7th Annual Meeting of the

European Society for the study of Human Evolution

21-23 September 2017
LEIDEN / THE NETHERLANDS

ESHE

Journal of Human Evolution

ELSEVIER

The *Journal of Human Evolution* concentrates on publishing the highest quality papers covering all aspects of human evolution. The central focus is aimed jointly at palaeoanthropological work, covering human and primate fossils, and at comparative studies of living species, including both morphological and molecular evidence. These include descriptions of new discoveries, interpretative analyses of new and previously described material, and assessments of the phylogeny and palaeobiology of primate species.

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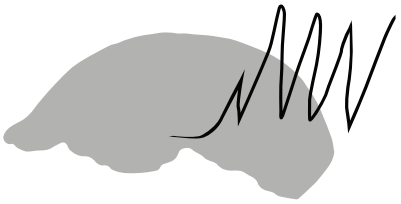
European Society for the study of Human Evolution

ESHE

7th Annual Meeting

Leiden, The Netherlands, 21st-23rd Sept. 2017



Proceedings of the European Society for the study of Human Evolution Vol. 6

Cover image: *Homo erectus* holotype cranium and shell engraving, Trinil, Indonesia (Dubois Collection, Naturalis, Leiden, The Netherlands)

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Dear participants of the 7th Annual Meeting of the European Society for the study of Human Evolution,

Welkom in Leiden!

We are excited to welcome you to yet another beautiful European city for our 7th Annual Meeting. The Netherlands has a long history of research in paleoanthropology. Eugène Dubois was the discoverer of *Pithecanthropus* (*Homo erectus*) and one of the pioneers of Human Palaeontology. Today the Faculty of Archaeology at Leiden University is one of the most active and successful centres of research and education in the field of Palaeolithic Archaeology.

This year, in lieu of an excursion, we have been lucky enough to be granted access to an ESHE exclusive exhibition of Eugène Dubois' Trinil collection housed at the Naturalis Biodiversity Centre. This will take place on Sunday, September 24th in the historic Pesthuis just outside of Leiden Centre and is a brilliant opportunity to see some iconic fossil specimens from Trinil, such as the Trinil 2 skullcap and the recently described carved shell associated with the hominin material.

Our society continues to experience a strong growth in both members and abstract submissions since our inception. This year, we have 220 presentations and expect to host approximately 350 participants in the beautiful Stadsgehoorzaal in the centre of Leiden city. We were also lucky enough to secure the National Museum of Antiquities, the Rijksmuseum van Oudheden, for both our public outreach lecture, which will be delivered by ESHE Board Officer Marie Soressi, and for the closing party. Guests of the closing party will have time to take a tour through the museum before drinks and dinner in the main hall.

As part of our mandate, we are proud to offer support to our student members. The travel grants allow students from anywhere in the world to travel to the meetings to present their research. In addition, we will grant two talented students the annual Poster and Pecha Kucha prizes during the general assembly.

During the general assembly this year, members will vote for both the general board and board officers. As per the statutes of the society, board members are elected every two years and board officers every three. All members of the society attending the 2017 conference will have the chance to vote.

The meeting in Leiden would not be possible without the tireless efforts of our local organisers Wil Roebroeks, Marie Soressi, Fulco Scherjon, Andy Sorensen, Femke Reidsma and their teams.

The preparation of the meeting and the publication of our abstract volume have been made possible by the work of the ESHE Board Officers and Board Members, in particular Mikaela Lui, Philipp Gunz, Shannon McPherron and Thomas Terberger.

In 2018, we look forward to hosting the Annual Meeting in the beautiful town of Faro, Portugal.

With best regards

Jean-Jacques Hublin
President, European Society for the study of Human Evolution

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National Museum of Antiquities (RMO)
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Leiden University

https://www.universiteitleiden.nl/en

Leiden University was the first university established in the Netherlands. Prince William of Orange gave the city of Leiden the *Academia Lugduno Batava* in 1575 in recognition of the city's courageous resistance against the long siege by the Spanish invaders during the Eighty Years War (1573-1574). The university became particularly prominent during the so-called Dutch Golden Age, roughly spanning the 17th century, when scholars from around Europe were attracted to the Dutch Republic with its climate of intellectual tolerance (reflected in the university's motto, *Praesidium Libertatis*, Bastion of Liberty) and Leiden's international scientific reputation.

