, F. Fiorillo and H. Temming for technical support. C. Brikemeyer and S. Deshmukh from the AG Massenspedktrometrie, Universität Leipzig, ran the samples submitted for GC-MS analysis. S. Schmidt and T. Büdel assisted with the sample preparation. S.A. Buckley is thanked for helpful comments on the MS data. We are grateful to Mr. Aldo Villabruna for support in fundraising for this specific study and the Laboratory of Archaeozoology and Taphonomy (L.A.T.) for giving access to the Stereomicroscopy.

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Podium Presentation: Session 3B, Th (15:40)

EQUATE – Building a European Quatermary Aminostratigraphic Timescale

Kirsty Penkman[1], **Richard Preece**[2], **Simon Parfitt**[3,4], **Tom Meijer**[5], **Nicole Limondon-Lozouet**[6], **Alexey Tesakov** [7]

1 - University of York · 2 - University of Cambridge · 3 - Natural History Museum · 4 - University College London · 5 - Naturalis · 6 - CNRS · 7 - Geological Institute of the Russian Academy of Sciences

Timing is everything: accurate dating of the archaeological record is essential to an understanding of the history of the human species. Chronology underpins our understanding of the past, but beyond the limit of radiocarbon dating (60 ka), sites become more difficult to date. Amino acid geochronology, which uses the time-dependent breakdown of proteins in biominerals, has the potential to date the whole of the Quaternary, and recent work on isolating the intra-crystalline fraction of calcitic biominerals (*Bithynia* opercula) has enabled the development of an aminostratigraphic framework for Britain for the Pleistocene. The intra-crystalline protein decomposition (IcPD) within the opercula provides a framework for understanding the regional geological and archaeological record, and has revealed a temporal structure within the British archaeological record for the Palaeolithic.

Correlation of Quaternary sequences, even in adjacent regions, is often problematic, but the development of regional aminostratigraphies promises to provide robust chronologies, enabling more confident correlation. The calcitic opercula of bithyniid (or similar) gastropods occur commonly in many Quaternary sequences, offering potential for development and correlation of regional aminostratigraphies around the world. Extending the British framework to continental Europe (and beyond) is one of the first steps, and we present the results from analyses of a series of key archaeological and palaeontological sites from across northern Europe from France to Russia. In order to build the most comprehensive framework possible, we are targeting type localities for various interglacial stages, as well as horizons that can be related to glacial sediments, river terrace sequences, biostratigraphy and archaeology. We have tested the technique against other geochronological techniques, and a detailed understanding of the temperature effects on the extent of protein breakdown allows us to make comparisons between regions, and correlations to the marine oxygen isotope record. These dating schemes will shed light on our human story, providing temporal context for episodes of human occupation across Europe, framed within their palaeoenvironments.

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Poster Presentation Number 13, Th (17:00-19:00)

Neanderthal mobility and technological change in the northeastern of the Iberian Peninsula: the patterns of chert exploitation at the Abric Romaní rock-shelter

Andrea Picin[1,2,3]

1 - Department of Prehistory and Early History, Friedrich Schiller Universität Jena, Germany · 2 - Neanderthal Museum, Mettmann, Germany · 3 -Institut Català de Paleoecologia Humana i Evolució Social (IPHES), Tarragona, Spain

An important aspect of studies of human evolution is an understanding of the factors that caused prehistoric hunter-gatherers to change their knapping strategies, and the benefits that these changes brought to their subsistence activities. During the Middle Paleolithic, the coexistence or the replacement between Levallois and discoid technologies has frequently been recorded, but there is still no clear understanding of the reasons for their alternating and fragmented use in the archaeological record. This paper aims to contribute with new data to the current debate, by exploring the chert assemblages from levels O and M of the Abric Romaní rock-shelter. Petrographic surveys of the area around the Abric Romaní rock-shelter document the abundance of diverse lithic raw materials [1, 2]. Limestone, sandstone and quartz nodules, in primary and secondary positions, are present within a radius of 5 km from the site. In this area, there is a scarcity of chert pebbles, and the main lithological formations are located further away at San Martí de Tous (≥12-15 km), Valldeperes (≥20–25 km) and Panadella-Montemaneu (≥25-28 km). The technological analysis reveals a change in the flake production from Levallois in level O to discoid in level M [3, 4]. This modification in Neanderthals technical behavior is accompanied by the more sporadic use of the Panadella-Montemaneu outcrop and therefore the more frequent utilization of other mobility axis in comparison with those identified in level O. If the embedded foraging strategy is a better choice for hunter-gatherers, it could be assumed that Neanderthal groups occupying level O collected the chert during their hunts and thus roamed further, and hunted close to the Panadella-Montemaneu area more frequently. Conversely, in level M, Neanderthals reduced their foraging territory and visited the Panadella-Montemaneu area more sporadically, shifting their attention to other areas close to Valldeperes and San Martí de Tous, or towards the hinge zones between the Prelittoral Range and the Vallès-Penedès depression. The use of the discoid method also promoted the introduction of a different approach to managing the raw materials, with more careful use of the chert nodules before they were discarded. Clear examples of this different approach are the intense exploitation of the discoid cores and the number of cores-on-flakes, which are more numerous in a discoid context. A cross comparison with other archaeological evidences indicates a similar pattern in the northeast of the Iberian Peninsula during the late Middle Paleolithic, in which the use of Levallois technology is associated with chert and high mobility patterns whereas discoid technology is more closely linked to the use of local raw materials and a lower degree of mobility. Climatic fluctuations and changes in the distribution of preferred prey animals may have influenced the Neanderthals' mobility patterns and contributed to modifying their technical behaviors in order to obtain better foraging incomes.
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Poster Presentation Number 7, Th (17:00-19:00)

New excavations in the Mesvin terrace (Belgium): implications for the appearance of Middle Palaeolithic

Stéphane Pirson[1,2], Paul Haesaerts[2], Philippe Lavachery[3], Paul Spagna[2], Hélène Collet[1], Kévin Di Modica [4]

1 - Service public de Wallonie · 2 - Royal Belgian Institute for Natural Sciences · 3 - Société de Recherche préhistorique en Hainaut · 4 - Archéologie Andennaise

In 2014, the excavation of a Neolithic flint mine in the area of Spiennes (Belgium) crossed Pleistocene sediments containing Middle Palaeolithic artefacts, c. 4.50m below the present-day surface. A small archaeological campaign was thus undertaken [1]. It led to the record of a complex stratigraphic sequence encompassing fluvial deposits (gravel deposits of a braided river covered by overbank silty sands) and its colluvial and loess cover. Several post-depositional processes affected the sequence, including two phases of solifluction, the development of a platy structure, and the precipitation of two generations of secondary carbonates. The interdisciplinary study of this sequence, including archaeology, sedimentology, micromorphology, large mammals, malacofauna, and palynology is in progress.

The altitude of the bottom of the fluvial terrace combined with the geological context of the area led to connect these fluvial deposits to the Mesvin terrace, defined in the 1970s by P. Haesaerts and positioned in MIS 8-7 [2, 3]. We will present in this poster a recent review of the chronostratigraphic position of the Haine Basin terraces suggesting that the Mesvin terrace is dating back to MIS 10-9.

Several Middle Palaeolithic assemblages, including well developed Levallois technology, have been previously reported from this terrace [4], being the oldest Middle Palaeolithic artefacts from Belgium [5]. However, their precise position within the Mesvin terrace deposits was not firmly established. Here, we report the discovery of several dozens of Palaeolithic artefacts in different stratigraphic contexts, including the bottom of the fluvial gravel deposits. Several artefacts strongly suggest a Levallois technology; this will have to be further documented through a detailed technological study of the whole assemblage (in progress). If this were to be confirmed, it would definitively demonstrate the existence of Levallois technology in the lower gravel deposits of the Mesvin terrace, and would then become the oldest Middle Palaeolithic assemblage known so far, in MIS 10, between 400-350 ka following the proxy correlation with the Somme terraces and the Middle Rhine (Ariendorf).

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Poster Presentation Number 26, Th (17:00-19:00)

Iberomaurusian Lithic Technology. New insights from Ifri El Baroud, NE Morocco

Alessandro Potì[1], Jörg Linstädter[2], Mustapha Nami[3], Abdeslam Mikdad[3], Josef Eiwanger[2], Gerd-Christian Weniger [1,4]

1 - Institut für Ur- und Frühgeschichte, Universität zu Köln, Germany · 2 - Deutsches Archäologisches Institut (DAI), Kommission für die Archäologie Außereuropäischer Kulturen (KAAK), Germany · 3 - Institut National des Sciences de l'Archéologie et du Patrimoine du Maroc (INSAP), Morocco · 4 – Neanderthal Museum, Germany

The Iberomaurusian represents the Late Upper Palaeolithic of north-western Africa, from the Atlantic coast of Morocco to Cyrenaica region in Libya. Numerical ages for this technocomplex range between 22ka and 11,5 ka calBP. Due to the lack of data for the previous period (between 30 and 22 ka), its origin is still unclear. It seems that Iberomaurusian industries appeared soon after the Last Glacial Maximum and lasted over 10 millennia until the end of the Pleistocene and the beginning of Epipalaeolithic tradition.

Radiocarbon chronology and sedimentology provide evidence for a differentiation of two phases within the Iberomaurusian. The breaking point seems to be Heinrich Event 1 (HE1) at around 16ka calBP. During HE1 radiocarbon chronology testifies a significant decrease of data which marks the separation of the Iberomaurusian into an initial and relatively weak occupation phase (Early-IBM, 22-16 ka calBP), and a more intense younger occupation phase (Young-IBM, from c. 16 ka calBP) which coincides with the more favourable conditions of the Bølling-Allerød Interstadial. Complete stratigraphic sequences document an important sedimentological shift with the transition from the yellow (the so-called "Couche Rouge") to the grey series (the so-called "Escargotière").

Even though the current chrono-stratigraphical evidence supports the Iberomaurisan dichotomy, variability in lithic material still remains partially investigated or mostly related with typological statements. Our poster presents preliminary results of a techno-economic analysis carried out on the lithic assemblage of Ifri El Baroud (Gunpowder´s Cave, NE Morocco). This cave is of particular importance in the Iberomaurusian scenery because of its complete archaeological sequence (nearly 3 meters thick) that spans from the earliest Iberomaurusian stages to the most recent ones.

Focusing on the analysis of the different components of lithic production, changes in raw material procurement and adaptive strategies across the archaeological sequence are discussed.

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Podium Presentation: Session 11A, Sa (16:00)

Dental calculus evidence of Taï Forest Chimpanzee plant consumption and life history transitions

Robert Power[1], Domingo Carlos Salazar-García[2], Roman Wittig[3], Martin Freiberg[4], Amanda Henry[1]

1 - Plant Foods in Hominin Dietary Ecology Research Group,Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 2 - Department of Archaeology, University of Cape Town, Cape Town, South Africa · 3 - Department of Primatology, Max Planck Institute for Evolutionary Anthropology · 4 - Leipzig Botanical Gardens, Leipzig, Germany

Dental calculus (calcified dental plaque) is an increasingly common source of data on paleodietary and life history reconstruction. Recent research has targeted the plant microremains preserved in this mineralised deposit as a source of dietary and health information for Pleistocene hominins [1]. The bulk of this research has inferred ancient hominin diet by extracting ancient microremains of plants from the dental calculus. However, it is unclear to what extent plant microremains that accumulate in dental calculus track hominin behaviour. No studies to date have directly compared quantitative dietary records to the microremain record from dental calculus [2], thus limiting how we can interpret diet, food acquisition and behaviour. It has also been suggested that plant material in dental calculus is not a dietary record and is deposited from other sources. These include, for example, stomach contents of herbivore prey, and sediment or laboratory contamination [3, 4]. Furthermore, critics have also argued that if it is relating to diet the microremains may be subject to mastication damage, hindering reliable identification [5].

Here we present analysis of calculus microremains from a skeletal collection of wild chimpanzees (*Pan troglodytes verus*) of Taï National Park, Côte d'Ivoire. Taï chimpanzees have a broad diet that includes most food classes relevant to hominin evolution (e.g. fruits, piths, leaves, mammals, birds, invertebrates and honey). We test microremain assemblages against more than two decades of field observations of their diet to establish the ability of calculus to capture the composition of hominin diet. Our results show that some microremain classes accumulate as long-lived dietary markers. We also report that phytolith abundance in calculus can reflect the proportions of plants in the diet, yet this pattern is not true for starches as their appearance is more stochastic. Though starches still provided information about chimpanzee diet and behaviour like nut-cracking, they do not closely reflect dietary trends. Thus, dental calculus can reveal insights into the evolution of hominin diets but quantities of some specific microremain types that are found may tell us little about the intensity of their use.

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Poster Presentation Number 65, Th (17:00-19:00)

A new early *Homo* specimen from Nachukui Formation, West Turkana, Kenya

Sandrine Prat[1], **Jean Phillip Brugal**[2], **Xavier Boës**[1], **Craig Feibel**[3], **Sonia Harmand**[4,5], **Hélène Roche** [5]

1 - CNRS, UPR 2147 · 2 - CNRS, UMR 7269 · 3 - Rutgers University · 4 - Stony Brook University · 5 - CNRS, UMR 7055

Paleoanthropological and archaeological investigations in the western side of the Turkana Basin (Nachukui Formation, Omo group) have an extraordinary impact on our understanding of human evolution in term of behavior, phylogeny and diversity. Even if the number of hominin specimens in the Nachukui Formation (with no sedimentological gap between 4 and 0.7 Ma) is less than in the other formations of the Omo group (e.g. Koobi fora) or other regions (e.g. Sterkfontein Valley), several discoveries from this Formation have changed previous ideas concerning human evolution and the origin of the genus *Homo* in particular. We can mention for example the skull KNM-WT 40000 (holotype of a new genus and species *Kenyanthropus platyops* [1]); KNM-WT 42718 (the oldest occurrence of the genus *Homo* in the Turkana Basin [2]).

We describe here a new tooth specimen (KNM-WT 47767) found in the Kalomeu laga, 150 meters from the Oldowan site of Naiyena Engol 2. The tooth has been found at the top of a paleobeach that belongs to one transgression/regression phase of the Lake Lorenyang (2.19 to 1.7 Ma). Stratigraphic correlations with another paleobeach located in the nearby sedimentological basin of Kalokodo lead us to consider a terminus ante quem of 1.7 Ma for this tooth. KNM-WT 47767 is a well-preserved permanent left upper first molar. The four main cusps are well-developed and have a low rounded form. The metacone is the largest, followed by the protocone, hypocone and paracone which are nearly equal in size. We have undertaken external and internal (EDJ) morphological and morphometrical studies of the crown in order to taxonomically identify this specimen. Given the persistent debate about the hypodigm of *H. habilis* and *H. rudolfensis* (e.g. see [2, 3, 4]), we followed here, a conservative approach grouping all these specimens from East Africa into an early *Homo* hypodigm. According to the comparative analysis, the specimen KNM-WT 47767 falls within the range of variation of east african early *Homo* specimens. KNM-WT 47767 does not present the Carabelli's trait which is frequently present and developed in *Paranthropus boisei* specimens. Furthermore, in occlusal view, KNM-WT 47767 preserves features present in specimens of early *Homo*, such as reduced dimensions, with a buccolingual narrowness of the crown, which is considered as a morphological indicator of similarity with early *Homo*.

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Poster Presentation Number 52, Th (17:00-19:00)

Morphological integration and modularity in the cranium of extant and fossil Hominoidea: a 3D geometric-morphometric approach

Antonio Profico[1], Costantino Buzi[2], Federica Landi[1], Flavio Lattarini[2], Alessio Veneziano[3], Fabio Di Vincenzo [1], Giorgio Manzi[1]

1 - Department of Environmental Biology, Sapienza University of Rome, Italy · 2 - Department of Earth Sciences, University of Rome, Italy · 3 - Research Centre in Evolutionary Anthropology and Palaeoecology, School of Natural Sciences and Psychology, John Moores University, Liverpool, United Kingdom

We report the results of a 3D geometric-morphometric analysis performed on the face (23 landmarks) and cranial base (17 landmarks) of 315 specimens belonging to extant Hominoidea (*Homo*, *Pan*, *Gorilla*, *Pongo*, and various genera of Hylobatidae) and 16 fossil specimens of *Australopithecus*, *Paranthropus* and *Homo*. The samples are heterogeneous for sex and age at death (estimated by dental eruption). After generalized Procrustes Analysis (GPA), the variance-covariance matrix was explored by Principal Component Analysis (PCA). The Centroid Size (CS) was used to quantify and predict the growth trajectories in the different genera. Finally, the phylogenetic signal was evaluated on the basis of an evolutionary tree built combining molecular data available on 10kTrees with those extrapolated from the fossil record. A Partial Least-Squares (PLS) analysis and the Escoufier test (10000 random partitions) were also performed in order to analyze the morphological integration between the face and the cranial base; the pattern of covariation was displayed by shape changes. Among the results we obtained, the PLS suggests a significant correlation between facial prognathism and basicranial features, namely the basioccipital length and the position of the foramen magnum. The RV test between the sets of landmark shows a strong morphological covariation between the two districts. The PCA highlights, both in facial and basicranial regions, the clear distinction of two groups: one being related to extant apes and the other one to the hominins; all the groups appear arranged as ontogenetic series. The linear regression of PC scores on CS (independent variable) reveals a considerable intraspecific allometric signal in both districts. The physignal function (geomorph "R" package) , performed on the adult sub-sample only, demonstrates the presence of a phylogenetic signal in both the face and cranial base morphology. In conclusion, our extensive analysis appears in accordance with previous studies that suggested the hypothesis of cranial integration [4, 5], pointing out a strong correlation between locomotion/postural patterns and functional demands of the facial districts.

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Podium Presentation: Session 7B, Fr (16:20)

Seasonal migrations of Gravettian prey and food storage at Pavlov I

Alexander J.E. Pryor[1], Alistair W.G. Pike[1], Jiří Svoboda[2], Martin Oliva[3], Martin K. Jones[4], Clive Gamble [1]

1 - University of Southampton · 2 - Masaryk University and Institute of Archaeology, Brno · 3 - Moravian Museum, Brno · 4 - University of Cambridge

Food storage is a fundamental technological and behavioural adaptation characterising human societies today. It underpinned the agricultural revolution at the origins of the Neolithic, and enabled the exponential population expansion that has been witnessed over the last 10,000 years. However the origins of this behaviour in humans has remained under-investigated in Palaeolithic archaeology, not least due to the problems with identifying food storage behaviours securely from archaeological evidence alone. In her seminal papers on food storage, Olga Soffer [1-3] suggested this technology first originated on the Russian Plain in the latter stages of the European Upper Palaeolithic, as a direct response to the increasingly harsh climatic and environmental conditions facing the human groups that lived here. This conclusion was based on the appearance at sites of large pits filled with densely packed mammoth bones, interpreted by Soffer as the remains of 'Palaeolithic fridges' used to store food. However alternative interpretations suggest the bones themselves were the primary material being stored to be used as fuel on fires ; archaeological evidence has been unable to distinguish these possibilities clearly, and little mention of food storage has been made in the literature since. This paper reports the first results from a Leverhulme funded project that returns to the issue of identifying Palaeolithic food storage from archaeological remains, via an intensive study of site seasonality. By identifying 1) the seasons during which a site was occupied and 2) the actual seasonal availability of prey animals targeted by Palaeolithic groups, we are testing whether food storage can be identified by demonstrating *human occupation during a season when none of the major prey species were being killed*. Our methods use strontium (high-resolution measurements by laser ablation) and oxygen isotope measurements and cementum thin sectioning of the same tooth to investigate seasonal mobility and season of death of all major prey species, and charcoal analysis to reconstruct the season of human occupation. This presentation will focus on the isotopic and cementum results from our first case study site of Pavlov I, a large Gravettian-era base camp dated ~29-30kya. Patterns of seasonal mobility will be outlined for all major prey species (mammoth, reindeer, horse, fox, wolf, hare) indicating when certain species may not have been available locally to Pavlovian hunters. These data are interpreted alongside season-of-death results to explore the possibility of long distance transport of prey foods from non-local sources. The implications for seasonal food availability and possible seasonal food storage at Pavlov I will be discussed.

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Podium Presentation: Session 7A, Fr (16:40)

Shared reduced adult size in African pygmies is the result of a convergent evolution

Fernando Ramirez Rozzi[1], **Alain Froment**[2], **Yves Le Bouc**[3], **Evéline Heyer**[4]

1 - UPR 2147 CNRS · 2 - IRD · 3 - INSERM · 4 - MNHN

African pygmies share a common ancestor and split from Bantu-speaking populations at around 60,000 yrs BP [1]. Pygmy's populations distribute across equatorial Africa forming one cluster in the East and another in the West. The split into an eastern and a western cluster would have taken place later than 20,000 yrs BP [1]. The pygmy phenotype itself is usually interpreted as an adaptation to life in equatorial rain forests. Studies of genetic introgression have shown that the pygmy phenotype stems from genetic foundations, perhaps involving a deficiency in the GH-IGF1 axis. Although populations with reduced adult stature are present in all continents revealing that this phenotype was acquired more than once, it is assumed that African pygmies by sharing a common ancestor have acquired pygmy phenotype at once. Parallel or convergent evolution can be assessed by comparing the growth process in two populations with a small body size. Knowledge of growth processes in pygmy populations is crucial to understanding their evolutionary history. The presence of similar growth patterns in eastern and western pygmies does not inform about the process of acquiring the pygmy phenotype, since this could have occurred before or after the split into two clusters. The presence of convergent evolution, however, indicates that development of the pygmy phenotype occurred after the split into two clusters (eastern and western) at around 20,000 BP. We have described growth patterns in Baka pygmies from Camerun (west cluster) and compared with data from Sua and Efe (east cluster). Comparison included also Bantu populations living in close contact with pygmy groups and other African non-pygmies populations. Baka pygmies born with dimensions similar to African non-pygmies populations; they show an accentuated decrease in velocity during infancy which is responsible for their pygmy phenotype. Differently, Sua and Efe born with reduced dimensions; the difference established during prenatal life is kept until adulthood. Sua and Efe show smaller dimensions during all growth stages whereas Baka distinguish from non-pygmy populations from childhood. Pygmeisation resulting by particular growth during pre-natal life in pygmies of the eastern cluster or during infancy in pygmies from western cluster reveals that process in the GH-IGF1 axis involved to produce a pygmy phenotype are very different. Therefore, two different growth processes are responsible for pygmy phenotype at east and west revealing a convergent evolution. It indicates that development of the pygmy phenotype occurred after the split into two clusters at around 20,000 BP. Great plasticity of growth is certainly closely linked to the duration of growth and growth in *H. sapiens* is longer than any other hominid species [2]. *Homo sapiens* could therefore be characterized by its high capacity for growth plasticity as revealed by different process to acquired pygmy phenotype in genetically closed populations. This capacity, which may be unique to our species, may have played a fundamental role in the biological adaptation that enabled its worldwide expansion and occupation of dissimilar environments within a short period after moving out of Africa.

Acknowledgements: ANR "GrowinAP".

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Poster Presentation Number 67, Th (17:00-19:00)

Young children copy cumulative culture in a construction task

Eva Reindl[1], **Sarah Beck**[1], **Ian Apperly**[1], **Claudio Tennie**[1]

1 - University of Birmingham

One thing that has been argued to separate humans from other animals is their ability to accumulate improvements in cultural products over time – the ratchet effect. Still, little is known about how this ability to produce cumulative culture develops ontogenetically. Cumulative culture requires two cognitive abilities in combination: Innovation and imitation. With respect to innovation, research has suggested that 4-year-old children might not yet be able to produce cumulative culture along transmission chains, i.e. these chains were not able to generate cultural products whose complexity goes beyond what children could have invented individually. In terms of the imitation aspect, studies have shown that children as young as 2 years of age are able to faithfully copy action sequences involving objects. However, although these actions can clearly be deemed cultural, they are unlikely to represent cumulative culture as they consist of simple movements that children are also able to invent on their own. Therefore, the question remains at which age humans become capable of copying cumulative culture. Our study explored the origins of the imitative aspect of cumulative culture by investigating whether young children would be able to improve their performance in a construction task when presented with cumulative culture. We asked 34 children aged 4 to 5.5 years to build a construction from sticks and plasticine that was as tall as possible. Half of the participants (demonstration condition) observed the experimenter building a tower ("tripod") whose height and shape was beyond what children in a separate baseline condition were able to reach on their own. The tripod thus represented a product of cumulative culture. Children in the baseline condition received no demonstration. Results show that children in the demonstration group built taller constructions than children who had no chance to see a specimen of cumulative culture. Thus, as a group, children clearly benefited from the cumulative culture demonstration. Crucially, we found that five children produced the complex technique shown, suggesting that they were able to copy cumulative culture. The current study thus demonstrates for the first time that 4- to 5-year-old children are able to *imitate* cumulative culture. As we also found that no child made a construction that was taller than the tripod, we suggest that the *innovative* part of cumulative culture is the component young children might be struggling with. In conclusion, while it is still unknown whether preschool children are able to produce cumulative culture among themselves (innovative aspect), we demonstrate that they at least possess one of the cognitive requirements for cumulative culture, namely: imitating cumulative culture once present, such that it boosts one's performance beyond the limits of individual invention.

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Poster Presentation Number 122, Sa (12:20-13:50)

Improving Resolution In Dental Cementum Analyses Applied To Archaeological Contexts: The CemeNTAA Project

William Rendu[1], Lionel Gourichon[2], Hala Alarashi[3], Emilie Blaise[4], Sandrine Bonnardin[2], Timothy G. Bromage [5], Pam J. Crabtree[6], Emmanuel Discamps[7], Valérie Dubois[1], Elodie-Laure Jiminez[8], Stephan Naji[2], Vanessa Parmigiani[9], Eric Pubert[10], Solange Rigaud[1], Stuart R. Stock[11], Randall White[1,6]

1 - CNRS – New York University, CIRHUS -UMI 3199 · 2 - CNRS-UMR 7264 CEPAM, Université Nice Sophia Antipolis · 3 - Archéorient MSH Maison de l'Orient et de la Méditerranée · 4 - UMR 6298 ArTeHiS, Universite de Bourgogne, CNRS Ministere de la Culture, INRAP · 5 - Department of Biomaterials & Biomimetics, New York University · 6 - Department of Anthropology, New York University · 7 - Bergen University, Norway · 8 – Université Libre de Bruxelles · 9 – CADIC-CONICET · 10 – CNRS-UMR 5199, PACEA, Université de Bordeaux · 11 – Feinberg School of Medicine, Northwestern University

In archaeology, seasonality is a key topic for the reconstruction and understanding of the subsistence systems and settlement patterns of past human communities. In prehistoric as well as in historical times, intra-annual variations and changes in environmental conditions, food resource availability, residential mobility, etc.., directly impacted social and economic activities. Such important issues surrounding the human behavior and the organization of social and economic activities closely linked to seasonality can be studied using the seasonal data derived from archaeological contexts.

Among various methodological approaches, the analysis of incremental structures within the tooth cementum – also known as cementochronology – has been developed to tackle such questions. It relies on the study of the dynamic patterns and rhythmicity in the deposition rate of the dental cementum. In many mammalian species, including human, cementum growth follows predictable seasonal cycles with an alternation of fast and slow rate deposits during respectively growth and non-growth seasons. The outermost increment, forming at the time of death, is expected to give precise estimation of the season at death.

While this method has been applied in zoology and archaeology for many years, several issues have been raised and need now to be investigated:

- Lack of reliable data about the timing of cementum growth for many species commonly found in archaeological sites and about variability between individuals or geographical populations;
- Absence of standardized procedures of examination and interpretation of the cementum increments;
- Partial destruction of the archaeological specimens by the most commonly applied technique of sample preparation (petrographic thin sections).

CemeNTAA consortium proposes a three step program to challenge the application of cementochronological analyses to archaeological contexts. Firstly, through different interobserver blind tests, a common protocol has been constituted. It will allow a better reliability of the observations and to a minimization of the inter-observer discrepancies or errors.

Secondly, a renew documentation of the biological phenomena has been made through the constitution of new comparative collections of modern specimens as well as archaeological sets gathering the main Pleistocene and Holocene European preys (Reindeer, Red Deer, Fallow Deer, Bison, Aurochs, etc.). It allows the identification of the intra-population variability of the cementogenesis phenomena. At term, it will be of help to systematically propose a standard deviation to all seasonal estimation. In the same time, these data progressively increase our open access database presenting analyses and pictures of teeth from different comparative collections.

Finally, multi-scale approaches (optical, microtomography and synchrotron X-ray fluorescence and diffraction mapping) are conducted to increase our knowledge of the cementogenesis. Using some specific markers, the first results lead to the establishment of a 3D mapping of the cementum in order to minimize the sampling within a specified tooth and thus to produce a less destructive method. The application to archaeological material is conducted simultaneously. We investigate through the cementochronological lens how past human populations coped with seasonal constraints during two major phases of the human past: the transition from the Middle to Upper Paleolithic and the Neolithic revolution. These two periods are characterized by different sets of seasonal pressures. The end of the Middle Palaeolithic in Southwestern France is marked by major climatic fluctuation and the replacement of migratory taxa by sedentary ones, forcing Neanderthals to adapt their hunting strategies. During the second transition for the first time in the human history, the early farming communities had to deal with seasonal issues raised by the adoption of a food-producing economy.

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Poster Presentation Number 23, Th (17:00-19:00)

A revised chronocultural framework for the Gravettian of European Russia

Natasha Reynolds[1]

1 - University of Oxford

Historically it has been rather difficult to integrate the Russian Palaeolithic record with that from the rest of Europe. This is due in part to language and communication barriers and differences in research frameworks and intellectual history. As a result, assemblages from different parts of the continent have frequently been studied and described in very different ways, creating a major stumbling block for comparative work . In recent years, it has also become plain that the radiocarbon dating of the Upper Palaeolithic is often more problematic than previously thought , and this issue applies in Russia as elsewhere. It is vital that the dating of sites and industries from all regions of Europe is carefully evaluated in order to make robust cross-continental comparisons.

The research presented here contributes towards addressing these issues for the Mid Upper Palaeolithic/Gravettian period, ca. 30,000 to 20,000 14C years BP. Backed lithic assemblages from five Russian Gravettian sites (Kostënki 8 Layer II, Kostënki 4, Kostënki 9, Khotylëvo 2, and Kostënki 21 Layer III) were studied using a techno-typological approach and compared with each other and with other European Gravettian assemblages. The lithics studied included Gravette points, micrograveттes, shouldered points and backed bladelets. Furthermore, the chronology of the sites was re-evaluated by obtaining new radiocarbon dates (for Kostënki 8, Kostënki 4 and Borshchëvo 5) and considering published geoarchaeological information. The new dates and results presented here are used to propose a revised chronocultural framework for this period and region, which helps to illustrate some large-scale trends when compared with information from elsewhere in Europe. The framework can also be compared with the palaeoclimatic record, allowing consideration of human responses to climate change.

The new radiocarbon dates have extended the chronology of the Russian Gravettian and partially filled the long gap that previously appeared to exist between the Early and Late Gravettian [3, 4]. Moreover, at different times either supra-regional homogenisation (perhaps the result of migration) or the appearance of local traditions is apparent among the lithic assemblages. The results also show some interesting possible impacts of climate change on trends of homogenisation/regionalisation and overall site numbers. However, the variation seen cannot be explained simply by reference to climatic conditions.

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Podium Presentation: Session 11B, Sa (16:20)

Temporalities in stone provisioning in the Middle Paleolithic stone artifact record of the cave of Pech de l'Azé IV in southwest France; Insights into the variability in Neanderthal landscape use

Zeljko Rezek[1,2]

1 - Department of Anthropology, University of Pennsylvania, Philadelphia, USA · 2 - Department of Anthropology, Rutgers University, New Brunswick, USA

The interpretation of Mousterian variability continues to be one of the major research subjects in the Pleistocene archaeology of Europe. In various models that focused in technological complexity of the Mousterian stone artifact record [e.g., 1, 2, 3], this variability has been increasingly associated with variation in paleoenvironment during the Late Pleistocene. Some of these models [3] even proposed new classification systems, comprised of various phases or lithic techno-complexes, as a replacement for Bordian systematics. Such advancements add to the known extent of the Mousterian techno-typological variability and improve our understanding of some of its formational processes. Nevertheless, their potential for inferring the variability in Neanderthal behavior that goes beyond the mere production of stone artifacts, and the degree to which such approaches represent a true departure from the conceptual framework for interpreting the archaeological record as being inherent in the Bordian systematics, is open for discussion. The problem of relating Mousterian variability with the variability in Neanderthal behavior is more complex than it seems, because, and as it will be argued here, this problem is more associated with the very concept of the stone artifact record that emerged almost two centuries ago than with tinkering with frequencies and occurrences of largely nominal typological or technological categories (e.g. 'Levallois', 'discoidal', 'Quina scraper', 'MTA biface').

By adopting an 'assemblageless' approach to the stone artifact record, this presentation investigates temporalities of processes related to stone provisioning by Neanderthals during their use of the cave of Pech de l'Azé IV in the record that accumulated from Marine Isotope Stage (MIS) 5 until MIS 3, and which was recovered during the excavations by Bordes and subsequently by Dibble and McPherron. The processes that will be examined are stone movement, blank production, tool selection and tool management. The analysis shows that these behavioral processes operated in a non-uniform way and on a different scale of time and events. Pech IV record was formed due to dynamic and various interactions between various behavioral processes, rather than due to a re-occuring concomitance of particular behavioral practices during the history of the use of this place. The dynamics between these four processes is used to model the variability in the use of this place and the variability in the use of stone over the landscape. The later part of the MIS 5 record and the MIS 3 record exhibit high variability in place use, even though they were formed due to different character of stone movement. In addition, the MIS 3 record exhibits low variability in stone use, but high intensity of stone movement, which in this case is related to export of non-cortical blanks from this place. The MIS 4 record, in contrast, exhibits low variability in place use, but high variability in the use of stone that involves import of blanks. These and other results are used to discuss the variability in Neanderthal landscape use, and by relating these results with Mousterian systematics the question of Mousterian variability is re-examined.

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Poster Presentation Number 132, Sa (12:20-13:50)

New ESR ages from Geißenklösterle cave: a chronological study for late Middle Palaeolithic and Early Aurignacian layers

Maïlys Richard[1], Christophe Falguères[1], Hélène Valladas[2], Daniel Richter[3], Bassam Ghaleb[4], Edwige Pons-Branchu[2] Norbert Mercier[5], Nicholas J. Conard [6,7]

1 - Département de Préhistoire du Muséum National d'Histoire Naturelle, UMR 7194 Histoire Naturelle de l'Homme Préhistorique · 2 - Laboratoire des Sciences du Climat et de l'Environnement, LSCE, CEA-CNRS-UVSQ · 3 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology · 4 – GEOTOP, Université du Québec à Montréal · 5 -Institut de Recherche sur les Archéomatériaux, UMR 5060 CNRS-Université de Bordeaux, Centre de Recherche en Physique Appliquée à l'Archéologie · 6 - Senckenberg Center for Human Evolution and Palaeoecology, University of Tübingen · 7 - Abteilung Ältere Urgeschichte und Quartärökologie, Institut für Ur- und Frühgeschichte und Archäologie des Mittelalters, University of Tübingen

The Geißenklösterle cave near Blaubeuren in the Swabian Alb, Germany, is one of the most important sites documenting human occupations during Middle Palaeolithic and Aurignacian in Europe. The Aurignacian layers prior to 35 ka ^{14}C BP contained both musical and figurative art objects, suggesting early *Homo sapiens* presence in this region, and the Middle Palaeolithic layers yielded lithic artefacts indicating that Neandertals had occupied the site before. The suggestion that two human species successively occupied the cave places particular importance on the establishment of a chronological framework for the entire archaeological sequence at Geißenklösterle Cave. Radiocarbon dating is only applicable to the younger section of the sequence. ESR dating was applied to the whole sequence on herbivorous teeth from Middle Palaeolithic and Early Aurignacian layers. Lacking any measurable uranium in most of the dental tissues ESR ages could be calculated without encountering the usual uncertainties resulting from the reconstruction of the unknown U-uptake history. The ESR results were compared with calibrated ^{14}C ages, ESR and TL dating results available for the Aurignacian and uppermost Middle Palaeolithic layers [1-4]. The cosmic dose rate is difficult to evaluate, due to the morphology of the cave and distance of the samples from the entrance. However, as a result of the internal dose rate being negligible, the cosmic dose rate represents up to 30% of the total dose rate, thus, being an important factor in the age calculations. Changes in the assumptions for cosmic dose rate calculations can change the resulting ESR results by up to 25%. We present the ESR results for a dozen of teeth samples as a function of cosmic dose rate modeling. The obtained ages are in agreement with ^{14}C and TL data, and suggest that Middle Palaeolithic and Early Aurignacian layers were deposited between around 75 ka and 35 ka, from the end of MIS 5 to MIS 3. These ESR results provide an extension of the existing chronological sequence at Geißenklösterle Cave, especially for Middle Palaeolithic layers.

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Podium Presentation: Session 1, Th (11:40)

Hominin paleoecology and use of lake margin environments in the early Pleistocene

Brian G. Richmond[1,2,3], Neil T. Roach[1], Kevin G. Hatala[3,4], Kelly Ostrofsky[4], Anna K. Behrensmeyer[5], Jonathan Reeves [4], René Bobe[4], Purity Kiura[6], John W.K. Harris[7], David R. Braun[4]

1 - Division of Anthropology, American Museum of Natural History, New York, NY, USA · 2 - Human Origins Program, National Museum of Natural History, Smithsonian Institution · 3 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology· 4 - Center for the Advanced Study of Human Paleobiology, The George Washington University · 5 - Paleobiology Department, National Museum of Natural History, Smithsonian Institution · 6 - Archaeology Department, National Museum of Kenya, Nairobi · 7 – Anthropology Department, Rutgers University

Ecology is thought to play a critical role in human evolution. Much of our understanding of early hominin ecology is based on the fauna and paleoenvironmental evidence found at hominin sites, often representing time-averaged evidence accumulated over many years. Fossil footprint assemblages represent a novel source of evidence about hominin ecology and landscape use that, unlike hominin dental and skeletal fossils, are formed extremely rapidly, usually within hours to days. However, footprint assemblages have historically been very rare in the human fossil record.

In recent years, excavations in 1.5 Ma sediments at Ileret, Kenya, have uncovered extensive footprint assemblages. Hominin footprints seem to be much more abundant than expected based on the scarcity of hominin individuals in the dental and skeletal fossil record from closely associated deposits. For example, from 2007-2013 we found hominin prints in five of eight targeted footprint excavations. Yet this high percentage could be biased by our initial focus on sites that previously recovered hominin prints as well as prints of other taxa of interest, such as rhinoceros. To test the hypothesis that hominins are more abundantly represented in footprint assemblages than in the dental and skeletal fossil record, we designed a systematic survey of a 1.25 km^2 area near Ileret, Kenya within approximately 9 meters of sedimentary strata forming the Ileret Tuff Complex (1.51-1.53 Ma). Using a survey guided by a random stratified sampling procedure, we selected 20 different sites that preserve footprint surfaces and we conducted 1x1m test excavations at each.

Results show that on randomly surveyed surfaces the prints of bovids and suids are most abundant, with medium/large-sized animals predominating. The next most abundant taxa are birds (e.g. storks, pelicans) and hominins. The presence of water birds indicates close proximity to a substantial body of water. When compared with relative abundances of taxa based on systematic sampling of dental and skeletal fossils from the same area and stratigraphic interval, hominin footprints are significantly more abundant in these randomly surveyed assemblages. This provides evidence that hominins were active in open near-lake habitats, even though their abundance as fossils in these environments is relatively low, and raises interesting questions about the environmental contexts of hominin foraging and social behaviors.

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Podium Presentation: Session 10B, Sa (13:50)

New results on the chronostratigraphy and palaeoenvironment of the Middle-Pleistocene sequence of Schöningen

Daniel Richter[1,2], Brigitte Urban[1], Jordi Serrangeli[3], Nicholas J. Conard[3], Thomas Terberger[4], Stefan Winghart [4]

1 - Institute of Ecology, LEUPHANA University of Lüneburg · 2 - Department of Human Evolution, MPI for Evolutionary Anthropology · 3 - Abteilung für Ältere Urgeschichte und Quartärökologie, Institut für Ur-und Frühgeschichte und Archäologie des Mittelalters, Universität Tübingen · 4 - Niedersächsisches Landesamt für Denkmalpflege

The Quaternary sequence at Schöningen represents one of the longest terrestrial records in Europe and has the potential to provide unique insight into human behaviour within Middle-Pleistocene environmental changes. Schöningen is famous for the recovery of the oldest wooden weapons which could have been used for long range hunting – the well-known Schöningen spears. However, formation processes and nature of the sediment trap containing this record, as well as the chronostratigraphic position , and thus the age of the spears, are still under debate. Extensive palynological work provides a relative framework for the age of the stratigraphical succession at Schöningen, including the definition of unique interglacial pollen assemblages which are difficult to be placed in the European chronostratigraphical framework. Especially the correlation of the Holsteinian with marine isotope stages (MIS) is under intensive debate. New palynological data provide more insight into palaeoenvironmental conditions prevailing during human occupations, and on environmental changes which are providing the relative chronostratigraphic position of the sequence as well as the relative correlation of several Palaeolithic locations at Schöningen. Chronometric dating is required to provide anchor points for such relative age estimates. Until present, only sporadic data is available for the long sequence, including U-series dating of peat formation [3, 4] and thermoluminescence age estimates for heated flint , which is neither sufficient for determining the age of the spears, nor the placement of the sedimentary sequence. Determination of the age of sediments is best done with luminescence dating. Due to the high age of the sediments, however, several techniques (i.e. IR-RF, pIRIR) are employed in order to provide verification of results for samples from identical stratigraphical positions. Results allow the placement of the sequence within an MIS scheme and provide age estimates for the spear site of Schöningen.

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Poster Presentation Number 127, Sa (12:20-13:50)

Late Pleistocene human rainforest specialisation in Sri Lanka: an isotopic perspective

Patrick Roberts[1], **Michael Petraglia**[1], **Julia Lee-Thorp**[1]

1 - Research Laboratory for Archaeology and the History of Art, University of Oxford

In the 1980s, anthropologists argued that tropical rainforests were an unattractive prospect for long-term human navigation, subsistence and occupation. Yet, over the last decade, archaeological research into the Middle Stone Age of the tropical forest regions of Africa, the Niah Caves of Southeast Asia, and the Ivane Valley of Melanesia has suggested that humans were able to inhabit and exploit rainforest ecologies at least as early as 45,000 years ago. Most of this work has, however, relied on indirect pollen, archaeobotanical, and archaeozoological palaeoenvironmental records, of unknown resolution and catchment, in association with archaeological sequences. Early human use of rainforest resources has been shown at sites such as the Niah Caves, but we still lack direct measures of the extent of reliance on rainforest resources, so that the nature, longevity, and potentially seasonal role of these ecosystems in early human subsistence remain under-explored.

Here we build on our recently published research that used stable carbon and oxygen isotope analysis of human and faunal tooth enamel from early human rainforest sites in Sri Lanka as a direct measure of Late Pleistocene human rainforest resource reliance. In tropical forests, plant and animal resources are strongly ^{13}C-depleted compared to those in open habitats, and especially compared to ^{13}C -enriched C_4 tropical grasses. This is due to the "canopy effect" whereby vegetation growing under a closed, dense forest canopy is strongly ^{13}C -depleted, due to low light conditions and the presence of large amounts of respired CO2. Forest-dwelling animals therefore have more negative $\delta^{13}C$ values than those spending some, or all, of their time consuming open-habitat foodstuffs. It has also been postulated that δ18O values in faunal tissues may track vertical stratification in forest ecolosystems, with increasing height and exposure to sunlight leading to increased evapo-transpiration and hence $\delta^{18}O$-enrichment [5].

The results for three Terminal Pleistocene-Holocene sequences (Fa Hien-lena, Balangoda Kuragala, and Bellan-bandi Palassa) and one Late Pleistocene assemblage dated to c. 20,000 cal. years BP (Batadomba-lena) demonstrate that early human foragers in Sri Lanka relied on rainforest resources from 20,000 to 3,000 cal. years BP, across periods of considerable environmental change. Here we show how stable isotope data can provide further detail about early human rainforest adaptations in Sri Lanka through the comparison of human forager $\delta^{13}C$ and $\delta^{18}O$ to that of three species of Sri Lankan primate (*Macaca sinica*, *Semnopithecus entellus priam*, and *Trachypithecus vetulus*) that form up to 80% of mammalian faunal assemblages at Late Pleistocene Sri Lankan rainforest sites. We argue that stable isotope results indicate rainforest niche separation of these primates in the past and provide information regarding the human hunting strategies used to exploit them.

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Poster Presentation Number 126, Sa (12:20-13:50)

Human predatory behaviour and social implications of bison communal hunting at Gran Dolina TD10.2 (Atapuerca)

Antonio Rodríguez-Hidalgo[1], **Palmira Saladié**[2], **Andreu Ollé**[2]

1 - Universidad Rovira i Virgili URV · 2 - IPHES

Zooarcheological research informs us about not only subsistence but social behavior in the past. Following Driver [1], the social organization of hunting parties, the type of predation (number and rate of animal slaughtered), and the technology used (tactics and tools) must be taken into account to identify and classify the hunting methods in prehistory. In these sense, communal hunting is a technique that implies the participation of several people, including those that usually don't participate in hunting parties as women, children and elders, for killing several prey animals in a single event, often seasonally [1-3]. Zooarcheological testing of this hunting practice provides valuable information about cognitive development, social integration, cooperation among group members, and other interesting aspects of past behavior beyond the strictly economical. Here we present the faunal analysis of the "bison bone bed" layer from TD10.2 sub-unit (Gran Dolina site, Atapuerca, Spain) based on zooarchaeology and taphonomical archaeology methods [4]. To obtain the results we have taken into account taxonomic diversity rates, skeletal composition, mortality profiles, seasonality, statistical approaches to density mediated attrition and taphonomic modifications in bone surfaces. The results indicates a monospecific assemblage heavily dominated by axial elements of *Bison* sp. The abundance of anthropogenic modifications are in concordance with early and primary access to the carcasses and the development of systematic butchering focused on the exploitation of meat and fat and the transportation of high yield elements to somewhere outside the cave. Together with a catastrophic and seasonal mortality pattern, our research suggests the procurement of bison by communal hunting as early as circa 400 ka B.P. Ethnographic, ethnohistorical, and archeological analogies allowed us to interpret the "bison bone bed" as a kill-butchering site used for several seasonal events of mass communal hunting in which herds of bison were slaughtered to be exploited intensively by the hominines that occupied the Gran Dolina cave. The repeated seasonal use of one location on the landscape for the development of specific tasks can be related with a modern logistical like pattern of resource management. In the same way, the early existence of mass communal hunting as a predation technique inform us about the emergence of cognitive, technological, and social skills similar to those exhibited by other modern communal hunters. Evidence from monospecific faunal assemblages largely dominated by large ungulates that exhibit a high number of animals slaughtered, catastrophic mortality profiles, seasonal mortality, systematic exploitation of carcasses, and transport of elements of high utility is common features used to infer communal hunting in the MP, Upper Paleolithic, and recent times [5]. These characteristics are fully consistent with those observed in the faunal assemblage of the TD10.2 "bison bone bed", suggesting that cognitive and technological capabilities required for successful communal hunting of large ungulates was fully developed in the pre-Neanderthal populations of Atapuerca as early as the Middle Pleistocene.
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Poster Presentation Number 103, Fr (12:20-13:50)

Trabecular bone ontogeny in the human calcaneus

Jaap Saers[1], Timothy Ryan[2], Colin Shaw[1], Jay Stock[1]

1 - University of Cambridge · 2 - Pennsylvania State University

The correspondence between trabecular bone architecture and habitual loading has been demonstrated experimentally . It has been suggested that adult trabecular architecture reflects both ontogeny and mechanical influences , but little is known about human trabecular bone ontogeny [3, 4]. A broad understanding of the relationship between trabecular bone growth and the potential influence of mechanical loading patterns during gait maturation is required before trabecular bone can be used to infer the behaviour of extinct hominins. Here we quantify variation in human calcaneal trabecular architecture throughout ontogeny, while considering the potential influence of mechanical loading related to developmental gait mechanics and body size changes. Two skeletal populations are examined: Norris Farms (1300 AD, USA) and St. John's Divinity School (1200-1500AD, UK). Thirty calcanei from individuals aged from fetal to adult were scanned using micro-CT. Adult calcaneal trabecular architecture consists of three distinctive trabecular systems with a triangular zone of low-density in the centre of the calcaneus. Compressive trajectories extend posteriorly and anteriorly along the superior half of the calcaneus and tensile trajectories extend along the inferior half. Trabecular bone properties were calculated from three volumes of interest (VOIs) taken from 3D virtual reconstructions of each calcaneus. The compressive trabecular trajectories were sampled using VOIs placed near the posterior talar facet (PT) and the calcaneocuboid joint (CC). Tensile trabecular trajectories were sampled using a VOI placed superior to the plantar ligament insertions (PL). Independent walking starts around 1 year of age in most human children. However, the muscles associated with plantarflexion are not sufficiently strengthened to propel the foot in a distinctive toe-off phase until about 2 years of age. By age four central nervous system maturation reaches adult levels, after which gait differences between adults and juveniles are caused largely by allometric differences. Our results suggest that in children younger than 9 months calcaneal trabeculae are isotropic, radiating from a central low-density area. Within the first year of life, bone volume fraction decreases. After 9-months of age, trabecular bone appears to reorganise into fewer, thicker, and more directionally organized systems of trabeculae. At around 1 year of age compressive bands begin forming at the PT and CC VOIs. At 2 years trabeculae near the PL VOI thicken, resulting in increased bone volume fraction and anisotropy and producing the clear tensile bands observed in adults. The delayed appearance of distinctive tensile bands compared to the compressive bands corresponds with increased loading by the Achilles tendon and plantar ligaments during the incorporation of the toe-off phase of gait at this stage of development. As the calcaneus increases in overall size, trabeculae become significantly thicker, spaced further apart and more anisotropic. In each VOI the primary trabecular orientation corresponds to the compressive and tensile loading directions predicted by finite element models . Trabecular thickness is greatest in the posterior talar facet, which is likely the result of higher loading during gait as predicted by finite element models . The ontogenetic patterns of calcaneal trabecular bone formation observed in this study support previous findings where a basic trabecular structure develops through endochondral ossification, and later modified through biological and mechanical factors . The results presented here suggest that compressive trabecular bands appear at the same time as the initiation of unassisted bipedal walking, and that tensile bands develop in concert with the onset of propulsive toe-off. These results suggest a strong relationship between the mechanical environment and trabecular bone architecture in the human calcaneus during growth.

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Poster Presentation Number 19, Th (17:00-19:00)

Evidence for mechanically-delivered armatures from early Upper Palaeolithic sites in Japan

Katsuhiro Sano[1]

1 - The University Museum, The University of Tokyo

In the Japanese islands, the number of Palaeolithic sites abruptly increases after c. 38 kcal BP. The lithic technocomplex between 38 and 30 kcal BP, assigned to early Upper Palaeolithic (EUP), is characterized by trapezoids, pointed blades, and edge-ground axes. Although human remains were not recovered from the Japanese EUP sites due to acid sediment primary comprising volcanic and aeolian deposits, the cultural characteristics, including systematic production of blades and edge-ground axes, trap-pit hunting, and maritime transport of obsidians, suggest that the lithic assemblages were remained by modern humans. Trapezoids are a specific tool type in the Japanese EUP, which were basically unearthed below the Aira-Tn (AT) tephra dated at c. 30 kcal BP and were not recovered from the EUP sites in Korea and China so far. It was assumed that, as European Mesolithic trapezes, the trapezoids from the Japanese islands were also used as transversely hafted arrowheads because of the small size and mass, whereas the Japanese trapezoids were larger than the European Mesolithic trapezes and they should not be classified into microlith. Recent usewear studies of the EUP assemblages indicated that some of the trapezoids were indeed used as hunting weapons. Determining the delivery modes of the EUP hunting weaponry is important to better understand hunting strategies of modern humans expanded into East Asian regions. However, projectile systems in this large area is totally unknown due to the lack of direct evidence for spearthrowers and bows. To reveal the delivery modes of Palaeolithic hunting in organic-scarce regions, reliable proxies for distinguishing mechanically-delivered armatures from thrust or thrown spear points are required. Thus, we conducted a series of projectile experiments to confirm macro- and microscopic trace patterns on thrust spear points and stone points projected at velocities of throwing, spearthrower, and bow using a calibrated crossbow [4, 5]. The controlled experiments indicated that complex fracture patterns, showing large number and dimension of spin-offs as well as distinctive microscopic linear impact traces (MLITs), would be useful markers to determine mechanically-delivered armatures. Based on the results of the projectile experiments, macro- and microscopic analyses of the EUP sites in Japan were performed. Although only limited scars for hunting were previously observed on trapezoids, the comprehensive investigation of the EUP assemblages provided considerable numbers of diagnostic impact fractures (DIFs) on trapezoids. The large dimension of the DIFs and its complex fracture patterns suggest that the Japanese EUP trapezoids include specimens which were mechanically-projected.

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Poster Presentation Number 46, Th (17:00-19:00)

Interproximal wear patterns of the Middle Pleistocene (420-200 kyr) Qesem Cave inhabitants

Rachel Sarig[1], Avi Gopher [2], Ran Barkai [2], Gerhard W. Weber [3], Cinzia Fornai [3], Kornelius Kupczik[4], Ellen Schulz-Kornas[4], Hila May[5], Israel Hershkovitz[5]

1 - Dept. of Orthodontic, Goldschleger School of Dental Medicine; Dan David Center for Human Evolution & Biohistory, The Steinhardt Museum of Natural History & National Research Center, Tel Aviv University · 2 - Institute of Archaeology, Tel Aviv University · 3 - Department of Anthropology, University of Vienna, Austria · 4 - Max Planck Institute for Evolutionary Anthropology, Max Planck Weizmann Center for Integrative Archaeology and Anthropology · 5 - Dep. of Anatomy & Anthropolgy, Sackler Faculty of Medicine; Dan David Center for Human Evolution & Biohistory, The Steinhardt Museum of Natural History & National Research Center, Tel Aviv University

Interproximal wear is a consequence of differential movement of adjacent teeth in the same arch. This could be the result of unequal mastication forces that influence adjacent teeth separately [1]. Unlike occlusal attrition, which reflects both the forces of mastication and the consistency of the diet, proximal attrition is primarily associated with the mechanics of mastication [2]. In the current study we present an analysis of the interproximal wear patterns of the Middle Pleistocene (420-200 kyr) Qesem Cave inhabitants.

Mesial and distal surfaces were examined for the presence of proximal facets and subvertical grooves using a low powered binocular microscope (Zeiss, Stemi 2000-C). The proximal facets were analyzed following the methodology described by Sarig et al. [3] and were compared to 594 modern teeth retrieved from the Hamann-Todd Osteologic Collection (HTH) (The Laboratory of Physical Anthropology, Cleveland Museum of Natural History, Cleveland, Ohio, USA). Occlusal wear was evaluated based on a score of 0-8.

Proximal facets could be identified in seven out of the nine permanent Qesem Cave teeth. The largest facet (15.26 mm2) was found on the mesial surface of the M2- QC12. Qesem Cave teeth presented relatively large facets; the P4- QC10 distal facet occupied almost half of the proximal wall (46.74 %) and presented higher ratio compared to modern human teeth (11.78±6.18 %). The facet on the M2- QC12 (29.17%) and on the P4- QC10 (16.26%) was almost double in size compared to its counterpart in modern populations (13.61±5.89% and 8.09±4.10% respectively). Only one proximal facet, the M2- QC12 presented clear subvertical grooves on the distal proximal wear surface. These defects appeared in the form of narrow furrows at the center of the facet and slightly wider furrows laterally. The permanent dentition of the Qesem Cave showed mild to moderate occlusal wear (2.33 ± 0.95 wear stage) ranging from 0-4 stages. These findings are in accordance with the general knowledge that proximal wear severity has been greatly reduced since the agricultural revolution, and has been further reduced since the industrial revolution [4]. It has been suggested that the presence of subvertical grooves in the posterior dentition should be expected in a population characterized by high masticatory forces [5].

Nevertheless, it is interesting to note that although the proximal wear in the Qesem Cave tooth was considerably severe, occlusal wear of the tooth was mild to moderate, which might indicate greater tightness between the adjacent teeth with a combination of high masticatory forces accreted on the dentition in the Qesem Cave teeth. The large size of the proximal facets and the presence of subvertical grooves indicate that the Qesem Cave people possessed a massive, strenuous masticatory system that could produce high occlusal forces.

Acknowledgements: This research was financially supported by the Dan David Foundation, and the Tassia and Dr. Joseph Meychan Chair for the History and Philosophy of Medicine.

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Podium Presentation: Session 6B, Fr (14:50)

The Middle Stone Age of the Senegal River Valley

Eleanor Scerri[1], **James Blinkhorn**[2], **Huw Groucutt**[1], **Niang Khady**[3]

1 - University of Oxford · 2 - University of Cambridge · 3 - University of Cheikh Anta Diop

The importance of Africa in human origins is widely recognised, yet knowledge remains strongly biased towards certain regions of the continent at the expense of others. In particular, West Africa is a vast area with extremely limited archaeological, environmental and fossil records. Long considered peripheral to the origins of *Homo sapiens*, recent research now indicates that West Africa may have played a central role in our evolution. Whole genome studies suggest that *H. sapiens* evolved within a complex set of structured populations situated across Africa [1, 2] which may have persisted into the Late Stone Age (LSA). This 'multiregionalism within Africa' is now also thought to involve introgression from archaic *Homo* in central and Western Africa [3], where some of the most basal and enduring Y-chromosome human lineages have been identified [4].

The Senegal Prehistory Project (SPP) was set up in response to these emerging themes in human origins. The project aims to characterise the Middle Stone Age (MSA, ~300-30 thousand years ago) archaeology and associated palaeoenvironmental records of Senegal, and, secondly, to place this evidence in pan-African narratives of Pleistocene demographic processes, persistence and intra-African dispersals. In the first season of research, the SPP focused on the Senegal, a major fluvial system with a dense network of tributaries spanning three different palaeoecological zones [5] that link the African interior both to the coast and the arid Saharan region to the north. Ten new MSA sites were identified during this field season. In this paper, we present the results of the technological, sedimentological and environmental analyses associated with these new sites, together with optically stimulated luminescence (OSL) age estimates. Our findings suggest a level of technological diversity congruent with a complex demographic history, but also find some common technological features between the different sites' assemblages. These include an emphasis on centripetal methods of Levallois reduction (both preferential and recurrent), with lesser levels of discoidal and other reduction methods. The discovery of several tanged tools in Senegal suggests some form of connection with North African assemblages. These tanged tools may represent the southernmost known extension of the Aterian technocomplex. Other technological features link the sites to sub-Saharan Africa. The overall results are consistent with the role of Senegal as a transitional zone between sub-Saharan and Saharan Africa, and articulate well with the evidence indicating that the Senegal River remained a major source of fresh water, even during arid periods. These emerging results demonstrate the potential of the region to contribute to some of the central debates in Palaeoanthropology, including intra-African dispersals and palaeodemography.

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Poster Presentation Number 95, Fr (12:20-13:50)

Evidence of strenuous physical activity in humeral trabecular bone in a Neolithic Linear pottery Culture (LBK) population

Heike Scherf[1], Joachim Wahl[2], Jean-Jacques Hublin[3], Katerina Harvati[1]

1 - Paleanthropology, Senckenberg Center for Human Evolution and Paleoenvironment, University Tübingen, Germany · 2 - Landesamt für Denkmalpflege Konstanz, Regierungspräsidium Stuttgart, Germany · 3 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany

The living conditions of Neolithic times were much more demanding in terms of physical strength and endurance than later times, when more and more tools for agricultural work were developed to facilitate the daily duties. Here we test the hypothesis that the trabecular bone network of the human humerus adapts to the different working routines performed by Neolithic and contemporary Europeans respectively.

Samples of humeral trabecular bone from both groups were visualized using high-resolution computed tomography. The Neolithic specimens were excavated at the site of 'Viesenhäuser Hof' near Stuttgart-Mühlhausen and date back to the Linear Pottery Culture (LBK). In total 14 (6 female, 8 male) Neolithic samples were collected from individuals of 20 to 50 years of age and were scanned at 120-150 kV and 100-200 µA with a GE v|tome|x s CT system at the University of Tübingen Computing Tomography Laboratory. 18 contemporary human humeri (10 female, 8 male) of individuals of 18 to 41 years of age from the Institute for Human Genetics and Anthropology, Friedrich Schiller University (Jena, Germany) were scanned with a BIR ACTIS 225/300 CT system at the Max Planck Institute for Evolutionary Anthropology, Leipzig.

In each specimen we virtually sampled a spherical volume of interest (VOI) of trabecular bone in the central part of the humeral head with a diameter of 57.5% ± 2.5% of the maximal diameter of the humeral head. We quantified the trabecular architectures in the specimens measuring seven standard 3D-morphometric parameters (BV/TV, SMI, Tb.Th, Tb.N, Tb.Sp, DA, Conn.D.). Subsequently we used univariate and multivariate statistical analyses to compare the trabecular network within and between the Neolithic and the contemporary human group. The univariate analysis of the 3D-morphometric parameters showed significant differences between the two populations in most of the variables (BV/TV, Tb.Th, Tb.N, Tb.Sp, Conn.D.). The principal components analysis partially separated the Neolithic and the contemporary human populations along PC 1. PC 1 accounted for 44.1 % of the total variance and separation along this axis was driven by variation in BV/TV, Tb.N and Tb.Sp. Three pathological cases were identified in the Neolithic sample. These individuals overlapped the most with the contemporary group in the PCA. Their exclusion from the analysis resulted in an almost complete separation of the two populations.

We interpret the difference in humeral cancellous bone between Neolithic farmers and present day Europeans as reflecting a higher physical workload in Neolithic times. The results of this study underline the informative value of trabecular bone and provide a basis for assessing activity levels in past human populations and extinct hominins.

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Poster Presentation Number 12, Th (17:00-19:00)

Neandertals on the move - Or not

Fulco Scherjon[1]

1 - Leiden University, The Netherlands

In temperate Western Europe the fluctuating climate during the latter part of the quaternary severely impacted the distribution of flora and fauna. During glacial and interglacial cycles geographic distributions shifted and for many species the changing environment influenced latitudinal patterns, the use of refugia, speciation, and range sizes. Such biogeographic effects might have been imposed on hominins as well. Species that neither track their suitable habitats nor have or evolve abilities to adapt to any new climatic conditions will become extinct.

The tracking of preferred habitats has also been described as "ebb and flow" dispersal, and involves individuals or groups moving to areas with the most favorable circumstances. This has often been opposed to a "sources and sinks" model where local populations must somehow cope with the changing climate or become (locally) extinct when conditions deteriorate too much. Both mobility types have been used to explain the Neandertal record of presence and absence (see [1]). The aim of this research is to model Neandertal movement and persistence through time in a (realistically) changing ecological and geographical environment.

The implementation of the model has resulted in *HominínSpace*, an agent based modelling and simulation system in which fluctuating carrying capacity is the key attractor for hominin dispersal. A parameterized and spatially explicit reconstructed palaeo-environment models available energy in the form of secondary biomass. A year-by-year demographic model for Neandertal groups moving through North-west Europe is simulated from 130 ky BP to 50 ky BP. Presence and absence results are matched against the archaeological record which has been collected into a comprehensive database of Checkpoints in Space and Time, with site name, location, chronometric dates, and confidence levels. The agent based model implements key aspects of hunter-gatherer behavior, and the simulations are used to explore how demographic and mobility parameters influence the population density patterns through time.

This poster presents the underlying model parameters and simulation results. Comparing the archaeology with the results for the two mobility types with varying demographic parameters and different initial conditions consistently suggest that the "sources and sinks" model matches the archaeological record best. This illustrates that competition for available resources is a major factor influencing mobility strategies. There are several reasons why populations following the static mobility strategy (sources and sinks) do better than those implementing the dynamic mobility strategy (ebb and flow):

- Even when resources become scarce hominins are sometimes capable of surviving in such areas, albeit at very low densities;
- In areas where resource competition is high, population density is lower than the potential maximum. Dynamic groups will converge on areas with high productivity, only to find other groups already living in that same area with whom they must compete. This reduces the available resources and negatively affects population levels. Effectively the total population size in the simulations is always lower for dynamic groups compared to those implementing static mobility;
- Static population will utilize the environment optimally by being forced to use resources from areas that dynamic groups do not enter or leave when conditions become less favorable.

The implemented static mobility model matches the archaeological record better than the dynamic implementation and supports the conclusion of Roebroeks *et al.* 2011 [1] by explaining how repeated regional extinction could have been an important factor in the demography of Neandertals.

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Podium Presentation: Session 3B, Th (15:20)

Bifacial serrated technology in the southern African Still Bay: new data from Sibudu Cave, KwaZulu-Natal

Viola C. Schmid[1,2], **Guillaume Porraz**[3,4], **Veerle Rots**[5], **Mohsen Zeidi**[1], **Nicholas J. Conard**[1]

1 - Department of Early Prehistory and Quaternary Ecology & Senckenberg Center for Human Evolution and Paleoenvironment, Universität Tübingen · 2 - UMR 7041, Equipe AnTET, Université Paris Ouest Nanterre · 3 - CNRS, USR 3336, UMIFRE 25, French Institute of South Africa, Johannesburg · 4 - Evolutionary Studies Institute, University of the Witwatersrand, Johannesburg · 5 - Service de Préhistoire/ TraceoLab, University of Liège

The Southern African Middle Stone Age (MSA) includes phases of behavioural innovations that spark the discussion with respect to their chronologies, nature and significance. One of these phases is the well-known Still Bay techno-complex, which features the use of compound adhesives, bone implements as well as symbols. The Still Bay is documented from a few sites, including Blombos, Hollow Rock Shelter, Diepkloof and Sibudu, and is generally defined as a short-term living bifacial lithic technology. In this paper, we point out some of the questions raised by this definition and develop further on the bifacial technology recently found at Sibudu Cave. The site of Sibudu Cave about 40 km north of Durban and 15 km inland of the Indian Ocean contains a long sequence of MSA strata, including Still Bay and Howiesons Poort. The recent exploration of the lowermost deposits, the so-called "pre-Still Bay", by the University of Tübingen, using the *chaîne opératoire* approach, has revealed the early presence of bifacial pieces together with a laminar technology. These layers are older than 77 ka. One striking element of these new assemblages is the presence of numerous serrated pieces, with a saw-like working edge. Here, we present a technological overview of these lithic assemblages together with a preliminary functional study based on use-wear. We pay special attention on the serrated pieces, made on crystal quartz, quartz and dolerite, and develop further on the functional advantage that this technological innovation may represent. We conduct a detailed study on the serrated pieces and the small retouch flakes documented in association and demonstrate the use of pressure to create the indentation. This represents to date the earliest known evidences of pressure flaking. This technology finds no equivalent in the present record with the exception of the site of Umhlatuzana Rock Shelter, located 43 km southwest. We discuss 1) about the significance of the Sibudu record, 2) about the general implications for our understanding of the bifacial phenomenon during the southern African MSA.
Acknowledgements: We thank the DFG (German Research Foundation) for funding the Sibudu-Project and the ERC for funding the functional study (EVO-HAFT, Agreement Nr 312283).

Poster Presentation Number 112, Sa (12:20-13:50)

Age estimation of the site Weimar-Ehringsdorf - history, recent discussion and outlook

Tim Schüler[1]

1 - Thuringian State Office for the Preservation of Historical Monuments and Archaeology

The history of the research of the site Weimar-Ehringsdorf started on the end of the 19th century. The first step of this scientific work was dominated by geologists. But the increasing number of paleontological and archaeological finds and human remains at the beginning of the 20th century generated an intensive discussion about the age of the travertine in relation to other travertine sites in the middle Ilm river valley around Weimar, like Taubach and Belvederer Allee. The results of the different sciences like geology, palaeontology, archaeology and physical dating methods since the 70th of the 20th century were not easy to merge into a consistent conception of the age. The arguments of the particular research fields are summarised in the first part of the poster to understand the recent discussion . At the moment, the finds from Ehringsdorf play an important role to understand the development of the early neanderthalians. On the one hand, the age of about 230.000 years , of the main find layer in the travertine complex, the so called Lower Travertine, is more or less accepted. On the other hand, we found DNA preservation only in animal bones yet. Therefore it seems to be necessary to get more evidence for this age. In the second part of the poster first results of a new ESR dating project of tooth enamel samples will be presented. The advantage of the current project is the sample-taking which allowed a more precise calculation of the external dose rate. The fragments of teeth (*dicerorhinus* sp. and *bos* sp.) were found by the present quarrying of travertine. On these grounds, the water content of the sediment and the environment of the sample in a radius up to one metre are known. The distribution of uranium and thorium in the teeth was measured by laser-ablation ICPMS, the potassium content was determined by Micro-XRF and the resulting dose rates were simulated using Geant4. In the first step, this simulation was done as a simplified model because of the large amount of calculation time. The problem of uranium uptake in the dentine could not be solved satisfactorily yet. The combination with uranium series measurements could be a help to get more reliable results in the future . As a conclusion, it is essential to improve the modern dating techniques and adapt them to the special conditions of travertine and other open systems. Only if that happens, it will be possible to understand the process of the formation of the whole travertine complex of Ehringsdorf. This is the base for a better understanding of the terrestrial climate change between marine isotope stage 7 and 5 or in other words for the environmental conditions of the early neanderthalians.

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Poster Presentation Number 44, Th (17:00-19:00)

Tooth wear analysis in molar samples from Natufian to modern populations in the southern Levant using the 3D surface texture approach

Ellen Schulz-Kornas[1], Rachel Sarig[2], Hila May[3], Kornelius Kupczik[1]

1 - Max Planck Weizmann Center for Integrative Archaeology and Anthropology, Max Planck Institute for Evolutionary Anthropology · 2 - Department of Orthodontic, Goldschleger School of Dental Medicine, Dan David Center for Human Evolution and Biohistory, The Steinhardt Museum of Natural History and National Research Center, Tel Aviv University · 3 - Department of Anatomy and Anthropology, Sackler Faculty of Medicine, Dan David Center for Human Evolution and Biohistory, The Steinhardt Museum of Natural History and National Research Center, Tel Aviv University

Following the Neolithic agricultural revolution in the southern Levant (14,900-8,450 cal BP), significant nutritional changes as well as new food processing techniques had occurred. Dental wear is considered a reliable indicator to directly trace such changes [1, 2]. Thus, 3D surface texture features such as frequent small micro valleys and sparse dales indicate low abrasiveness of food items while an increased amount of surface roughness is indicative of high abrasive dietary components like external abrasives (e.g. grit). The advantage of studying the teeth of populations from the southern Levant is that they are all from a similar ecological and environmental area, which allows us to differentiate between the factors directly related to diet and those that reflect non-dietary, environmental influences on human tooth wear. Here, we aim to track changes in tooth wear in the southern Levant and to differentiate dietary adaptation using 3D surface texture analysis [3] on lower second molar enamel facets 3 and 9. We measured selected geometric surface texture variables using confocal disc scanning microscopy on a human molar sample from three archaeological periods: the Natufian (dated to ~13,500–12,750 cal BP), the pre-pottery Neolithic B (dated to ~10,150-8,450 cal BP), the Chalcolithic (dated to ~5,500-4,000 cal BP). These were compared to a modern desert-dwelling human sample from Lahav, Israel. The Neolithic teeth showed the roughest surfaces on both molar facets as indicated by a high mean surface roughness and void volume values, but low peak densities. These may be linked to higher loads of abrasive particles in the diet (e.g. originating from grains as well as the limestone used for grinding of grains). Comparably smoother surfaces were found in the teeth of the Natufians and modern individuals. Our preliminary results demonstrate that it is possible to differentiate between the diets of these archaeological groups. Moreover, since the modern sample occupies habitats with high external abrasive loads but show such a weak signal we argue that external abrasives (e.g. sand, grit) can be excluded as the sole cause for the abrasion dominated tooth wear signature seen in the Neolithic teeth.

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Poster Presentation Number 111, Sa (12:20-13:50)

Cuts, Corpses, and Cannibals: Disposal of the Neanderthal Dead in Palaeolithic Europe

Sarah Schwarz[1]

1 - CAHO, University of Southampton

Death is a natural and expected part of everyday life, and in every culture, from the initial responses of grief to the rich variety of cultures found around the world today. But we were not the firs to dispose of the dead – and no other method of disposal causes more alarm and unease than the subject of cannibalism. However, it may have been an early form of disposal method used by other hominid species of the Palaeolithic.

A number of Neanderthal sites have been presented as displaying evidence of cannibalistic practices, such as Krapina, but are they really consuming the flesh of the dead? Or could this instead be a rather misunderstood mortuary practice of the Middle Palaeolithic?

This paper aims to address the potential reasoning behind the consumption of human remains, in order to further understand the distinction between corpse processing (specifically disarticulation and defleshing) and cannibalism as Palaeolithic mortuary practices.

Preliminary studies suggested that corpse processing techniques, which could also lead to cannibalism, were being employed across the Neanderthal world – and they were being applied to all Neanderthals, regardless of age, sex, or geographical location. However, not all of the sites displayed conclusive proof of the consumption of human remains (in the form of marrow extraction), and therefore we must question the decisions and intentions of the living group regarding their method for disposing of their dead. Was the decision based upon a nutritional requirement by the living group, or was this a more complicated ritualistic based practice?

This paper will use an anatomical based method in order to understand the corpse processing methods employed by Neanderthals, which could therefore be used to reconstruct the intentions of living group in order to further understand the mortuary practices which were regularly in use in the Middle Palaeolithic. It will examine the archaeological evidence for mortuary practices in the Middle Palaeolithic, and the paradoxical nature of our response to the Neanderthals: our approval of their ability to conform to the ideal of honouring the dead, but through the controversial practice of breaking apart a body.

Poster Presentation Number 114, Sa (12:20-13:50)

Reanimating the La Cotte de St Brelade 'Bone Heaps': reconstructing complex early Neanderthal responses to environmental change

Andrew Shaw[1], Marie-Anne Julien[1], Beccy Scott[2], Matthew Pope[3], Martin Bates[4], Richard Bates [5], Leif Isaksen[6], John McNabb[1], Clive Gamble[1]

1 - Centre for the Archaeology of Human Origins, University of Southampton · 2 - The British Museum · 3 - The Institute of Archaeology, University College London · 4 - University of Wales Trinity St. David, Lampeter · 5 - University of St. Andrews · 6 - University of Southampton

La Cotte de St. Brelade provides the key sequence for recording long term human occupation and climate change in North West Europe from MIS 7 through to at least MIS 3. Between 1953 and 1978, a series of early Middle Palaeolithic (MIS 7/6) deposits containing an exceptionally rich lithic artefact assemblage were excavated successively by Christian Burdo and Charles McBurney. The combined collection of over a quarter of a million lithic artefacts from ten stratigraphic units forms the largest database of Neanderthal activity from a single site in northern Europe. Alongside the stone tools, mammalian faunal remains were recovered, including two 'bone heaps' comprising elements of mega-fauna dominated by mammoth and woolly rhinoceros, seemingly arranged in a structured manner . Yet despite the central importance of these lithic assemblages, their relationship with these remarkable faunal assemblages has never previously been investigated, whilst the full three dimensional structure of the 'bone heaps' themselves has remained elusive.

Here we report on the first detailed taphonomic and technological study of complete lithic assemblages from the 'bone heap' layers (5 and 3/top A). We demonstrate that the two accumulations are technologically different, whilst the spatial relationship between the lithics and the fauna illustrates that, rather than reflecting a single, repeated behaviour (a game drive; [2]), the two bone heaps are distinct deposits resulting from Neanderthal occupations during times of cooling climate. These two accumulations are associated with artefact assemblages reflecting changing technological repertoires, differing strategies for raw material provisioning relatable to changing sea level, and varied levels of site residency and group mobility (as illustrated by stone tool lithologies, refitting studies and the movement of artefacts into and through the site). We argue that the two La Cotte 'bone heaps' represent organised, but markedly different, lithic and faunal accumulations which demonstrate that early Neanderthals at La Cotte were engaged in chronologically variable, flexible approaches to exploiting the site and the wider changing landscapes of the western La Manche region. This varied, extended and structured use of landscape and place forms part of repeated signature at the site during MIS 7/6 and a wider emergent behavioural pattern that develops in Europe during the late Middle Pleistocene.
Acknowledgements: Arts & humanities Research Council (AHRC), Jersey Heritage Trust, The Société Jersiaise, The National Trust for Jersey, Dr Kate Scott, Olga Finch, Neil Mahrer.

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Poster Presentation Number 77, Fr (12:20-13:50)

Lateral scraper rejuvenation in 400 ka assemblages from Tabun Cave, Israel: new dimensions of raw material exploitation and tool reduction complexity in the Lower Paleolithic

Ron Shimelmitz[1], **Steven Kuhn**[2], **Avraham Ronen**[1], **Iris Groman-Yaroslavski**[1], **Mina Weinstein-Evron**[1]

1 - Zinman Institute of Archaeology, University of Haifa · 2 - School of Anthropology, University of Arizona

In this paper we present novel evidence pertaining to the transition between the Acheulean and the Acheulo-Yabrudian that is currently documented only in Tabun Cave, Israel. We focus on a particular mode of lateral scraper rejuvenation, the use of which flourished at this phase. Its significance in the timeframe of the Middle Pleistocene is in demonstrating new dimensions in raw material exploitation and in new strategies of tool maintenance. The study is based on our current analysis of the material of Tabun, which combines the results from Jelinek's and Ronen's excavations at the site and explores long-term changes in human evolution through the lens of lithic technology. Scrapers constitute the main retouched artifacts of the Acheulo-Yabrudian (415-250/220 ka). These scrapers are often heavily reduced and reworked, and several studies explore intensity of retouch as well as transformations in forms. Within the layers that encompass the transition from the Acheulean to the Acheulo-Yabrudian (layers R65-R64) and the earliest Acheulo-Yabrudian (layer R63) the frequency of scrapers increases, gradually becoming the dominant tool type. Although the scrapers of this phase are generally more delicate and are characterized by lighter retouch than the 'classical' large Yabrudian scrapers, they demonstrate a similar technology of manufacture [1]. In most of the Acheulo-Yabrudian layers of Tabun as well as in other Acheulo-Yabrudian sites rejuvenation of scraper edges was mainly accomplished by retouch (often Quina retouch). In the layers under consideration it was also accomplished by a lateral removal of the scale retouched edge. This procedure is familiar from Middle Paleolithic assemblages and often referred to as 'long sharpening flakes' [2]. It was recently reported in the Levant in the Middle Paleolithic site of Nesher Ramla, and less frequently, in the Acheulean site of Holon [3, 4]. The significance in our case is in the early date of the assemblages, originating in layers lower than Jelinek's Unit XIV, dated to 415 ka. Analysis of both spalls and their negatives on scrapers indicates that this method was an integral part of the lithic industry of the late Lower Paleolithic. It is not just another element of technological variability, however. Rather it demonstrates a strategy in which calculated rejuvenation was part of the design of artifacts, enabling their prolonged use. This is in contrast to the flake tools of the earlier Acheulean, that often exhibit less organized retouch and rejuvenation techniques. It is of note that heavy rejuvenation of handaxes in the Levant also appears at the same timeframe. The discussed method of rejuvenation illustrates the high cognitive capabilities of the late Lower Paleolithic hominins. This follows Perreault et al. [5], who argue that the complexity of manufacture can be represented by the number and variety of distinct stages that make up the chaîne opératoire. The renewal of the active scraper edge in these early layers was not performed through a continual, redundant action of retouch but was instead segmented by the lateral removal. This new step also increased the potential for "ramification" in trajectories of artifact manufacture and use. This strategy is similar to resharpening of handaxes by tranchet removals, which became a more regular feature of the technological arsenal roughly at the same time. The described mode of modification is another example of how traits previously attributed to the Middle Paleolithic or later periods appeared as early as the late Lower Paleolithic.

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Podium Presentation: Session 7B, Fr (15:40)

Cultural unities and funerary behaviour: connected or independent?

Andrei Sinitsyn[1]

1 - Inst. for the History of Material Culture, Russian Academy of Sciences

The cultural affiliations of Upper Palaeolithic sites are mostly defined according to lithic assemblages. It has been widely believed that other aspects of material culture, such as osseous assemblages, dwelling structures, ornaments, decorative and figurative art, etc., directly or indirectly relate to lithic-based cultural entities. Modern analyses of both lithic and non-lithic material provide evidence for an increasing number of cross-cultural affinities. When they are found in adjacent areas and close in time, they are usually explained as manifestations of a population's contacts and influences; when they are separated by large distances or chronological intervals, they are seen as coincidental features which arose independently.

The problem of the relationship of burials, funerary behaviour and grave goods to cultural unities is almost never discussed because of the extreme rarity and distinctiveness of Upper Palaeolithic burials. Idiosyncratic and specific features of material culture have always been a special area of study because comparative analysis cannot be applied. Unique and expressive cultural phenomena are valuable for museum exhibitions, but are not a suitable basis for generalization.

This presentation deals with five burials from the Kostenki group of sites related to four cultural unities. They have no common features in their symbolic features, intra-site locations or grave goods. The variability of the Sungir burials and two burials related to the Gorodtsovian cultural entity suggest an absence of connections between funerary behaviour and cultural units based on lithic assemblages. Furthermore, they provide no evidence for cross-cultural commonalities, such as we have for dwelling structures.

It is likely that we are contending with a shared Palaeolithic conception of the afterlife which allowed a high degree of freedom of choice, perhaps influenced by the individual qualities and social status of the deceased. One possible approach to interpretation is based on the location of burials within settlements that (may) indicate their inclusion in the everyday activities of the human population. Despite the increasing number of parameters used for analysis of burials and the growing number of attempts at reconstruction of the behavioral component of ritual activity, Palaeolithic burials remain distinct and unsuitable for cultural diagnostics.
Acknowledgements: Grants RFBR 14-06-00295, RFH 15-01-18099. I am grateful to N. Reynolds (RLAHA, University of Oxford) for correcting my English.

Poster Presentation Number 125, Sa (12:20-13:50)

What's in a meal? Assessing proportions of plant and meat intake in Paleolithic diets through faecal biomarkers

Ainara Sistiaga[1,2], Carolina Mallol[1], Richard Wrangham[3], Bertila Galván[2], Jessica Rothman[4], Roger Summons [2]

1 - University of La Laguna · 2 - Massachusetts Institute of Technology · 3 - Harvard University · 4 - Hunter College CUNY

Paleodietary research is becoming an increasingly important and socially relevant topic thanks to a renovated focus of evolutionary medicine on a "healthy primitive nutrition". Most authors agree that meat eating was one of the main factors to have triggered the emergence of physiological and behavioural traits defined as the "human package". Yet, we know little about Paleolithic diets. Most of our information comes from stable isotope analysis, which reflects only the protein sources. Supporting information comes from the recurrent occurrence of butchered bones in archaeological sites, which together with isotope analysis have awarded a leading role to meat eating in our evolution and diet. Meanwhile, plant intake is only known from scattered evidence of plant remains, phytoliths analysis and dental calculus. The polarity of the record has conveyed an image of Paleolithic diets as largely based on large game hunting. Nevertheless, to date we are not substantially closer to an understanding of our ancestors' regular meals and how we became capable of sustaining such a largely carnivorous diet. This investigation reports the application of a new method capable of providing visibility to plant and animal tissue intake in Paleolithic diets. We believe that faecal biomarkers, because they are uniquely formed in the intestinal tract of most mammals and given their relationship with dietary habits, are useful to approach the relative proportions of animal and plant tissues in our ancestors' diets. In this work besides our data obtained in Middle Paleolithic sediments, we also performed analysis in faecal samples from our sister taxon, *Pan*, as well as some samples from our relative *Gorilla beringei*, as a referential framework and to help us understand their reaction to meat eating and the possible diagnostic steroidal fingerprint that first hominin persistent meat eaters might have shown. Our Gas Chromatography- Mass Spectrometry (GC-MS) results from sediments from the Middle Paleolithic site of El Salt (ca. 50 ka) and wild chimpanzee and gorilla faeces show that faecal biomarkers are a valuable analytical tool in the sourcing of faecal matter. Moreover, preservation is assessed through the oldest record of sterols and stanols in a Pleistocene archaeological setting. In a chemometric approach to modern non-human primate and Neanderthal faecal biomarker data, results indicate that the method proposed here is capable of distinguishing human species and non-human primates as well as recording the unusual ingestion of meat among our closest relatives . With the application of the faecal biomarker approach to the Middle Paleolithic site of El Salt we have corroborated the reliability of the approach, which has provided the first evidence of omnivory among hominins and challenged the previous picture of Neanderthals as top predators . Besides, the analysis of faecal biomarkers in wild chimpanzee and gorilla samples has yielded important clues to meat ingestion-related problems that the earliest persistent carnivores possibly had to overcome. Our results also represent the first application of the faecal biomarker approach to the diet of non-human primates. This work represents a step forward in our pursuit of efficient methods to exploit the organic content of Pleistocene archaeosedimentary deposits, which will open a new window to the secrets entrapped in Paleolithic soils.

Acknowledgements: We thank Prof R. Wrangham and Prof. JM Rothman for their contributions and for providing chimpanzee and gorilla samples. Archaeological research at El Salt is funded by the Spanish Government I+D project (HAR2012-32703 MEC-FEDER). . Research at MIT was supported by a Canarian Government predoctoral grant and a EAOG travel grant to AS, and by a grant (NNA13AA90A) from NASA Astrobiology Institute to RES.

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Podium Presentation: Session 5, Fr (12:00)

Genetic analyses of three Denisovan individuals from the Altai Mountains (Siberia)

Viviane Slon[1], Susanna Sawyer[1], Gabriel Renaud[1], Bence Viola[1,2,3], Jean-Jacques Hublin[3], Marie-Theres Gansauge [1], Michail V. Shunkov[4,5], Anatoly P. Derevianko[4,6], Matthias Meyer[1], Kay Prüfer[1], Janet Kelso[1], Svante Pääbo[1]

1 - Department of Evolutionary Genetics, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 2 - Department of Anthropology, University of Toronto, Canada · 3 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 4 - Institute of Archaeology and Ethnography, Russian Academy of Sciences, Siberian Branch, Russia · 5 - Novosibirsk National Research State University, Russia · 6 - Altai State University, Russia

In 2010, the genetic analysis of a juvenile manual phalanx (*Denisova 3*) from Denisova Cave (Siberia, Russia) revealed the existence of a previously unknown hominin group, the Denisovans [1]. While the mitochondrial genome of this specimen falls basal to Neandertals and modern humans, nuclear DNA shows that Denisovans were a sister-group to Neandertals [2, 3]. More recently, three teeth from this site have been tentatively attributed to the Denisovan group: one deciduous second molar (*Denisova 2*) and two permanent third molars (*Denisova 4* and *Denisova 8*). Ongoing genetic analyses of these three samples are presented here.

DNA was extracted from the three teeth and converted to DNA libraries. Mitochondrial (mt) DNA fragments were isolated from each DNA library and used to reconstruct high-coverage mitochondrial genomes. The three teeth and the phalanx originate from four different individuals, whose mitochondrial genomes cluster together outside the mtDNA variation of Neandertals and modern humans. While the mitochondrial genome sequences of *Denisova 3* and *Denisova 4* differ by two positions, those of *Denisova 2* and *Denisova 8* are more divergent. The branches leading to *Denisova 2* and *Denisova 8* are shorter than those leading to *Denisova 3* and *Denisova 4*, reflecting that the former mtDNAs have accumulated fewer nucleotide substitutions. Assuming that the mutation rate for human mtDNA [4] is applicable to the Denisovan lineage, we estimate that *Denisova 2* and *Denisova 8* are approximately 65,000 years older than *Denisova 3* and *Denisova 4*, consistent with their putatively greater age inferred from the stratigraphy at the site. Thus, these findings could indicate that Denisova Cave was inhabited by Denisovans over a prolonged period of time.

A total of 47.2Mb, 1.0Mb and 24.1Mb of nuclear DNA sequences were recovered from *Denisova 2*, *Denisova 4* and *Denisova 8*, respectively. By comparing the number of sequences mapping to the autosomes to those mapping to the X chromosome, we determined that *Denisova 2* originates from a female (as does *Denisova 3*), while *Denisova 4* and *Denisova 8* belong to males. Nuclear DNA sequences from the three individuals are more similar to the high coverage *Denisova 3* genome than to the Neandertal genome. Moreover, we find that nuclear diversity among the four Denisovans is higher than among seven Neandertals for which nuclear DNA have previously been recovered.

Our findings confirm that these three molars originate from Denisovan individuals, thus expanding the known fossil record attributed to this extinct hominin group and providing additional information to assist in the identification of other fossils potentially belonging to Denisovans. Although to date, Denisovans have been identified only from a single site, genetic diversity among members of this group is higher than among Neandertals from a wide geographic range. However, we note that the large age differences estimated between the four Denisovans may also explain the higher diversity.

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Poster Presentation Number 17, Th (17:00-19:00)

White light, white heat: On the relationship of *Homo* and lightning as a source of domestic fire

Andrew Sorensen[1]

1 - Leiden University

The genus *Homo* has since its origins been subject, by and large, to the same whims of Nature endured by other creatures. In the recent past, however, cultural innovations like clothing and shelter helped our ancestors to work with (or buffer against) Nature to make life more comfortable. Harnessing fire was another. Prior to learning how to make fire artificially using tools, hominins were dependent on Nature to provide periodic access to fire, usually ignited by lightning strikes. Sandgathe and colleagues [1] suggest this dependency on lightning-derived wildfire was only overcome by modern humans, citing as evidence the apparent reduction in fire use by Neandertals during cold-climate periods being due to reduced lightning frequency. They base their claim on relative decreases of up to 96% for heated lithic artefacts and faunal remains between older levels assigned to mid-late MIS 5 (warmer), and younger layers assigned to MIS 4 (colder) at two SW France cave sites (Roc de Marsal and Pech de l'Azé IV). Lightning and wildfires are both infrequent phenomena in France today. Compared to Spain, Portugal, Italy and Greece, European Commission data shows France experienced 9.7% of the total fires between 1980 and 2013, affecting only 5.5% of total area. On average, 15% of the burned area is located within the SW portion of the country, and the majority of the fires are anthropogenic in origin. According to data compiled by NASA, the Aquitaine Basin today only receives on average 2 to 6 lightning flashes/km^2/year. Lightning frequency tends to decrease by 12±5% for every 1°C drop in global mean annual temperature (GMAT) [2]. An estimated 3–6°C reduction in GMAT for the Last Glacial Maximum compared to modern (pre-industrial) climate [3] provides a baseline for MIS 4 GMAT. This suggests a drop in lightning frequency of roughly 30.8±11.2% to 51.3±16% during these colder periods, far less dramatic than the ~96% reduction in heated artefacts discussed above. Daniau and colleagues [4] have shown how millennial scale variability in microcharcoal deposition in deep-sea core MD04-2845 (Bay of Biscay) attests to changes in fire regime in SW France that correspond to climatic shifts. Looking at microcharcoal concentration (number of fragments: CCnb; total surface area: CCsurf) values, one can potentially assess relative differences in the level of fire regime between periods. Comparing median (and mean) values from MIS 5c–a (~105–73 ka) to MIS 4 (~73–60 ka), there appears to be only a 4.2% (11%) decrease in CCnb, while CCsurf shows an overall increase of almost 13.5% (7%) in MIS 4, contrary to expectations. Between MIS 4 and the first portion of MIS 3 (60–32 ka), the overall median CCnb values decrease by 7.1% (mean values indicate a 1.6% increase in MIS 3), while CCsurf values decrease by 8.4% (mean: 7.8%), potentially suggesting a reduction in fire activity; yet, fire use on archaeological sites appears to increase dramatically during this period [5]. The relative difference in fire activity observed in marine microcharcoal records between MIS 5c–a and MIS 4 in the very least does not appear to support the Sandgathe et al. model in magnitude (with regard to CCnb), and appears to contradict the model when one only considers the CCsurf values. Unfortunately, there is currently no calibration method for assessing the relationship between the percentages of heated lithic or bone artefacts and the amount of fire use in an archaeological layer, or between microcharcoal concentrations from marine sediment and the fire frequency or total area burned within a region. We are therefore still stuck in the mire of interpreting imperfect data that is only relative to itself. Nevertheless, these results suggest a blanket statement of *less lightning means less fire during cold stages* does not necessarily hold and highlight the need for alternative explanations for the apparent reduced fire signal in archaeological layers deposited during glacial conditions.
Acknowledgements: Continuing funding for this work is provided by the Netherlands Organisation for Scientific Research (NWO). Many thanks to Anne-Laure Daniau (CNRS, Bordeaux, France) for sharing her microcharcoal dataset and for her very helpful comments and instruction.

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Poster Presentation Number 139, Sa (12:20-13:50)

Funerary dynamics of an epipalaeolithic cemetery: a new database on Arene Candide skeletal remains

Vitale Sparacello[1], **Paul Pettitt**[1], **Charlotte Roberts**[1]

1 - Durham University

The Arene Candide cave (Finale Ligure, Italy) has been excavated from 1940 to 2012 and has yielded one of the most important Late Upper Paleolithic Epigravettian skeletal series in the world, consisting of ten primary burials and six clusters of secondary depositions. The first database of the skeletal material was published by Paoli and co-workers in 1980 , but was in Italian and had limited dissemination. Over the years, researchers have revised some of Paoli's attribution of the skeletal elements in the secondary deposits at this site , but an updated database has not been made available to the anthropological community to date. We collected all the available information on the taphonomy of the depositions and on the anthropological analyses performed on the skeletal series from the original excavation diaries, field pictures and notes, dissertations, and scientific publications. In addition, we performed 3D surface scans of the skeletal elements that were found in the secondary deposits, and collected new information on the presence of bone elements that articulated or were contralateral of another. The results of this study shed new light on funerary behavior at Arene Candide, and allowed for a better understanding of the *tempo* and mode of the depositional process. The remains of at least seven individuals are present in the six clusters of secondary depositions that were recorded during excavation. Of those seven, two individuals (Arene Candide 3 and 4) are distributed in three clusters; two of them include the crania, and were deposited in close association with a new primary deposition, Arene Candide 2. The third cluster lay at the feet of Arene Candide 2 and includes postcranial elements from both individuals. This suggests that Arene Candide 3 and 4 were originally deposited together in a double burial, which was re-arranged in a single action for the interment of Arene Candide 2. As a result, our study extended the AMS date for Arene Candide 3 (10065±55 BP Uncal.) to Arene Candide 4, which had not been dated . From the excavation diaries, we were able to determine that one of those three clusters lay above another undisturbed double burial – Arene Candide 5-6 – which was dated to 9925±50 BP Uncal. Given that the formation of the clusters is contemporary to the deposition of Arene Candide 2, this provides a *terminus post quem* for the burial. Both Arene Candide 2 and 3 display skeletal traits suggestive of a mild form of hereditary X-linked hypophosphatemic rickets, which possibly indicates a shared maternal lineage. The rearrangement of the older Arene Candide 3 cranium close to the Arene Candide 2 skull may therefore be a sign of relatedness which was recognized by the people who buried both individuals. If this is true, Arene Candide 2 cannot be much more recent than Arene Candide 3. Based on the above evidence, we propose that Arene Candide 2, 3, 4, 5, and 6 are roughly contemporary and date to around 9,900-10,100 BP Uncal. The rest of the dated burials and secondary depositions belong to an earlier phase dated to between 10810±65 and 10585±55 Uncal. BP , and show a similar pattern of primary burials, often disturbed by new inhumations and clusters of secondary depositions. The new findings further attest for a remarkably long endurance of Upper Paleolithic cultural traditions, but suggest that burial activity was condensed to relatively short periods of time. The database will be available online for download hoping that this will foster new bioarchaeological research on this important site.

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Podium Presentation: Session 1, Th (11:00)

Early *Homo*: making sense of new fossils and new interpretations

Fred Spoor[1]

1 - UCL / MPI-EVA

The publication in 1964 of the species *Homo habilis* marked the beginning of a period of intense debate about the origin and early radiation of the genus *Homo*. Initially, the discussions were about the validity of this species and based on the hominin fossils found at Olduvai Gorge, Tanzania. However, with the discovery from 1968 of a rich early Pleistocene fossil record at Koobi Fora and Ileret, east of Lake Turkana, Kenya, the debate widened and became more complex. Apart from the broad agreement that certain specimens could be attributed to *P. boisei* and *H. erectus* it was the affinities of the other hominin fossils that stimulated most discussion, and two additional species were named: *H. ergaster* in 1975 and *H. rudolfensis* in 1984. The wide range of interpretations concerned both which early *Homo* species, if any, should be recognised besides *H. erectus* and *H. habilis*, and the composition of various hypodigms. Grouping were often based on more complete specimens, typically crania such KNM-ER 1813, KNM-ER 1470 and KNM-ER 3733. However, if type specimens such as the mandibles OH 7 or KNM-ER 992 ended up in different groupings the species names of these groupings varied as well. An important factor in the sorting of the eastern African fossil record of early *Homo* was that researchers would differ in their emphasis on neurocranial size, dental size or facial form as the key to species identification. The scientific debate about early *Homo* in the 1970s and 1980s culminated in the simultaneous publication of the monographic descriptions of the *H. habilis* fossils from Olduvai Gorge [1] and the cranial, mandibular and dental hominin remains from Koobi Fora and Ileret [2]. The former advocated a variable hypodigm of *H. habilis* which includes all early *Homo* specimens not attributable to *H. erectus*. In contrast, the latter recognised additional species, including *H. rudolfensis* and *H. ergaster*, and this interpretation has arguably been accepted most widely over the following decade.

From 2000 the Koobi Fora Research Project resumed fieldwork on the eastern side of Lake Turkana, and up to 2009 a number of important early *Homo* fossils were discovered [3, 4]. Moreover, to help with the interpretation of these fossil finds the type specimen of *H. habilis*, OH 7, was virtually reconstructed and re-analysed . In all, these studies have resulted in a better understanding of what characterizes *H. habilis* and *H. rudolfensis*, and as a consequence new hypodigms of these two species have been proposed [4, 5]. The origin and early radiation of the genus *Homo* will be reviewed by integrating the new evidence obtained over the last decade, including the recent announcement of the earliest evidence from Ledi-Geraru, Ethiopia at 2.8 million years ago.

Acknowledgements: I thank the National Museums of Kenya, Tanzania and Ethiopia for giving access to fossils in their care, as well as my colleagues with whom I study early *Homo* in the Turkana Basin and elsewhere. Research was supported by the Max Planck Society.

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Poster Presentation Number 90, Fr (12:20-13:50)

Visualising trabecular bone architecture and distribution in the human hand: Variation, consistency, and implications for reconstructing behaviour

Nicholas Stephens[1], Tracy Kivell[1,2], Dieter Pahr[3], Jean-Jacques Hublin[1,2], Matthew Skinner[2]

1 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany · 2 - Skeletal Biology Research Centre, School of Anthropology and Conservation, University of Kent, United Kingdom · 3 - Institute of Lightweight Design and Structural Biomechanics, Vienna University of Technology, Austria

Reconstructing individual and group level transitions in technology, habitual activity, and subsistence strategies over time is a primary focus in anthropology. Methods that address this at the individual level generally rely on skeletal evidence, whereby behaviour is inferred from morphological variation incurred as a result of *in vivo* bone remodelling in response to mechanical loading. Generally, analysis has focused on the external cortical shell; however, recent advances permit analysis of how variation in the internal trabecular bone reflects habitual behaviour. The quantification and visualization of this internal variation has recently been applied to questions related to the evolution of the human hand and the unique ability to create forceful precision grips. Although asymmetrical distribution of trabecular bone volume (BV/TV) at the first, third, and fifth metacarpal heads are consistent with such grips , little is known about how these distributions relate to those of other bones of the hand. Moreover, we lack a precise understanding of how trabecular distribution or other architectural features vary throughout the hand and between individuals. In this study we aim to: 1) quantify and characterise the trabecular architecture of the entire human hand; 2) ascertain if the microstructure/distribution of trabeculae corresponds to documented power or precision grips and; 3) determine if consistent patterns or variations in trabecular microstructure/distribution may thereby be used to reconstruct individual behaviour. To investigate trabecular microstructure and distribution we use micro-CT scans of associated and unassociated carpals, metacarpals (MC), proximal phalanges (PP), and intermediate phalanges (IP) from individuals deriving from several archaeological and geographic contexts (Egyptian Nubia), Tierra del Fuego (Argentina), Syracuse (Sicily), Canterbury (UK) and Lower Saxony (Germany). We quantify the relative bone volume (BV/TV), anisotropy (DA) and elastic modulus (E) of the carpals and the heads and bases of the metacarpals and phalanges. BV/TV values are subsequently mapped onto a 3D model to qualitatively compare trabecular distribution within and across individuals. We use a Mann Whitney U test to compare individual specimen heads and bases within and between each analysed region. The within bone Mann-Whitney U comparison finds significant differences ($p < 0.05$) between the heads and bases for each of the proximal phalanges and metacarpals in BV/TV and E. DA was only significantly different for the PP2, PP3, PP4, MC1, and MC5. Excluding the MC5, the 3D models clearly illustrate that this pattern is driven by a greater and more uniform distribution of BV/TV at heads, whereas the BV/TV at the bases is concentrated palmarly. The between-bone Mann-Whitney U comparison finds significant differences between the MC1 head for BV/TV and E when compared to the relatively low values for all other metacarpals in this region. Significant differences were also identified at the MC2 and MC3 base, as a result of comparatively high BV/TV and DA. When the quantitative results are combined with the 3D models, the overall pattern of trabecular architecture and distribution within the human hand indicates a greater demand for BV/TV and E at the central portion of the palm and the distal portions of fingers. Low levels of DA in the heads of the phalanges speaks to a more varied loading regime, whereas the high levels of DA at the base of proximal phalanges suggest consistent loading, which is reflected in strong palmar distribution of BV/TV at this location. This pattern and the asymmetrical BV/TV distribution present at the metacarpal heads are consistent with loading incurred during flexion of the fingers. Individual variation in both architecture and bone volume distribution from this overall pattern strongly supports the use of trabecular bone for reconstructing individual behavior.
Acknowledgements: We are grateful for the samples provided by the Museo Nazionale Preistorico Etnografico "Luigi Pigorini" (Roberto Macchiarelli), Naturhistorisches Museum Wien (Maria Teschler-Nicola, Ronald Muehl), Senckenberg Museum (Virginie Volpato), University of Florence (Jacopo Moggi-Cecchi and Silvia Bortoluzzi), University of Kent Skeletal Biology Research Center (Tracy L. Kivell), and the Johann-Friedrich-Blumenbach-Institut für Zoologie und Anthropologie der Georg-August-Universität Göttingen (Birgit Großkopf). For scanning assistance we thank David Plotzki and Heiko Temming. For discussions we thank Zewdi Tsegai, Colleen Stephens, and Adam Van Casteren. This research was supported by the Max Planck Society (NBS, MMS, TLK, JJH) and the European Research Council Starting Grant #336301 (TLK and MMS).

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Poster Presentation Number 84, Fr (12:20-13:50)

Innovations in the spotlight: a new approach to study qualitative and quantitative differences of innovative behaviour and cultural change during the Middle Stone Age (MSA) of Southern Africa

Regine Stolarczyk[1], **Miriam Haidle**[2]

1 - The Role of Culture in Early Expansions of Humans, Department of Early Prehistory and Quaternary Ecology, Tübingen University · 2 - The Role of Culture in Early Expansions of Humans, Senckenberg Forschungsinstitut

In Palaeolithic research, a systematic qualitative and quantitative study of changes in innovative behaviour is so far missing. An ongoing DFG (German Research Foundation) project aims to fill this gap, focusing on differences in the MSA techno-complexes of Southern Africa and Lesotho. The main goal of the project is to further develop a universal approach to analyse artefact spectrums in the context of the capacity for innovation, which is accessible through the material remains. The basic concept has been introduced by Haidle and Bräuer . It is based on the fundamental premise that innovations are seldom completely new solutions, but rather affect diverse parts of object behaviour. The developed approach includes the quantitative and qualitative characterisation of object behaviour under consideration of typological aspects, various technological attributes like material, form or function, and to a certain extent some mental aspects. The goal is, to identify innovations in different parts of object behaviour and to evaluate the behavioural flexibility, variability and complexity.

To this end, two qualitative methods, cognigrams and effective chains , developed by Haidle, are being applied. The use of these methods facilitates the reconstruction of tool behaviour and the underlying actions and thoughts. Haidle combined the Problem-Solution-Distance-Concept with the method of the châine opératoires. Cognigrams and effective chains are both methods for coding tool use schematically, but they are used to analyse behaviour on different scales. Cognigrams are allowing insights into detailed aspects of tool use, for example, the production process of an artefact. They code not only the complete action sequence, but also the underlying perceptions of the acting individual and all active, passive, and notional elements of behaviour, as well as the various effects the different elements have on each other. Effective chains, on the other hand, are meant to illustrate the general structure of complex systems. They summarize the foci and effects of the modules involved in an event chain of complex behaviours. Furthermore, diverse quantitative analyses are performed on the identified innovative aspects (e.g., comparative analyses of the frequencies of innovations, analyses of the distribution of new elements). The identified aspects of tool behaviour are then evaluated in terms of their innovativeness, by comparative analyses on a larger geochronological scale.

In total, 436 assemblages from sites in South Africa and Lesotho were analysed. 91 different types of stone implements, nine bone tool types, and five different kinds of symbolic artefacts were identified. Several new tool types were detected, including awls, arrow heads, pins, beads, engraved objects, and segments. A detailed analyses of the bone artefacts under consideration of technological elements and aspects concerning the behavioural and mental complexity yielded diverse insights. These South African bone tools seem to be the oldest findings of their kind. They appear around 130 ka and are represented in nearly all following chronological subdivisions of the MSA. Nonetheless, it has to be stressed that, with just 59 published pieces so far, their numbers are quite low. On the other hand, they show a marked diversity regarding tool types and production technologies and appear during various time periods. Diverse technological and mental aspects of the reconstructed tool behaviours, like new production techniques or complementary tool sets, as well as new problem-solution-concepts, seem to be innovations of the South African MSA. The new cultural developments shed some light on the behavioural capacity of the people living in this region during this time. The innovations of the MSA of Southern Africa represent different cultural expressions of flexible, variable, and complex behavioural abilities, at least since 130 ka.

Acknowledgements: This research is funded by the DFG (German Research Foundation)(Project title: 'Qualitative and quantitative differences in innovative behaviour in the Palaeolithic - the example of Middle Stone Age techno-complexes of Southern Africa.').

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Poster Presentation Number 29, Th (17:00-19:00)

New AMS dating results for aurochs (*Bos primigenius*) at the initial Mesolithic site of Bedburg-Königshoven, northern German Rhineland

Martin Street[1], **Birgit Gehlen** [2]

1 - MONREPOS Archaeological Research Centre for Human Behavioural Evolution · 2 - University of Cologne, CRC 806

Since its discovery in the late 1980s Bedburg-Königshoven has generally been seen as the oldest directly dated Mesolithic site in the southern central part of the Northern European Lowlands. Pollen analysis suggested that the sub-aquatic gyttja layer containing many butchered aurochs remains and typically Early Mesolithic lithic and organic artefacts formed in an ancient meander of the River Erft during the Middle Preboreal. This age is confirmed by two conventional radiocarbon dates provided by the Cologne laboratory for wood of twigs recovered from the layer, which are themselves bracketed by compatible older and younger radiocarbon dates in sequence. At odds with this interpretation were five conventional radiocarbon dates on aurochs bone obtained from the Cologne laboratory in the early 1990s. With the exception of one result similar to the Preboreal results on wood, the bone dates scattered widely, spanning the Younger Dryas almost back to the Allerød Interstadial. This suggested unexplained methodological problems and it has seemed best to interpret these dates as not reflecting the true age of the site. In the framework of a major research project into the status of Mesolithic and other early aurochs coordinated by Birgit Gehlen a large series of new dates on bone of several aurochs individuals was obtained from the Cologne AMS facility. Unexpectedly the spread of the AMS dates mirrored the picture provided by the conventional radiocarbon bone results. The problem was addressed by adjustment of the sample preparation methods used, producing revised results compatible with the early Holocene context of the site but producing a significantly older age for human activity at the very beginning of the Preboreal phase of the Holocene. The now comprehensive dating evidence for the age of the Mesolithic occupation at Bedburg will be presented and its implications will be discussed for the interpretability of radiocarbon dates at high precision levels, for the interpretation of both human activity and faunal taphonomy at the site itself and, at a more far-reaching level, for understanding the origins of the Mesolithic as a cultural response to the environmental changes of the early Holocene.

Poster Presentation Number 33, Th (17:00-19:00)

Tooth cusp morphology and mechanical performance during hard food object breakdown

Karen R. Swan[1], **Samuel N. Cobb**[1,2], **Laura C. Fitton**[1,2]

1 - Centre for Anatomical and Human Sciences, Hull York Medical School · 2 - Department of Archaeology, University of York

Teeth play an important role in the acquisition and processing of food, therefore it is not surprising that dental morphology is often associated with various dietary adaptations. Whilst observations and correlations are frequently made between extant and extinct primate teeth and diet, it is not yet clearly understood which aspects of tooth morphology make some teeth better than others at acquiring or processing food. This is due in part to the complexity of dental form and categorising diets without taking into account the mechanical or material properties of the food items. Durophagous (hard object feeding) primates, such as *Cercocebus atys*, offer an interesting opportunity to investigate whether some tooth morphologies are better for processing hard food items over others.

In order to test this, idealised cusp models were created by altering the angle and bluntness of virtual cones thus replicating a range of radius of curvatures found within the functional morphospace of mammalian cusps. An additional cusp was also made based on the radius of curvature and angle of the cusps on an unworn M1 of *C. atys*. These cusp designs were manufactured in stainless steel and individually attached to a universal testing machine. In order to simulate a bite onto a hard food item, a brittle object was created using 3D printing. Two forms of semi hemispheres were made: one hollow, to model the endocarp; and one solid, to model the food item itself. For each of the 13 cusps, with 10 repeats, the initial load at failure and a fragmentation score was recorded to indicate mechanical performance. Given the nature of the food items in *C. atys* diet (seeds with a stress resistant endocarp) it was predicted that, relative to the other idealised cusp morphologies, the *C. atys* cusp will be optimised for the following functions: 1) cusp morphology of *C. atys* will have a reduced initial force required to break both the hollow dome (endocarp) and solid dome (food item); 2) the *C. atys* cusp will break the hollow dome into a small number of large fragments to facilitate their removal from the mouth rather than ingestion; and 3) the *C. atys* cusp will break the solid dome into a large number of small fragments to increase the surface area to volume ratio and thus increase efficiency of its digestion.

Results show that a relationship exists between radius of curvature and mechanical performance. The cusp with the smallest radius of curvature (the most sharp and acute cusp) requires the lowest force at initial fracture for both hollow and solid domes, and breaks the hollow domes into the smallest fragments. In contrast, cusps with a larger radius of curvature perform best at breaking the solid domes into a large number of small fragments.

There appear to be several ideal cusp forms for reducing force at initial fracture, minimising fragmentation of hollow domes, or maximising fragmentation of solid domes. The *C. atys* cusp does not perform best in any one of these individual functions but it is clearly the best performing cusp when all three functions are considered together. Other factors such as the structural integrity of the tooth may also need to be considered when comparing cusp design, but the results of this study indicate that *C. atys* has a cusp morphology advantageous for its durophagous diet. Interestingly the cusp radius of curvature used in this study for *C. atys* was that of an unworn tooth; therefore based on these findings it is predicted that *C. atys* will experience an increase in the force required at initial fracture with increasing wear. Given that adult and juvenile *C. atys* have the same stress resistant diet, we hypothesis that the unworn morphology of a juvenile tooth give it an advantage over adults by minimising the force required at initial fracture and thus counteracting their smaller absolute muscle size.

Podium Presentation: Session 9, Sa (11:00)

Reconciling X-ray microtomography of recent fossils and paleogenetics: simple technical solutions and good practices

Paul Tafforeau[1], Adeline Le Cabec[1,2], Alexander Immel[3], Marion Bonazzi[4], Verena Schuenemann[3], Alexander Herbig [5], Heiko Temming[2], Bence Viola[2,7,8], Jean-Jacques Hublin[2], Johannes Krause[3,5,9]

1 - European Synchrotron Radiation Facility, Grenoble · 2 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig · 3 - Institute for Archaeological Sciences, Archaeo- and Palaeogenetics, University of Tübingen · 4 - Institute of Clinical Molecular Biology, Kiel University · 5 - Max Planck Institute for the Science of Human History · 7 - Department of Evolutionary Genetics, Max Planck Institute for Evolutionary Anthropology · 8 -Department of Anthropology, University of Toronto · 9 – Senckenberg Centre for Human Evolution and Palaeoenvironment, University of Tübingen

For over a decade, both conventional and synchrotron X-ray microtomography have become key tools to investigate the inner structures of invaluable fossils. Despite their reputation of being non-destructive, strong concerns have been recently raised regarding the deleterious effects of strong X-rays on the preservation of ancient DNA (aDNA) in both recent fossils and archaeological specimens . Originally based on the knowledge derived from biology and radiotherapy on DNA of living organisms, these assumptions have been since then tested on aDNA [2-3]. By using synchrotron irradiation protocols, we showed that the normal scanning conditions for voxel size of 30 microns in polychromatic beam were not leading to any measurable degradation of aDNA. However, we have noticed that when increasing the X-ray dose up to the one used for scanning dental microstructures with sub-micron resolution, it leads to more and more visible degradation of the aDNA, both in total retrievable quantity and on the length of the aDNA fragment [3-4]. Based on these results and on common sense, we proposed basic rules of good practice for scanning. More importantly, these results led to the experimental determination of the safe X-ray dose level to ensure that no measurable degradation of aDNA can occur . Here we present the technical solutions to make X-ray microtomography safe for future aDNA analyses, for both conventional and synchrotron approaches. In the case of synchrotron scans, the dose delivered during the scans for investigating incremental lines in complete teeth (6µm voxel size) has been decreased by a factor 70 times, well below the level of detectable effect on aDNA. These ongoing improvements are mostly based on new developments of the detector systems and on the optimization of the use of propagation phase contrast. The optimization of reconstruction algorithms should allow for a new dose decrease by 2 to 5 times without affecting significantly the quality of the data. The only setup that remains above the safe dose level is that used for dental or bone microstructure (0.7µm voxel size or smaller). Even if the dose was also decreased by 50 times, it still could partially degrade aDNA, although only in very limited areas of the specimens as only a small part of the sample is always in the beam. These irradiated areas can easily be tracked and documented for a given specimen. In the case of teeth, it is mostly located in enamel, where no aDNA analysis would be conducted anyway. Based on the synchrotron results, we applied the same approach in dosimetry on conventional X-ray sources used for microtomography at the MPI-EVA. This aims to test various scanning parameters, to ensure that the irradiation remains well below the defined safety level. If researchers and scanner operators comply with the basic rules to limit the X-ray dose delivered, namely by following simple recommendations, it will be possible to reconcile X-ray microtomography with aDNA analysis.

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Poster Presentation Number 6, Th (17:00-19:00)

Among the last Neanderthals. A reappraisal of the Grotta Breuil case-study (Monte Circeo, Latium, Italy)

Mary Anne Tafuri[1], Francesca Alhaique[2], Federico Bernardini[3], Fabio Di Vincenzo[1], Antonio Profico[1], Claudio Tuniz [3], Stefano Grimaldi[4], Giorgio Manzi [1]

1 - Sapienza University of Rome · 2 - Università della Tuscia, Viterbo · 3 - The 'Abdus Salam' International Centre for Theoretical Physics, Trieste · 4 - University of Trento

Survival in *refugia* could have been a critical aspect in the demise of Neanderthals, in a way that makes it crucial to investigate human dispersal and paleoecology of the last Neanderthal populations during the Late Pleistocene. South of the Alps and bound by the Appennines to the east and the Tyrrhenian coast to the west, southern Latium constitutes a geographical *cul de sac* and a possible refuge area during the Pleistocene, as also mirrored in the fossil record . In this perspective, we present a reappraisal of the Middle Paleolithic site of Grotta Breuil (Monte Circeo) , within a multidisciplinary investigation. The cave represents a Mousterian site that was is in use while, elsewhere in the Peninsula, Upper Paleolithic contexts are already present. Fossil human remains most probably associated with layer 5, dated to about 34,600 ± 330 BP (AMS uncalibrated date) , include the posterior-lower portion of a left parietal and two molars belonging to two different individuals, an adult and an old juvenile respectively . Zooarchaeological analysis revealed changes in hunted species, especially for what concerns seasonality (with main occupation of the site during autumn to spring) . The Grotta Breuil sequence seems to show changes in adaptive strategies across layers of occupation, with lower layers showing residential use and upper layers associated with a sporadic use of the cave throughout the year. Our project envisages a paleoantropological, archaeological, and palaeoecological investigation paired with a systematic isotopic study of human and animal fossils. The human specimens have been imaged by X-ray microtomography (μCT), with the aim to perform detailed morphometric analyses. The isotopic investigation includes oxygen (δ18O a), carbon (δ13C), and strontium (87Sr/86Sr) isotope ratios of carbonates of teeth of fossil faunas (with multiple species available for our study) sampled from the whole stratigraphy at the site. We aim at reconstructing the paleoecology of the later phases of the Middle Paleolithic with the isotopic ratios from the Neanderthal fossil found at the cave reconnecting human behavior with a wider ecological context.

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Poster Presentation Number 20, Th (17:00-19:00)

Re-thinking small: a difference between before and after the appearance of microblade technology in northeastern Asia

Jun Takakura[1]

1 - Hokkaido University

It is widely known that microblades from prepared cores appeared during the last glacial maximum in northeastern Asia, including northern China, Korea, Japan, and the Russian Far East. This technology is considered as the hallmark of highly mobile hunters who commonly exploited large angulates. Obviously there is a remarkable difference in the overall technological and behavioral characteristics of the lithic assemblages between before and after the appearance of the microblade technology in northeastern Asia. The appearance of the microblade technology in northeastern Asia is an imperative issue to evaluate the origins of "behavioral modern" elements in eastern Eurasia. Although the potential advantages of composite artifacts incorporating microblades over simple stone or bone tools have been often discussed, the appearance of the long-distance movement of high-quality raw materials and the curated tools maintenance have not been fully assessed until recently. The question why and how this technology appeared and dispersed rapidly throughout northeastern Asia, associated with "behavioral modern" elements, remains unclear. In this paper, I review the evidence of the origins and development of microblade technology in northeastern Asia and evaluate several hypotheses for their origins. In particular, I focus on the existence of variability among the earliest stages of the microblade assemblages throughout northeastern Asia, including northern China, Korea, Japan, and the Russian Far East, in terms of the lithic reduction sequences and the lithic raw material procurements. Although the pressure microblade flaking technique was applied for the various microblade production processes throughout northeastern Asia, different reduction processes of microblades, particularly the preparations of microblade cores as well as tools compositions, can be recognized. Given this diversity and complexity, a "one size fits all" model may neither satisfactorily characterize nor explain the origin of microblade technology.

Podium Presentation: Session 11A, Sa (16:40)

Quadrupedal subjects in a family (Adana, Turkey): comparison between two adult brothers' skeletons, one bipedal, one quadrupedal. Are they similar or different?

Christine Tardieu[1], Noémie Bonneau[2], Eylül Akbal[3], Levent Ozgozen[4], Ömer Sunkar Biçer[4], Osman Demirhan [3], Anthony Herrel[1]

1 - CNRS Paris · 2 - MNHN · 3 - Cukurova University, Dept. of Genetics · 4 - Cukurova University, Dept. of Orthopaedics

A better understanding of the role of genetic and epigenetic factors on skeletal features are of critical importance to the study of human evolution and the acquisition of bipedal locomotion in the human lineage. What was the role of genes? What is the role of environment ? Some models have been very informative such as Japanese macaques trained to walk bipedally or experiments during which goats were deprived of the use of their upper limbs at birth. Recently, humans which practice habitual quadrupedal locomotion were identified and the study of their skeletons constitutes a unique source of information. Our aim is to understand the impact of growth on a skeleton which presents the inherited characters of bipedalism but did not acquire the epigenetic features linked with bipedal gait acquisition [2, 3] and was remodelled by a quadrupedal practice of walking.

In a South Turkish village five adults of a family of 19 children suffer from a mutation at a gene of chromosome 17, inducing a loss of a fundamental protein implied in the development of the cerebellum . The cerebellar hypoplasia results in a drastic imbalance which renders the acquisition of bipedal locomotion difficult.

Two patients and one of their non-pathological brothers were examined at the hospital in Adana. Physical examinations, radiographies and CT-scanning were performed. Three-dimensional reconstructions of the pelvi-femoral complex based on the CT scans were obtained using Aviso software.

Here, we present our first results concerning femoral, spinal and pelvic characters. We measured the angle of femoral obliquity (bicondylar angle) and the anteversion and inclination angles of the femoral neck. We observed sections of the femoral diaphysis. On the pelvis we measured the angle of sacral incidence, a sagittal parameter which confers the location of the sacrum in relation to the acetabula and is tightly correlated with the degree of lumbar lordosis in adult humans . We measured the lumbar lordosis of the vertebral column. Values obtained on the male quadrupedal patient were compared to values obtained on the healthy brother who represents a control compared to the general population. We observed differences and we discuss these results in the light of acquired/inherited characters.

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Podium Presentation: Session 7B, Fr (16:40)

Upright to eternity - a new Mesolithic burial ground in NE-Germany

Thomas Terberger[1], Bettina Jungklaus[2], Andreas Kotula[3], Anna Schulz[4], Joachim Burger[4]

1 - State Agency for Heritage Service of Lower Saxony · 2 - Anthropologie Büro Berlin · 3 - Greifswald University · 4 - Mainz University

More than 50 years ago a multiple burial with three adult individuals and three children was accidently found on top of the Weinberg at Groß Fredenwalde, c. 90 km NE of Berlin. Recently the skeletons were analyzed in detail and a series of AMS-dates assigns the burial to c. 6000 calBC. At the same time re-excavation of the site started and in 2014 it was possible to detect new Mesolithic burials preserved in excellent condition neighboring to the former excavation. Among the new features the burial of a young man about 25 years old is outstanding: First the dead body was put standing into a deep pit with the legs fixed in sands. Gnawing marks indicate that the burial was left open for a while. After the collapse of the upper body part the burial was re-visited and some flint knifes were deposited together with the skull and mixed bones. Finally the burial was closed and a fire lit on top of the burial. There is no parallel for this unusual rite in Central Europe and the burial custom might reflect influences from the East. The burial was dug into a former burial, which was preserved by a few bones only. Together with a further burial found about 1 m distant there is now a minimum of 9 individuals identified at the site. Because there are indications that further burials are present on top of the Weinberg we suggest Groß Fredenwalde being a larger and very important burial ground of northern Central Europe with excellent preserved skeletons. The burials date to the 7th and 6th millennium and are very interesting for the study of the late hunter-gatherers and early farming communities. The lectures will also present first results of $^{13}C/^{15}N$-analyses and aDNA analyses. The ^{15}N-values vary between 11 to 12 ‰ and probably indicate consumption of fresh water fish. First results of aDNA-analysis of Groß Fredenwalde are strongly supporting the idea that the native Mesolithic population was genetically completely different to the new LBK farmers. In conclusion the potential of the site is outstanding.

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Poster Presentation Number 64, Th (17:00-19:00)

Sigma taxonomy in relation to palaeoanthropology and the lack of clear boundaries between species

Francis Thackeray[1]

1 - University of the Witwatersrand, South Africa

Hublin [1] has highlighted a problem relating to "the limits of a paleontological species". This problem may be approached using a morphometric method of the kind developed by Thackeray et al. [2], recognising that boundaries between species such as *Australopithecus africanus* and *Homo* are not necessarily clear. The method has been applied to measurements obtained initially from modern species (70 taxa), using least squares linear regression to quantify the degree of scatter around a regression line associated with the general equation y=mx + c, where m is the slope and c is the intercept. Thackeray et al. [2] reported central tendency of the log-transformed standard error of the m-coefficient, known as "log sem", based initially on pairwise comparisons of conspecific specimens in museum collections of extant taxa. Central tendency has been found for both vertebrates and invertebrates [2], associated with a mean log sem value of -1.61 [3]. This log sem value has been hypothesised to be an approximation for a biological species constant (T), expressed through geographical space and evolutionary time, associated with a statistical (probabilistic) definition of a species that could be applied to fossils, including specimens attributed to *Australopithecus* and early *Homo* [3]. This approach offers the potential to assess probabilities of conspecificity when pairs of fossils are compared. In the light of criticisms from Gordon and Wood [4], it is necessary to take into account the range of variation of log sem values when pairwise comparisons are made between specimen A (on the x axis) and specimen B (on the y axis), and vice versa. This range of log sem values for pairs of specimens is designated Delta log sem. The mean range of log sem values for pairwise comparisons of modern conspecific primates is small, in the order of 0.03, contrasting with larger Delta log sem values when comparisons are made between modern specimens of different taxa (Thackeray and Dykes, unpublished). Log sem and Delta log sem values, when taken together, have potential for assessing probabilities of conspecificity, and can be used in the context of "sigma taxonomy", without assuming clear boundaries between species. "Sigma" relates to "S" in the context of a spectrum of variation between taxa within evolutionary time and geographical space. As an example, pairwise comparisons of crania of selected well-preserved specimens attributed to *A. africanus* and *H. habilis*, dated within the period 1.6 – 2.6 mya, are undertaken to assess the probability that they are conspecific. In this study, comparisons are made where specimen A is on the x axis and specimen B on the y axis, and vice versa. The mean log sem value for pairwise comparisons of early Pleistocene hominin specimens (Sts 5, Sts 71, OH 24 and KNM-ER 1813) is -1.60 +/- 0.07. The mean delta log sem value for the pairwise comparisons of these early Pleistocene hominin specimens (attributed to *Australopithecus* or early *Homo*) is small (0.03). Implications of the results are as follows: (1) that certain hominin crania attributed to either *A. africanus* or *H. habilis* (dated within the period 1.6 – 2.6 mya) have a high probability of conspecificity, and (2) there is no clear boundary between *Australopithecus* and *Homo*. There is a need to assess the classification of hominins in a probabilistic framework (sigma taxonomy), as opposed to alpha taxonomy defined by Mayr et al. [5] which is based on the assumption of clear boundaries between species.

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Poster Presentation Number 100, Fr (12:20-13:50)

Trabecular bone architecture and distribution in the talus and distal tibia of *Homo* and *Pan*

Zewdi J. Tsegai[1], Matthew M. Skinner[1,2], Dieter H. Pahr[3], Jean-Jacques Hublin[1], Tracy L. Kivell[1,2]

1 - Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology · 2 - School of Anthropology and Conservation, University of Kent · 3 - Institute of Lightweight Design and Structural Biomechanics, Vienna University of Technology

As trabecular bone remodels during life in response to loading, trabecular architecture and regional distribution are expected to reflect joint kinematics. However, previous trabecular analyses, focused primarily on the proximal humerus and femur, have often been unable to identify functionally relevant signals of behaviour. The joint between the distal tibia and talus is highly congruous, and therefore trabecular bone across the ankle joint may be more likely to directly reflect loading, in comparison to joints supported by complex musculature, such as the proximal humerus and femur. This makes the talocrural joint well-suited to testing the relationship between joint loading and trabecular structure. We apply a whole epiphysis method of trabecular analysis (medtool) to microcomputed tomographic (microCT) scans of paired distal tibiae and tali of knuckle-walking/climbing *Pan troglodytes verus* and bipedal *Homo sapiens* in order to determine whether trabecular bone at the talocrural joint, and at the talar head, reflects known joint kinematics in these taxa. These two taxa differ in loading of the talocrural joint due to both their different modes of locomotion, and to differences in conformation of the leg and set of the ankle joint. We create 3D colour maps to visualise the distribution of bone throughout the talus and distal tibia, in addition to quantification of overall bone volume fraction (BV/TV), degree of anisotropy (DA), connectivity density (ConnD), bone surface to volume ratio (BS/BV), trabecular thickness (Tb.Th) and structure model index (SMI) throughout the bone. We find differences in trabecular bone distribution of the talus and distal tibia which reflect use of the talocrural joint in a more neutral position in *Homo*, compared with the greater degree of dorsi- and plantar- flexion in *Pan*. Although highly variable in both taxa, the trochlea in *Pan* is characterised by an anterolateral region of high BV/TV, in contrast to the more central region in *Homo*. The known kinematic differences in degree of flexion are more clearly reflected at the distal articular surface of the tibia. Here, there is a central localisation of trabecular bone in *Homo*, which is unlike the anterior and posterior concentrations in *Pan*. This variation in the distal tibia is also visible in the mid-sagittal plane, where there is a central density in the human specimens in contrast to the anterior and posterior densities in *Pan*. Differences in mobility of the talonavicular joint are also reflected in trabecular bone distribution in the talus. On the anterior surface of the talar head, *Homo* is characterised by a localised point of high BV/TV and a trajectory of bone running through the centre of the head, reflecting a more rigid joint than that of *Pan*. In contrast, in *Pan*, the region of high BV/TV extends mediolaterally and there is no central concentration, reflecting greater mobility at this joint. The trabecular architecture of the *Pan* talus differs from that of *Homo* in having thicker trabeculae, higher BV/TV, lower BS/BV, and less preferentially oriented and more plate-like trabeculae. There are fewer interspecific differences in trabecular architecture of the distal tibia, where *Pan* is characterised by higher BV/TV and greater connectivity combined with a lower BS/BV. There are clear interspecific differences in trabecular bone architecture between *Homo* and *Pan* in both the talus and distal tibia, of which at least some can be related to variation in joint function. Trabecular bone distribution across the talocrural joint, and at the talar head, correspond with loading of these joints in *Pan* and *Homo*, suggesting that this region is a promising location for inferring locomotor kinematics in fossil taxa.

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Poster Presentation Number 102, Fr (12:20-13:50)

Phenotypic Plasticity: Behavioral induced change in ankle shape due to altered habitat in the Macaque model, with insights into rapid shape change in Plio-pleistocene hominins

Kevin Turley[1], Andrea Eller[1], Julia Arenson[1], Stephen Frost[1]

1 - University of Oregon

Recent studies of the Plio-Pleistocene hominin fossil record show rapid change in morphology concomitant with rapid climate change. The relation of behavior to ankle shape with change in habitat among closely related Hominoid species (*Homo sapiens* and *Pan troglodytes*) suggests phenotypic plasticity as a possible mechanism to potentiate natural selection. Previous studies using Singular Warp analysis of talo-crural joints in a diverse Catarrhine sample of talo-crural joints showed that superfamilies respond to stable (terrestrial) or flexible (arboreal) use with similar shape changes, genera differ in shape in response to this same behavioral stimuli, and within species differences in shape are observed in response to environmental factors. The current study examines the talo-crural joint shape of three closely related extant species of *Macaca*, a genera genus second only to *Homo* in worldwide distribution. It focuses on *Macaca mulatta*, the Rhesus macaque, as a model to study the effect of habitat change on behavior effecting substrate use and with it talo-crural shape. Phenotypic plasticity as the mechanism of behind such rapid shape change is explored.

The study group was 80 specimens (46 adults and 34 subadults) from three closely related species *M. thibetana*, *M. fascicularis* and *M. mulatta*. The 29 adult *M. mulatta* included wild shot (5), captive in a contained facilities (5) and captive in an open facility (7) all captured from wild populations as adults, and a free ranging multigenerational (8-12 generations) wild captured population (Lucknow, India, 1938) (12). All had provenience and generational data documented. Specimens of distal tibiae and matched tali (right or left side from the same individual) were laser scanned and twenty-seven landmarks (15 talar and 12 tibial) were placed using Landmark Editor software. The total, adult, and subadult *Macaca*, as well as, the five *M. mulatta* subgroups were separately examined using Generalized Procrustes analysis, Multivariate Regression, Relative Warps, and Singular Warp analysis. Singular warp analysis, as in prior studies, found no trajectory of talo-crural joint shape in relation to developmental age. Evidence for an epigenetic effect associated with individual substrate use was detected in the adults. All subadults clustered with more flexible adults. *M. thibetana* displayed the most stable talo-crural joint shape. *M. fascicularis* had the most flexible joint profile. Finally, *M. mulatta* demonstrated a difference among subgroups, in specific, the free ranging captive population. Although all had flexible profiles relative to *M. thibetana*, the free ranging group, 8 to 12 generations in an island habitat, altered their behavior and had a uniquely more stable ankle profile.

Macaca demonstrated sorting of talo-crural shape consistent with prior total Catarrhine and Hominoid samples by substrate use. The *M. mulatta* samples, from the first generation from a wild habitat showed no difference in shape profile from wild shot. However, the free ranging group sorted with a more stable profile, suggesting rapid change in morphology over generations due to change in behavior related to substrate use. These effects were observed in *P. troglodytes* and *H. sapiens* in a prior study, and in the latter, the extragenomic transfer of information, "culture". Rapid change in environment, such as human interventions in Rhesus macaque habitat, may provide a model for rapid shape changes among Plio-Pleistocene hominins, with behavioral change over a limited timeframe (generations) manifest in phenotypic plasticity within the context of interaction-driven evolutionary divergence.

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Podium Presentation: Session 7B, Fr (16:00)

Animal crania as funerary artefacts in the Iberomaurusian cemetery at Grotte des Pigeons at Taforalt, north-east Morocco

Elaine Turner[1], Louise Humphrey[2], Abdeljalil Bouzouggar[3,4], Nick Barton[5]

1 - Monrepos Archaeological Research Centre and Museum for Human Behavioural Evolution · 2 - Department of Earth Sciences, The Natural History Museum · 3 - Institut National des Sciences de l'Archéologie et du Patrimoine, Rabat-Instituts · 4 Dept. Human Evolution, Max Planck Institute for Evolutionary Anthropology · 5 - Institute of Archaeology, University of Oxford

With its unparalleled sequence of human occupation spanning well over 100ka, the cave site of Grotte des Pigeons, close to Taforalt in north-east Morocco, plays an important role in our understanding of human evolution and behavioural development. Ongoing investigations at this site have already produced groundbreaking results, such as evidence of the early use of personal adornment at 82ka, high precision AMS dates for the Late Pleistocene Maghreb and the first appearance of the Iberomaurusian and details of Iberomaurusian human mortuary behaviour in the remains of perhaps one of the earliest and most extensively used Epipalaeolithic cemeteries in North Africa. In this presentation, we focus on Iberomaurusian funerary objects, in particular the crania of medium-large sized herbivores placed deliberately in some graves, probably as part of funerary rituals. In the first half of the 1950's, Abbé Roche directed excavations at Taforalt. He recovered many partial skeletons from two burial areas inside the cave, which he named Necropolis I and II [1, 2]. He also reported skeletons of adults and children in association with deliberate arrangements of "mouflon" horns [1, 2]. Recent studies of finds from Roche's excavations stored in the museum in Rabat revealed several partially preserved crania of Barbary sheep (*Ammotragus lervia*) and these are probably the finds identified as "mouflon" by Roche. The bulk of these crania show a repetitive pattern of preservation, comprising the bases of the horns, and portions of the frontal, parietal and occipital bones respectively. When Roche closed his excavations in 1955, he had only partially excavated Necropolis II and left intact an area of at least six square metres of this burial area in a recess at the back of the cave. In 2004, just after the commencement of the recent investigations at Taforalt, a rich accumulation of human and animal bones, lithic artefacts and burnt terrestrial snails were observed eroding out of thick deposits of grey ash in this area (Sector 10) [3]. Excavations uncovered a number of single, primary inhumations within the lowest levels of the ash deposits. Human bone samples from these graves have been direct dated by AMS to between 13929 and 15016 Cal BP. One of these graves (TAF I1) [4] contained the skeleton of a young woman, buried with portions of horn cores of a very large bovine. The horn cores had been deliberately laid in the grave after deposition of the body and arranged on either side of the corpse. The location of bones of the right fore-arm and hand, indicate a deliberate placement of the hand with the palm facing down on the upper surface of the horn-core to the right side of the body [3]. Crania of Barbary sheep were also revealed during excavation of the burial area in Sector 10. It is noteworthy that the preservation of these finds is remarkably similar to that observed on the crania of this species found during Roche's investigations, suggesting the former finds were also funerary objects. However, in contrast to Roche's findings, the horn-cores in Sector 10 are, so far, only associated with the graves of adults. Evidence from the newly excavated graves in Sector 10 at Taforalt and results of new analyses of the human remains recovered by Roche [5], suggest funerary activities at Taforalt became more elaborate with time . In contrast to other funerary objects which show no consistent pattern of inclusion, the presence of horn cores of medium-large sized herbivores, either laid in, above or close to the graves, suggests a continued use of horn cores in Iberomaurusian funerary traditions.
Acknowledgements: E. Turner thanks the director of the Musée Archéologique in Rabat. We also thank the National Institute of Archaeological Science and Heritage (INSAP, Morocco). Research at Taforalt was supported by the Leverhulme Trust (F/08 735/F) and the Calleva Foundation.

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Poster Presentation Number 58, Th (17:00-19:00)

Sexual dimorphism in the bony labyrinth of geographically diverse samples

Alexandra Uhl[1], **Katerina Harvati**[1]

1 - Paleoanthropology, Senckenberg Center for Human Evolution and Paleoenvironment, Eberhard Karls Universität Tübingen

Previous research on the bony labyrinth focused primarily on its morphology, phylogeny, and role in locomotion, e.g. [1-3]. The bony labyrinth was recently also shown to be sexually dimorphic in a Greek population [4]. The present research aims to assess whether the results of Osipov et al. [4] are applicable across samples of diverse geography. Population samples studied include 38 adult Zulu from the Dart collection at the University of the Witwatersrand, Johannesburg, South Africa; as well as 30 adults from Baden-Wuerttemberg, Germany, housed in the collections of the Eberhard Karls Universität Tübingen. All individuals were of known sex. CT-scans of crania were obtained on site. The sample from Germany was scanned at the Paleoanthropology High Resolution CT Laboratory, Eberhard Karls Universität Tübingen, using a Phoenix v|tome|x µCT scanner (General Electric) and 180 kV, 120 µA, 2500 images per scan with an exposure of 200 milliseconds (ms) per image and a resolution between 101.778 and 130.461 µm with a 0.1Cu filter. The Zulu sample was scanned at the Palaeosciences Centre Microfocus X-ray Computed Tomography (CT) Facility with a Nikon Metrology XTH 225/320 LC at 100 kV, 105 µA, with an exposure of 500ms per image, resolution between 60 and 120 µm and a 1.8AI filter. Both the left and right bony labyrinths were segmented using Avizo software (FEI Company, Hillsboro, OR, USA). The segmented volume was thinned to a skeleton (a centerline of connected voxels), which was placed through the virtual endocast with the Auto Skeleton module, following methods similar to those established by ref. [3]. Then, 20 landmarks per side (40 total) were placed along the three semi-circular canals, as well as on the cochlea. Using the pythagorean theorem, the distances between certain landmarks allowed us to calculate the height and width of each canal and the cochlea according to the dimensions used in ref. [4] and based on ref [5]. Indices from these publications for the radius of curvature (ASC-R, PSC-R, LSC-R) and relative radii (ASC%R, PSC%R, LSC%R) were also calculated. In order to observe and classify the relationship between males and females based on the variables measured, a discriminant analysis was used. For the Zulu (n =38), correct classification by sex was 82 percent. For the German sample (n = 30) discrimination accuracy for sex was slightly lower at 77 percent. When all individuals were analyzed together (n = 68), the discriminant classification accuracy was 76 percent. T-tests reveal that for the Zulu, ASC-R (anterior semicircular canal radius of curvature) was significantly different between the male and female means with a p-value of 0.005. PSC-R (posterior semicircular canal radius of curvature) was significant at p=0.025. For the German sample, SLI (a ratio indicative of the position of the lateral canal relative to the posterior canal) was significant (p=0.048). These results are similar to those found by ref. [4] with PSC-R as the single best variable for sex estimation with 76 percent accuracy. Two multivariate functions increased this accuracy to 84 percent. Since the petrous portion of the temporal bone (which houses the bony labyrinth) is often preserved in the fossil and archaeological records, the development of a sex estimation method based on this structure could provide an important tool, applicable across several fields.

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Podium Presentation: Session 10A, Sa (14:30)

Neanderthal Genomics Suggests a Pleistocene Time Frame for the First Epidemiologic Transition

Simon Underdown[1], **Charlotte Houldcroft**[2]

1 - Human Origins and Palaeoenvironmental Research Group (HOPE), Department of Anthropology, Oxford Brookes University · 2 - Infection, Immunity, Inflammation and Physiological Medicine, UCL, Institute of Child Health and Division of Biological Anthropology, University of Cambridge

Current models of infectious disease in the Pleistocene tell us little about the pathogens that would have infected Neanderthals (*Homo neanderthalensis*). High quality Altai Neanderthal and Denisovan genomes are revealing which regions of archaic hominin DNA have persisted in the modern human genome. A number of these regions are associated with response to infection and immunity, with a suggestion that derived Neanderthal alleles found in modern Europeans and East Asians may be associated with autoimmunity. Independent sources of DNA-based evidence allow a re-evaluation of the nature and timing of the first epidemiologic transition.

The paradigm of the first epidemiologic transmission, the hypothesis that epidemic disease did not occur until the transition to agriculture, with larger, denser and more sedentary populations, has been essentially unchallenged since the 1970s. Our views of the infectious disease environment of the Pleistocene period are heavily influenced by skeletal data and studies of contemporary hunter-gatherers. New genetic data – encompassing both hosts and pathogens – has the power to transform our view of the infectious disease landscape experienced by Neanderthals in Europe, and the AMH with whom they came into contact. The Pleistocene hominin environment cannot be thought of as free from infectious disease. It seems likely that the first epidemiologic transition, envisaged as part of the package of the Holocene farming lifestyle, may be fundamentally different in pace or scope than has previously been suggested.

This paper demonstrates how high quality genomic data sets can be used to address questions arising from the ecological context that shaped the co-evolutionary relationship we share with infectious diseases. We analyse the evidence for infectious disease in Neanderthals, beginning with that of infection-related skeletal pathologies in the archaeological record, and then consider the role of infection in hominin evolution. We have synthesised current models on the chronology of emergence of notable European disease packages and analyse what implications this evidence has for the classical model of the first epidemiologic transition. Using emerging data from Neanderthal palaeogenomics and combining this with fossil and archaeological information we re-examine the impact of infectious diseases on human populations from an evolutionary context.

We argue that the first epidemiologic transition in Eurasia was not as tightly tied to the onset of the Holocene as has previously been assumed. There is clear evidence to suggest that this transition began before the appearance of agriculture and occurred over a timescale of tens of thousands of years. We suggest that the epidemiological transition was not, as has been thought since the 1970s, a phenomenon of the human shift to sedentary agriculture during the Holocene but a much older and more complex process that involved at least two species of humans. The origin of resistance to infectious disease has a much deeper timeframe and is highlighted by the ingression of Neanderthal DNA into modern human lineages. The transfer of pathogens between human species may also have played a role in the extinction of the Neanderthals.

Our analysis of the genomes of archaic hominins provides evidence of pathogens acting as a population-level selection pressure, causing changes in genomes that were passed on to descendants and preserved in the genomes of modern Eurasians. The analysis of ancient genomes demonstrates that human behavioural patterns (in this case a shift to agricultural subsistence) should not be used as an ecological proxy to explain shifting trends in the co-evolutionary relationship between pathogens and human populations.

This work is available on BioRxiv: http://dx.doi.org/10.1101/017343

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Poster Presentation Number 66, Th (17:00-19:00)

A New Model of Human Dispersal

Trevor Underwood[1]

1 - Independent researcher

This presentation examines previously unpublished allele counts obtained from the French-San-Neanderthal-Chimpanzee alignment of the high quality DNA sequence of a Neanderthal from the Altai Mountains [1]. This analysis indicates the existence of an unidentified third archaic ancestor of present-day Europeans, which diverged from its common ancestor with sub-Saharan Africans and Neanderthals around 900 thousand years ago. It also shows that the relative proportions of derived alleles of Neanderthals versus sub-Saharan Africans versus the third archaic ancestor, in the 0.0826% the European genome that is not shared with the common ancestor of humans and chimpanzee, are 13.6%, 32.3% and 54.2%, respectively. In addition, analysis of the also unpublished allele counts from the alignment of the 45 Kya fossil from Ust'-Ishim in western Siberia [2] and of the alignment of the 36.2 Kya Kostenki 14 (Markina Gora) fossil from Kostenki-Borshchevo in European Russia [3] show similar relative proportions, suggesting that these individuals were closely related to the ancestor of present-day Europeans. These results differ significantly from previous estimates of the proportion of Neanderthal ancestry in present-day Europeans which range from 1.3% to 2.7% [1, 4, 5]. This presentation also identifies a mathematical error in the derivation of the admixture proportion estimators used to generate the previous estimates which explains this difference. The analysis of the allele counts together with anthropological and archaeological evidence suggests a new model of human dispersal based on a Eurasian lineage in the Levant, which admixed with Neanderthals between 250-55 Kya as they expanded eastward, and subsequently with members or descendants of the African mtDNA haplogroup L3 after their emergence from Africa between 84-63 Kya. This was followed by radiation from a basal admixed population in the Levant from around 55-50 Kya, with no subsequent major contribution to the European genome. Ancestors of the Ust'-Ishim individual, a member of mtDNA haplogroup R, probably went northeast from the Levant into western Siberia around 47 Kya; and ancestors of the Kostenki 14 individual, a member of mtDNA haplogroup U2, probably moved northward from the Levant into the Central European Plain between 40-36 Kya. It is likely that other members of these hybrid populations with a morphology similar to present-day *Homo sapiens*, including mtDNA haplogroups N, R, U, U2, U8 and JT, expanded westward into Europe along the Danube and Mediterranean coast and replaced the already dwindling Neanderthal populations between 45-35 Kya, rather than newly emerged sub-Saharan Africans as has been assumed. If this new model of human dispersal is correct, it has profound implications for the interpretation of the anthropological and archaeological evidence, which has largely been framed within the Recent Out-of-Africa model.

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Podium Presentation: Session 9, Sa (11:20)

Not so much strength in numbers after all – Demographic explanations of cultural change re-examined

Krist Vaesen[1,2], **Mark Collard**[3,4]

1 - Eindhoven University of Technology · 2 - Leiden University · 3 - Simon Fraser University · 4 - University of Aberdeen

We argue that, despite claims to the contrary, demography hasn't been established to be the key driver of cultural change. Consequently, we urge caution in explaining cultural transitions documented in the archaeological record (e.g. cultural loss in Holocene Tasmania, the Upper Paleolithic transition, the Neanderthal-*Homo sapiens* transition in Europe) in terms of demography.

Our argument proceeds in three steps. First, we point out that population-dynamic models supposedly confirming the dependence of cumulative culture on demography make very strong, unsubstantiated assumptions about social learning mechanisms and about cultural complexity. Based on work by Vaesen and colleagues [1, 2], we show that under more conservative and, on empirical and theoretical grounds, equally reasonable assumptions, the models predict cultural stasis rather than change.

Second, we evaluate the empirical evidence invoked in support of the demographic hypothesis. We explain that population size may play two roles — it may act as a *passive* constraint on or as an *active* driver of cultural complexity — and that confirmation of either of those requires different types of evidence. The former would be confirmed if, minimally, correlations between *absolute* measures of population size and complexity were observed; confirmation of the latter demands, minimally, correlations between demographic and cultural *change*. Based on earlier and new research on contemporary hunter-gatherers by Collard and colleagues and based on a careful re-examination of the evidence provided by Henrich and by Powell and colleagues , we conclude that there is little empirical support to assign demography either a constraining or a driving role.

Third, we argue that demographic explanations, even if the models and evidence on which they are based were sound, do not do what they have been claimed to do, namely to provide an alternative to cognitive explanations. More specifically, demographic explanations of cultural loss in Holocene Tasmania and of the Upper Paleolithic transition are in fact cognitive explanations in disguise; those of the Neanderthal-*Homo Sapiens* transition do not qualify as explanations at all.

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Podium Presentation: Session 10A, Sa (14:10)

Inferring Human History Using DNA

Lucy van Dorp[1,2], **Saioa Lopez**[1], **David Balding**[1,3], **Garrett Hellenthal**[1]

1 - UCL Genetics Institute (UGI) · 2 - Centre for Mathematics, Physics and Engineering in the Life Sciences and Experimental Biology (CoMPLEX), University College London, London, United Kingdom · 3 - Schools of BioSciences and of Mathematics & Statistics, University of Melbourne, Australia

The widespread availability of densely genotyped individuals sampled from hundreds of world-wide geographic locations has enabled researchers to reconstruct the ancestral histories of populations in unprecedented detail using DNA alone. This includes quantifying the extent of genetic relatedness among different labeled populations, e.g. those with varying levels of cultural and phenotypic similarity, and determining whether populations share similar recent genetic ancestry versus being anciently related to one another. DNA can now also be used to determine whether different groups have intermixed in the past due to migration events and, if so, precisely which groups and when. Importantly, the ability to classify DNA segments within extant individuals to a specific time and place where the segments were inherited allows researchers to discern which periods of known (or proposed) cultural transmission were accompanied by genetic transmissions.

We demonstrate an approach that is more powerful than other commonly-used approaches to study DNA within and between populations, such as principal-components-analysis (PCA) and STRUCTURE/ADMIXTURE. In particular our approach "chromosome painting" (implemented in the freely-available software CHROMOPAINTER, fineSTRUCTURE, GLOBETROTTER) exploits correlations among neighboring Single-Nucleotide-Polymorphisms (SNPs) to increase power in identifying and quantifying the ancestral histories of groups. We show how the application of these algorithms to different populations and datasets has enriched our previous understanding of the history of these populations. For example, we apply our methods to genome-wide DNA from the Ari people of Ethiopia to distinguish between two alternative theories among anthropologists concerning the origins of marginalised occupational groups in the region. Specifically, we show that Ari Blacksmiths and Ari Cultivators share similar recent genetic origins, contradicting theories (some based on DNA evidence) that Blacksmiths are remnants of hunter-gatherer populations anciently genetically related to other Ethiopian ethnic groups. We furthermore show how the DNA from extant populations can be used to shed light on the number of initial waves of migration out-of-Africa when colonizing the rest of the world.

Overall we illustrate how DNA can be used to resolve controversies about the origins and interactions of world-wide groups, particularly cases where there are debates among anthropologists or where few historical records exist.

Podium Presentation: Session 10B, Sa (14:30)

Lower Palaeolithic bone tools from the 'Spear Horizon' at Schöningen (Germany)

Thijs van Kolfschoten[1], Simon A. Parfitt[2], Jordi Serangeli[3], Silvia M. Bello[4]

1 - Faculty of Archaeology, Leiden University · 2 - Institute of Archaeology, UCL · 3 - Institut für Ur- und Frühgeschichte, Tübingen · 4 - Dept. of Earth Sciences, NHM London

The Palaeolithic locality of Schöningen (Germany) is well known for the discovery of extraordinary Lower Palaeolithic wooden spears found amongst the butchered remains of horses and other large herbivores at the site Schöningen 13II-4 (the Horse Butchery Site). The discovery of the spears initiated debates on spear-aided hunting of large game in the Lower Palaeolithic. However, other aspects of the artefact assemblage of the site have received less attention; in particular the bone tools. We investigated in detail an extraordinary assemblage of 88 bone tools from the 'Spear Horizon'. The modified bones include numerous long bone shaft fragments with localized areas of overlapping impact pits and scores, some of which contain microscopic chips of flint. Many of these retouchers exhibit extraordinary long scraping marks related to the removal of periosteum and/or other adherent material. The lithic assemblage is dominated by unifacially-retouched flint flakes. Technological analysis and microartefact evidence demonstrates that tools were re-sharpened to maintain functional cutting edges during butchery. Whereas the flint tools were curated and maintained, the retouchers had a shorter use-history and were either discarded after a short period of use or broken for their marrow content. These differences in the use-history of the bone and flint tools may be a result of local circumstances and the availability of different raw materials, both at the site, and regionally

Horse and bison metapodials with unusual flaked and rounded epiphyses exhibit none of the characteristic microscopic features found on the knapping percussors; it is suggested that these metapodials were used to break marrow bones. Several of the 'metapodial hammers' were also used as knapping percussors. These represent the earliest evidence for multipurpose bone tools in the archaeological record

Our results highlight the advanced knowledge in the use of bones as tools during the Lower Palaeolithic with major implications for understanding planning depth in early humans and the degree to which they were able to adopt a flexible response to cope with abundance and limited resources.

Podium Presentation: Session 6A, Fr (14:10)

Allometry, encephalisation and mandible reduction in *Homo*: a primate perspective

Alessio Veneziano[1], Carlo Meloro[1], Joel D. Irish[1], Chris Stringer[2], Isabelle De Groote[1,2]

1 - Research Centre in Evolutionary Anthropology and Palaeoecology, School of Natural Sciences and Psychology, John Moores University, Liverpool, United Kingdom · 2 - Earth Sciences Department, The Natural History Museum, London, United Kingdom

A reduction of the masticatory apparatus has been identified as one of the major anatomical changes that occurred during the evolution of the genus *Homo*. The hypotheses put forward so far suggest that advances in food processing and a dietary shift to softer foods may have driven this reduction: a smaller size in mandibles and teeth would have been the result of the reallocation of energy no longer needed for large jaws [1, 2]; also, moving to softer foods might have relaxed the selective pressures on mastication [3]. Both size and robusticity have been claimed to be part of this decreasing trend but none of the proposed explanations has proven conclusive. In addition, the trends toward larger body mass and big brains are accepted facts in *Homo*. Nonetheless, the role that allometry and encephalisation played in the evolution of the hominin masticatory apparatus is still not well understood. In this study we adopted a primate perspective on the reduction of the lower jaw in *Homo* through a Geometric Morphometrics approach. 3D landmark configurations were recorded on the mandible, teeth and neurocranium of 49 species of catarrhines, inclusive of colobines, cercopithecines, hylobatids, great apes and hominins. Centroid Size of the landmark configurations was used as a proxy for mandibular, cranial and dental size; for each species sex-averaged body mass values [4] were considered in the analyses. Procrustes shape coordinates were employed to test for mandibular and tooth allometry and to analyse the pattern of morphological integration between the three anatomical regions considered: morphological integration was assessed by calculating RV coefficients of covariation. Due to species sharing more traits with closely related taxa, phylogeny was taken into account in the allometry analyses using Phylogenetic Generalised Least Squares (PGLS). The results highlight a significant association between body mass and mandible size before (R_2=0.74, slope=0.27) and after phylogenetic corrections (PGLS λ=0.92, slope=0.53). However, *Homo* shows a considerable departure (slope=-0.66) from the trends observed in the other catarrhines families (slopes from 0.30 to 0.41). A similar pattern is observed for tooth size, although after body mass correction only the molars size correlates with mandible size in *Homo* (slope=0.77), while great apes show strong correlations for the whole post-canine dentition. The major allometric changes in the mandible (45.01% of total morphological variance) are associated with the anterior alveolar projection, and with the proportions of the mandibular ramus relative to the corpus. In these regards, *Homo* is characterised by a decrease in the alveolar projection, probably leading to the emergence of the chin, and by a marked reduction in mandibular ramus proportions. A negative correlation between the mandibular ramus proportion and neurocranium size has been detected in *Homo* (R_2=0.51, slope=-0.18), which is absent in great apes. The morphological integration between mandible and teeth was lower in *Homo* (RV=0.53 on RVmin=0.53) than in great apes. Also, *Homo*, *Gorilla* and *Pongo* show high degrees of integration between mandible and neurocranium (RV= 0.70, 0.55 and 0.67 respectively). Integration between teeth and neurocranium is high in great apes, while no significant pattern is detected for *Homo*. These results indicate that lower jaw reduction in *Homo* was caused by changes in the size of the neurocranium as well as of masticatory muscles, and that allometry may have played an important role in molar size reduction. The absence of integration between mandible and teeth may indicate a possible functional decoupling of the two regions. The outputs of this study support the hypothesis that functional relaxation and allometric constraints were crucial in the reduction of the masticatory apparatus in *Homo*.

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Podium Presentation: Session 10B, Sa (14:10)

A Site for all Seasons: Reconstructing the Occupational History of the Middle Pleistocene Schöningen 13II-4 "Spear Horizon"

Aritza Villaluenga[1], Jarod Hutson[1], Alejandro García-Moreno[1], Elaine Turner[1], Sabine Gaudzinski-Windheuser[1]

1 - MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution-RGZM, Neuwied, Germany

The first report of several well-crafted wooden spears and numerous butchered horse bones at the Schöningen 13II-4 site (Lower Saxony, Germany) drew international attention and altered the perception about the capabilities of Middle Pleistocene hominins [1]. Since its discovery, a wealth of research has sought to clarify the geological, palaeoenvironmental and biostratigraphical settings for the "Spear Horizon" within a regional context [2]. However, lacking are the finer details of site formation that relate directly to Middle Pleistocene hominin behaviours along the interglacial lakeshore at Schöningen, some 300,000 years ago (MIS 9). Here we present an in-depth examination of the complete faunal assemblage from the Schöningen 13II-4 "Spear Horizon", focusing on high-resolution taphonomic and GIS-based spatial analyses to evaluate the unique depositional history of this important site. With the remarkable preservation of the bone assemblage, we can reconstruct the various biotic and abiotic processes that ultimately led to site formation within a precise spatial framework. Coupled taphonomic and spatial data point to a shifting shoreline, with accumulation and subsequent deposition in very shallow water. Despite the fluctuating shoreline, we contend the site is largely *in situ*, as no hydrological processes have influenced the distribution or orientation of bones within the deposit. Through multiple lines of evidence, it is becoming increasingly clear that the faunal remains and other associated artefacts represent more than one hunting and butchery episode. Horse (*Equus mosbachensis*) bones overwhelmingly dominate the assemblage, a large portion of which shows traces of butchery, and are heavily concentrated along a single, north-south axis spanning the large excavated area (3.900 m2). Further clusters of horse bones are scattered across the site, possibly indicating relict shorelines. Bovid and cervid remains are also well-represented, but cluster within different areas of the site. Bone concentrations of these large mammal species roughly overlap with the distributions of lithic, bone and wooden artefacts across the site, providing further evidence for repeated use of the locality for ambush hunting and butchery by Middle Pleistocene hominins. In contrast, small mammals, fish, some bird remains and unmodified wooden fragments show no preferential distributions, thus reflecting natural inputs into the site unrelated to hominin activities. Carnivore remains are present, but access to carcasses in most instances appears to be secondary to hominin butchery. At present, we hesitate to hypothesise on the exact number of hunting events or time depth represented in the deposit, but animal deaths spanning all seasons of the year indicate a constant hominin presence along the Schöningen lakeshore. Together with a detailed archive of the wider palaeolandscape, these high-resolution taphonomic and spatial analyses form a holistic approach to contextualize Middle Pleistocene hominin behaviours at multiple scales. The warm, interglacial environment offered hominin groups a diverse assortment of resources. The wider lakeshore environment was likely a dominant feature on the landscape, supporting a wide array of vegetation and providing water for abundant herds of large game. At a local scale, Middle Pleistocene hominins took full advantage of this collection of resources to repeatedly ambush unsuspecting prey. While the initial interpretation of the Schöningen 13II-4 "Spear Horizon" must be amended to include multiple hunting episodes, the site continues to change the perceptions of Middle Pleistocene hominin behaviour.

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Podium Presentation: Session 6A, Fr (14:50)

Shape variability in the human postcanine dentition

Gerhard Weber[1], Viktoria Krenn[1], Lisa Buchegger [2], Dominika Teplanova[2], Cinzia Fornai[2]

1 - Department of Anthropology & Core Facility for Micro-Computed Tomography, University of Vienna · 2 - Department of Anthropology, University of Vienna

Tooth shape is used frequently in palaeoanthropology for taxonomic and comparative purposes, nonetheless little is known about dental variation in modern human populations, particularly in 3D. In general, we cannot expect strong selective pressure on tooth form in recent humans, even if they show different subsistence patterns, because the influence on reproductive success would be rather small considering that extra-oral food processing was universally practiced since at least the Late Pleistocene. Food properties are significantly modified through cooking, milling, or preservation techniques which "may have almost taken the job of the dentition and masticatory apparatus away" [1]. Random gene drift, population bottlenecks, sexual selection, and possible admixture with archaic humans are factors that could have influenced tooth shape of modern humans. Dental shape might thus vary between different geographical populations. For instance, those populations featuring a deeper split time and subsequent reproductive isolation from others should in principle present greater differences. We therefore hypothesize that behaviourally diverse recent human populations will overlap considerably in tooth shape, but populations such as Khoesan and Europeans, which might be genetically separated since 100,000 years or more [2], will show a different pattern of diversity. Given the functional constraints acting on teeth (e.g. maintaining occlusion), we further hypothesize that, beside an overall shape variation, there will be some tooth regions showing less plasticity than others.

We examined the 3D surface of the enamel-dentine-junction (EDJ) as well as cervical and crown outlines of upper premolars (P3, P4), upper molars (M2), and lower premolars (P3, P4) using a Virtual Anthropology approach [3]. Our sample of micro-CT scans comprised Africans (Khoesans and other sub-Saharan Africans), Australasians (Papuans, Australian aboriginals, Indonesians), and Europeans (Avars, middle Europeans), thus populations showing diverse subsistence patterns (e.g., agriculturalists, nomads, hunter/gatherers).

The overwhelming signal from analyses of these three traits for each of the five tooth types was that there exists considerable variation in tooth shape, but the shape distributions of all three continental groups overlap widely. Also the discriminant analyses based on the first 10 PCs correctly classified only 35-59% of the cases. This complies with our first hypothesis that, in the absence of selective advantages, subsistence pattern does not have a significant impact on postcanine tooth shape, as represented in this sample. Our results also indicate that allometry is rather low, in the range of 4-6%. We observed some moderate size differences between individual populations, particularly Australasians tend to have slightly larger teeth than Africans and Europeans. In summary, it is not possible to distinguish between modern human populations on the basis of the morphology of the teeth we considered.

Our second hypothesis that certain tooth regions might be more susceptible to shape variation than others can be partly confirmed. For instance, the lingual region of lower P3s and the distal part of the upper M2s show high variability. Upper premolars, instead, vary in their overall shape rather than in particular regions. Partial Least Squares analysis shows that neighbouring teeth such as lower or upper premolars covary considerably.

Although our sample size (38-43, depending on tooth type) is still limited due to the laborious 3D protocol applied, our results indicate that tooth shape variation can hardly be explained by subsistence pattern or geographical origin. The genetics behind tooth morphology are not yet fully understood. We hope that our results will stimulate further research in this direction.

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Poster Presentation Number 8, Th (17:00-19:00)

Another piece of the puzzle - a new site of the late Middle Paleolithic *Keilmessergruppen* in central Germany

Marcel Weiß[1,2]

1 - MPI EVA · 2 - University of Leiden

The late Middle Paleolithic in central Germany, from MIS 5a to early MIS 3, is characterized by the abundant use of prepared core techniques and a high variability in retouched pieces. Typical are backed bifacial knives, leaf-shaped bifacial tools, bifacial scrapers, handaxes and various scraper forms. The assemblages of the well-known sites like Salzgitter-Lebenstedt and Lichtenberg (Lower Saxony), Königsaue and Neumark-Nord 2/0 (Saxony-Anhalt) and Gamsenberg/Oppurg (Thuringia) are grouped together typologically as *Keilmessergruppen*. The region around Leipzig (Saxony) was one of the most important brown coal mining areas in the former GDR. During rehabilitation of the pit mines from the 1990s to the early 2000s, volunteer archaeologists collected more than 1200 late Middle Paleolithic artifacts in early MIS 3 river gravels (Lower Terrace) of the former brown coal quarries east of Bitterfeld (Saxony-Anhalt). With regard to the retouched pieces, the recovered artifacts clearly belong to the *Keilmessergruppen*. In 2002, in-situ artifacts were discovered in Pouch (Saxony-Anhalt), within the former strip mine „Tagebau Goitzsche - Baufeld Rösa-Sausedlitz". During refilling of the pit, waves on the growing lake eroded the bank and exposed the site. Unfortunately, after only a few days of excavation (State Office for Heritage Management and Archaeology Saxony-Anhalt), they had to stop when a flood of the Mulde river raised the level of the new lake and the site disappeared under water. Nevertheless, 371 artifacts made on erratic flint were recovered. Sediment samples for ^{14}C- and OSL-dating were taken during the excavation. Appart from one small piece, bones were not found. The find layer was about 1 m above the base of the Lower Terrace. The bottom of the sequence consists of large gravels. These sediments were incised by small river channels which were filled with isolated silty clods containing the Middle Paleolithic artifacts. Unfortunately, the radiocarbon datings on one bone, sediment samples and a piece of wood were not successful, probably due to contamination. The luminescence dating was done in the University of Freiberg (2003, M. Krbetschek, S. Clasen/LDA). The findlayer yielded OSL ages of 46.2 ± 2.5 ka and 47.1 ± 2.7 ka. The latter are roughly uniform and fit with the technological and typological characteristics of the stone artifacts. With 67 retouched pieces, the frequency of tools is quiet high. There are 24 cores, 264 flakes and 15 angular fragments. One flint object is an indeterminate piece. Most of the complete cores are oval or rounded in shape. 13 of 14 better preserved pieces show core edge preparation. That the variation and flexibility in core reduction methods could have been quiet variable in one knapping sequence is shown by the refit of a core: initially an oval shaped Levallois core with edge preparation broke off in the middle and one of the chunks was further reduced in an opportunistic way. That core edge preparation played an important role in flake production is indicated by the platforms. 72% of 293 platforms show facetting. The retouched artifacts (excl. fragments) consists of 44 pieces with retouched edges, 13 unifaces and 6 bifacially retouched pieces. Typologically, three bifacial objects are bifacial backed knives, two are leaf-shaped scrapers and one is indeterminate. Interestingly, some of the unifacial tools show features of bifacial backed knives. The concept of a back itself appears to play an important role in the assemblage, ranging from natural backs to backing. The site of Pouch provides new insights into late Neanderthal life in the northeastern European plain at the end of the Middle Paleolithic. With its artifacts in an exceptionally fresh condition, a high proportion of retouched pieces, bifacial pieces, refits, solid OSL-dates and embedded in thousands of collected artifacts in a micro-region, the site provides new informations about the chronology of the late Middle Paleolithic in central Germany and about factors that drive stone tool variability.

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Poster Presentation Number 119, Sa (12:20-13:50)

ZooMS analysis of two Châtelperronian faunal assemblages

Frido Welker[1,2], Marie Soressi[3], William Rendu[4], Jean-Jacques Hublin[1], Matthew Collins[2]

1 - Department of Human Evolution, MPI-EVA · 2 - BioArCh, Department of Archaeology, University of York · 3 - Faculty of Archaeology, University of Leiden · 4 - CNRS – New York University, CIRHUS -UMI 3199

Recently, ZooMS has been introduced as a cost-effective taxonomic identification method for bone specimens using MALDI-TOF-MS analysis of collagen type I (COL1; [1]). Assemblage-wide applications of this technique have been few, however, and no data is available on success rates for Pleistocene bone assemblages. Further, there have been no comparisons between the two main extraction protocols used, acid demineralization and non-destructive buffer extraction using ammonium-bicarbonate [2, 3].

Here, we present ZooMS results on Châtelperronian faunal assemblages from Les Cottés, France (including the Châtelperronian unit 06) and Quinçay, France (Châtelperronian units Ej, Em and En). For Les Cottés, 145 bone samples were demineralized while for Quinçay 448 bone and tooth samples were incubated in ammonium bicarbonate buffer to extract soluble COL1. Previously available data on faunal assemblage composition for both sites indicate differences in the number of identified specimens (NISP) as well as species richness.

Our results indicate that both extraction procedures result in similar percentages of successful identifications (≈90%). The remaining specimens (≈10%) yielded limited taxonomic information, while a single specimen for Les Cottés and two specimens for Quinçay remained unidentified. Despite overall similarity in success rates, there are striking differences in peptide marker presence between acid demineralization and buffer extraction. This observation is especially relevant for peptide marker C (α2(I) 512–529), and should guide future extraction strategies.

ZooMS adds previously unrepresented species to both sites and all studied units. These include carnivores, leporids, and herbivores from a range of size classes. For Les Cottés, our results indicate a significantly higher species richness for unit 06 compared to the similarly-sized morphologically identified assemblage [2].

The success rate observed is promising for the application of ZooMS to other faunal assemblages covering the Middle to Upper Palaeolithic transition and characterized by a low number of identified specimens, providing a better informed picture of environmental conditions during this time period and more accurate data for discussing the subsistence strategies developed by the involved hominin populations. Finally, we will highlight recent advancements in *de novo* COL1 sequencing and its potential to improve taxonomic identifications using ZooMS [4].

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Poster Presentation Number 86, Fr (12:20-13:50)

Convergence in derived elements of lithic technologies complicates identification of early modern human dispersals

Manuel Will[1], **Alex Mackay**[2]

1 - Department of Early Prehistory and Quaternary Ecology, University of Tübingen, Germany · 2 - Centre for Archaeological Science, School of Earth and Environmental Sciences, University of Wollongong, Australia

Lithic technologies have been used to trace dispersals of early human populations within and beyond Africa. Convergence in lithic systems has the potential to confound such interpretations, implying connections between unrelated groups. The problem of convergence in material culture is particularly acute in lithic technologies, an essentially reductive method of tool manufacture bound by functional requirements of edge production, and by the physics of fracture mechanics. Nevertheless, the unique durability of lithic artefacts and their tendency to pattern in space and time means that they remain the basis for most assessments of population flux in the Palaeolithic. In order to limit the confounding potential of convergence, researchers focus on the most derived components of lithic assemblages, where elaborate, multi-step flaking systems reduce the probability of chance morphological similarities. The Nubian core reduction method and the spatially circumscribed techno-complex associated with this technology provide a significant recent example of the application of this approach (e.g.[1,2]). Here we present data suggesting that Nubian core reduction systems associated with late Pleistocene populations in North Africa – and potentially with early human ex-migrations from Africa to Arabia – also occur in southern Africa, but much later and with no clear connection to the North African occurrence. Our surveys at Uitspankraal 7 (UPK7) and excavations at Mertenhof, both situated in south-western South Africa and about 25 km apart, have yielded a total of 36 cores with all the hallmarks of Nubian technology. These necessary technological attributes include a steeply angled median distal ridge, an opposed striking platform, a triangular core shape and a prepared main striking platform (Sensu [2]). The cores confirm either to type 1/2 or type 2 variants of the Nubian system and are manufactured on all principle raw materials. They are small relative to those from north-eastern African and Arabia, a difference driven largely by available raw materials, but generally fall in the lower end of the size spectrum of Nubian cores. At both UPK7 and Mertenhof, Nubian-like cores and the concomitant convergent flakes occur exclusively in assemblages of the early post-Howiesons Poort and can be age bracketed to 60-50 ka. These observations constitute the first demonstration of this core reduction system from the southern part of the African continent. The timing and spatial distribution of Nubian cores in southern Africa implies convergence, rather than diffusion or dispersal. This interpretation is consistent with the absence of documented Nubian systems in any part of the intervening space between northern Africa and South Africa, and the fact that by 60 ka the Nubian had probably disappeared from its source area. Interpreting our data as including an instance of technological convergence on the Nubian core reduction system carries several implications. Foremost, the distribution of Nubian cores cannot always be assumed to reflect information sharing networks. In cases where similar lithic systems occur in the same restricted time interval in contiguous areas, information transmission with or without attendant population movement remains a relatively parsimonious explanation: the suggestion that the Arabian Nubian techno-complex was made by populations related to those in north-east Africa is reasonable, although it should be substantiated by more detailed quantitative comparisons of relevant lithic assemblages. Having said that, where assemblages are separated by considerable intervals of time and/or space, convergence cannot be precluded on the grounds of technological complexity. While lithic technologies can be a critical guide to human population flux under favorable circumstances, their utility in tracing early human dispersals at large spatial and temporal scales thus remains questionable.

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Poster Presentation Number 92, Fr (12:20-13:50)

A Virtual Geometric Morphometric approach to the quantification of long bone bilateral asymmetry and cross-sectional shape

Laura A.B. Wilson[1], **Louise T. Humphrey**[2]

1 - University of New South Wales · 2 - The Natural History Museum

The relationship between mechanical loading regime and bone morphology provides a basis for the investigation of behavior and mobility patterns in recent and past populations. Directional bilateral asymmetries in upper limb length and diaphyseal width have been documented for a number of populations using standard osteological measurements. More recently, detailed information about loading regime has been reconstructed from measures of cross-sectional geometry, typically involving the analysis of second moments of area to measure resistance to deformation (bending and torsion). In tandem to analyzing biomechanical properties, those studies have employed a range of linear measurements to quantify cross-sectional geometry. Although linear measurements convey information about shape they do not capture the entire outline shape of the cross section. Similarly, while biomechanical properties, such as second area moments and section modulus, provide information about resistance to bending by measuring bone distribution, this information is restricted to measurement of bone distribution about defined axes.

Quantitative evaluation of entire outline shape has not previously been employed in the study of human long bone directional bilateral asymmetry. The aim of this paper is to introduce a method to extract cross sections, and analyze the shape of those sections using a geometric morphometric protocol. Our method was developed for use with virtual models because advances in scanning technology have resulted in the widespread use of 3D digitization, hence models of whole bone geometry are routinely captured for many applications in virtual anthropology. An example study set of paired humeri from Andaman Islanders sampled at 35%, 50% and 65% locations was analyzed. We retain anatomical orientation of the shape data by capturing landmarks using polar radii. Our results show that landmark configurations permit variation in outline shape to be visualized and that shape data effectively reveal differences between left and right humeral cross sections that are not recovered in measurements of size. The directionality of shape change (distribution of bone from centroid) was evaluated in the context of whole outline shape and in relation to the axis of maximum bending rigidity, thereby providing a sensitive means to quantifying amount and extent of diaphyseal plasticity. We introduce a new, scale-independent metric that allows for differences in circularity along the humeral shaft to be evaluated using outline shape. The approach is highly extensible in terms of a) number of landmarks that may be captured around the outline, b) number of cross sections that may be extracted from the model, c) type of model that may be used - surface scan or Computed Tomography (CT), and d) capacity to capture both periosteal and endosteal outline shape as well as traditional biomechanical properties.

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Poster Presentation

Diversity of bifacial tools of the late Middle Palaeolithic with examples from SW Poland

Andrzej Wiśniewski[1]

1 - Instytut Archeologii Uniwersytetu Wrocławskiego

One of the most intriguing subjects is a manner of production and diversity of bifacial tools of the late Middle Palaeolithic industries including Keilmessergruppe (KMG, Prądnik culture) and assemblages with leaf points in Central Europe. In traditional approach based on morphometric and typological evaluations, prevailed an opinion that the diversity's ground lay in a mental area. It was claimed that regional groups differing in terms of bifacial tools morphology existed [1], see also comments [2]. Some data suggest, however, that apart from a pre-adaptative cultural factor, of great importance in the formation of diversified tools' assemblages was a profile of implemented activity and raw materials base. In order to test the hypothesis it was decided to carry out refitting study of waste material, geometric morphometric assessment of tools and scar pattern analysis [3,4]. Results of refittings and scar pattern analysis were illustrated with diacritical models presenting steps and methods of making tools. The impact of these factors was recorded in the context of assemblages from SW Poland, or more specifically from Głubczyce Plateau located in the foreland of the Moravian Gate. The first assemblage comes from site Pietraszyn 49a excavated since 2012. Excellent state of preservation of the artefacts in the low-energy depositional environment, as well as considerable number of specimens allowed for partial re-construction of activity manners related to the tools production, their partial use on the spot, and development of bifacial forms, which could have been abandoned. The second site - Pietraszyn 11, located only 3 km south from the site 49a, was discovered in in the thirties of the 20th century [5]. The above data indicate that capacity and flexibility of technological cultural packages of the Middle Palaeolithic population were significant and created an opportunity to adapt to local conditions as well as to situational and strategic tasks.

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Podium Presentation: Session 11B, Sa (16:00)

Nesher Ramla karst depression, Israel: A new evidence for Middle Paleolithic adaptations during MIS 6 and 5

Yossi Zaidner[1,2], David E. Friesem[3], Amos Frumkin[4], Leore Grosman[1], Naomi Porat[5], Ruth Shachack-Gross [6], Alexander Tsatskin[2], Reuven Yeshurun[2], Lior Weissbrod[2], Laura Centi[1], Marion Prevost[1], Maayan Shemer[2,7], Oz Varoner[8]

1 - Institute of Archaeology, the Hebrew University of Jerusalem, Israel · 2 - Zinman Institute of Archaeology, University of Haifa, Israel · 3 - Kimmel Center for Archaeological Science, Weizmann Institute of Science, Rehovot, Israel. · 4 - Department of Geography, The Hebrew University of Jerusalem, Israel · 5 - Geological Survey of Israel, Jerusalem, Israel · 6 – Department of Maritime Civilizations, University of Haifa, Israel · 7 – Israel Antiquities Authority · 8 – Department of Bible, Archaeology and the Ancient Near East, Ben-Gurion University of the Negev, Beer-Sheva, Israel

A recently discovered eight-meter-thick open-air sequence at Nesher Ramla (Israel), dated by OSL to 167±11 - 78±6 ka, provides new evidence regarding Middle Paleolithic adaptations during MIS 6 and 5. The site is located in a karst depression formed by gravitational deformation and sagging into underground voids. The site formation involved episodic deposition of eroded soils, water-logging and pedogenesis, interbedded with human occupation. Such a geomorphological context and formation processes are profoundly different from the Levantine Middle Paleolithic cave and open-air sites. Excavations yielded exceptionally large and well-preserved lithic and faunal assemblages, different types of combustion features, hominin-induced concentrations of lithics, bones and manuports and ochre. The eight-meter-thick archaeological sequence was divided into six stratigraphic units, in which several horizons and distinct concentrations of lithics and bones were identified.

The site shows pulses of intensive occupation separated by low-density stages and a general tendency toward reduced occupation intensity and more expedient lithic technology in the upper part of the sequence. The Nesher Ramla industry lacks true laminar and elongated Levallois components and is dominated by short and broad flakes. Several reduction sequences were identified among which Levallois is the most common. Preliminary study of the lithic assemblages shows several distinctive traits that were not documented in the Levantine Middle Paleolithic, among them high frequency of heavily retouched sidescrapers, in situ sidescraper resharpening and recycling and high frequency of naturally backed knives. The faunal assemblage is dominated by *Bos primigenius*, which is usually rare in the Levantine Middle Paleolithic cave sites. Nesher Ramla is one of a very few sites dated to MIS 6 in the north-east Africa and the Near East and at present it is the one that provides the richest evidence for human behavior from this time span. The long archaeological sequence and large lithic assemblages allow testing and generating models on human movement out of Africa during MIS 6 and 5, as well as on the Levantine Middle Paleolithic technological variability, continuity and change.

Poster Presentation Number 36, Th (17:00-19:00)

Tooth endostructural characterization of the Early Pleistocene specimen SK 27 from Swartkrans, South Africa

Clément Zanolli[1,2,3], José Braga[1], Frikkie de Beer[4], Jakobus W. Hoffman[4], Roberto Macchiarelli[5,6], Francis Thackeray [7]

1 - UMR 5288 CNRS, Université de Toulouse, France · 2 - Anatomy Department, University of Pretoria, South Africa · 3 – The 'Abdus Salam' International Centre for Theoretical Physics, Trieste, Italy · 4 - South African Nuclear Energy Corporation, Pelindaba, South Africa · 5 - UMR 7194 CNRS, Muséum National d'Histoire Naturelle, Paris, France · 6 – Département Géosciences, Université de Poitiers, France · 7 – Evolutionary Studies Institute, University of the Witwatersrand, Johannesburg, South Africa

The partially crushed juvenile cranium SK 27 was found in 1949 in the Hanging Remnant of the Swartkrans Formation Member 1, at the eponym site. Biochronological and U-Pb isotopic datings of its provenance stratigraphic unit coincide for an estimated age of c. 1.8 Ma [1]. The specimen preserves some maxillary elements of a mixed dentition, with the externally visible LI2, Ldm2, LM1, and RM1, the unerupted LP4 and LM2, small crown and root fragments representing the I1s, the RC and the Rdm2, as well as the isolated LC and LP3 [2]. The marked plastic defor-mation affecting the fossil and the juvenile condition of the repre¬sented individual convolute to make its taxonomic assessment challenging. Formerly attributed to *Paranthropus ro-bustus*, SK 27 is now considered as more likely representing early *Homo* [2]. Based on cranial morphology and tooth metric and non-metric outer features, this specimen was then clas-sified as *H. habilis* [2, 3], but it has been recently proposed that it belongs to a distinct southern African endemic taxon, *H. gautengensis* [4]. In order to noninvasively extract from this problematic specimen additional morphostructural information suitable for clarifying its taxonomic status and phylogenetic relationships, the maxilla and the two isolated teeth of SK 27 were imaged by micro-focus X-ray tomography in 2015, using the X-Tek (Metris) XT H225L industrial CT system available at the South African Nuclear Energy Corporation (Necsa) accord-ing to the following parameters: 190 and 150 kV voltage, 120 and 100 μA current, and a projec-tion each 0.36°. The final volumes were reconstructed with an isotropic voxel size of 100.0 μm, for the maxilla, and of 32.7 μm, for the LC and LP3. In the ongoing comparative analyses of the inner tooth structural organization, we use similar microtomographic-based evidence from the upper dentition of a number of extant and fossil humans, including Indonesian *H. erectus* from Sangiran and North African *H. heidelbergensis* from Tighenif, as well as *Au. Africanus* and *P. robustus* representatives from the South African hypodigm. Because of the fragmentary nature of the SK 27 dentognathic remains and of the advanced degree of occlusal wear affecting the deciduous molar and some permanent tooth as well, besides the virtual exploration and GM analysis of the premolar and molar enamel-dentine junction (EDJ), we primarily focused on molar crown tissue proportions (assessed through the 3D RET index) and the enamel thickness distribution pattern (as rendered by chromatic scale cartographies). Our preliminary results reveal a mixed signal. More specifically, SK 27 has thick molar enamel (3D RET ranging from 22.3 to 24.6), intermediate between *Homo* and *Australopithecus*; an australopith-like EDJ morphology of the canine, with a sharp cusp and low marginal ridges; a more human-like premolar and molar EDJ shape, with a mesiodistally extended trigon basin. Conversely, in all analyses run so far, SK 27 always sets it apart from the *Paranthropus* endostructural signature, which is typically characterized by thicker and more evenly spread enamel, a more bulbous EDJ of the canine, lower and more closely set dentine horns of the post-canine teeth. Following our preliminary 3D analyses of the internal tooth features and structural crown organization of SK 27, the taxonomic status of this problematic specimen remains contentious. Its combination of primitive (australopithecine-like) and derived (*Homo*-like) signals points to the need for extending the comparative record to additional Plio-Pleistocene tooth specimens from the Cradle of Humankind, notably by including evidence from the taxon *Au. Sediba* [5].

Acknowledgements: Research was funded by the National Research Foundation (NRF) and the Department of Science and Technology (DST) of South Africa, the program "*A European and South African Partnership on Heritage and Past*+" (AESOP+), and the French CNRS.

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Podium Presentation: Session 5, Fr (11:20)

Is the Modern vs. Neanderthal dichotomy appropriate any longer for the technocomplexes of the Middle-to-Upper Paleolithic transition

João Zilhão[1], William Banks[2], Francesco d'Errico[2]

1 - ICREA/University of Barcelona · 2 - CNRS/University of Bordeaux

Based on the morphology of two deciduous molars and radiocarbon ages from layers D and E of the Grotta del Cavallo (Lecce, Italy), assigned to the Uluzzian, it has been proposed that modern humans were its makers and that this finding weakens the case for an independent emergence of symbolism among western European Neandertals. Reappraisal of the dating evidence, of the finds curated in the Taranto Antiquities depot, and of the information provided in coeval publications detailing the site's 1963–66 excavation work shows that (a) Aurignacian and Early Epigravettian lithics exist in the assemblages from layers D and E, (b) even though it contains both inherited and intrusive items, layer D formed during Protoaurignacian times, and (c) as implied by artefact labeling patterns, the constitution of the extant Cavallo assemblages is influenced in a non-negligible manner by the fact that items originally found together were assigned post-hoc to distinct stratigraphic units of analysis. In addition, a major disturbance feature affected the 1960s excavation trench down to Mousterian layer F, this feature went unrecognized until 1964, the fossil teeth were discovered that year and/or the previous year, and there are contradictions between field reports and the primary anthropological description of the remains as to their morphology and level of provenience.

Given these major contextual uncertainties, the Cavallo teeth cannot be used to establish the authorship of the Uluzzian. Since (a) this technocomplex's start date is ca. 45,000 calendar years ago, (b) a number of Neandertal remains are dated to this period, and (c) the oldest diagnostic European modern human fossil is the <41,400 year-old Oase 1 mandible, we believe that Neandertal authorship of the Uluzzian is the parsimonious reading of the evidence.

Where the Protoaurignacian is concerned, it has been claimed that the dental tissue proportions and mtDNA from isolated teeth recovered at Bombrini and Fumane, respectively, support modern human authorship. However, these teeth have not been directly dated, so their stratigraphic context needs to be adequately assessed. The Bombrini tooth is reported to come from level III of a salvage excavation carried out in 1976, but dates on close-by faunal bone samples fall in the time range of the Aurignacian I; in addition, the "Protoaurignacian" label originally attached to the site's early Upper Paleolithic levels reflects the traditional Italian nomenclature whereby it stands for the Italian aspect of the Aurignacian as a whole, not for its earliest phase alone—as corroborated by the dating of the site's level II, also designated as "Protoaurignacian," to ~30-32 uncal BP, i.e., to the time range of the Evolved or Later Aurignacian.

The mtDNA of the Fumane tooth suggests that this individual "was a modern human, or had at least some ancestors who were modern humans," which does not exclude that he/she was a Neandertal with modern human ancestry along the female line. This possibility needs to be borne in mind given that the age and biological features of the Oase fossils suggest significant interbreeding between Neandertals and modern humans in Europe at the time of contact and that this time must have been no more than a few generations prior to when Oase 1 was living. In addition, the evidence from Manot and Ksar Akil purportedly placing modern humans in the Near East, on the path to Europe, at 45-55 ka, is equivocal and does not stand up to close scrutiny. In light of this evidence, we suggest that the makers of the Protoaurignacian were populations that are not easily amenable to a Neandertal/modern human dichotomy and whose morphology and genetic mosaic may have varied significantly between the different regions of Eurasia where the technocomplex is represented.

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