During this period, Leiden was home to people such as René Descartes (have a look at his house at Rapenburg 21), Christian Huygens and Baruch Spinoza. At the end of the nineteenth century, Leiden University again became one of Europe's leading universities: for instance, at the world's first low-temperature laboratory, Kamerlingh Onnes achieved temperatures of only one degree above absolute zero (−273°C). In 1908, he was also the first to succesfully liquify helium and can be credited with the discovery of superconductivity in metals. He was awarded the Nobel Prize for Physics in 1913, one of the fifteen Leiden Nobel Prize laureates.

At present, Leiden holds a strong international position amongst the top research institutes in many fields. The university is a member of the Coimbra group, the Europaeum and the League of European Research Universities, and has about 5,500 employees and more than 25,000 students.

Leiden University is well embedded in the historic centre of the town, and the history of the close relationship between the city and its university goes back many centuries. Leiden, twinned with the city of Oxford (UK), is rich with cultural heritage, not only in science, but also in the arts. One of the world's most famous painters, Rembrandt, was born and educated in Leiden. Many of the university's faculties are housed in historic buildings spread throughout the city, including the Academy Building (pictured), a former cloister in use as a university building since 1581, and currently where academic festivities, inaugural lectures and PhD-defenses take place, situated at the entrance of the Hortus Botanicus, which goes back to the late sixteenth century (Rapenburg 73) .

The science laboratories are all just outside the center, located in the so-called Bio Science Park (https://leidenbiosciencepark.nl/). It is also here that the Faculty of Archaeology is situated: originally located in the centre of town, the growth of the faculty required a move to a larger building, which brought the faculty physically closer to the natural sciences (Van Steenis Building, Einsteinweg 2).

Faculty of Archaeology

https://www.universiteitleiden.nl/en/archaeology

The Faculty of Archaeology is the largest academic centre of archaeology in the Netherlands, and one of the seven Leiden University faculties. It owes its independent status to the interdisciplinary character of its archaeology and its continuing success in research and fundraising, both at the national (N.W.O.) and international (E.R.C.) level. The Faculty ranks in the top ten worldwide in academic reputation and research impact (March 2017 QS World University Ranking by subject) and has a staff of more than 170 people.

Staff members are active in various fields of research all around the world, from excavations and laboratory studies to heritage management with museums. The faculty offers an international (English) undergraduate program, as well as a one-year M.A/M.Sc and two-year research M.A/M.Sc option. About 300 Bachelor and 200 Masters students are enrolled, as well as about 60 PhD-students. Approximately half of the faculty's graduate students come from outside of the Netherlands. The Human Origins group of the Faculty of Archaeology is organizing ESHE 2017.

Human Origins Group

https://www.universiteitleiden.nl/en/archaeology/world-archaeology/human-origins

The Human Origins group studies the ecological niche and adaptive flexibility of the Pleistocene members of the hominin lineage. The group focuses on the archaeological record of these hominins, cooperating with a wide range of disciplines. Three projects are currently central in its research. The first concerns study of the deep prehistory of fire usage, which involves a series of experiments[1-4] and archaeological case studies [5-9], and cooperation with molecular biologists[10] and physicists[11] from various universities. The interaction between the last Neandertals and the first modern humans in Europe is the topic of a second research project, which includes major fieldwork at the site of Les Cottés (Saint-Pierre-de-Maillé, Vienne, France)[12,13]. A third project entails studies of the rich material from the Trinil *Homo erectus* type site at Java, Indonesia excavated by Eugène Dubois at the end of the 19th century and now stored at Naturalis Biodiversity Centre in Leiden[14]. In cooperation with Indonesian colleagues, this project now also incorporates new fieldwork in the Trinil area. Research also extends to southern Africa, with Gerrit Dusseldorp's N.W.O.-funded project focussing on the development of technology and subsistence behaviours during the MSA-LSA transition. A very recent addition to the group is Dr. Amanda Henry, previously at the MPI-EVA Leipzig. Her E.R.C.-funded HARVEST project seeks to identify the plant foods that hominins consumed.

In addition, the Human Origins group hosts the N.W.O.-funded research group of Dr Krist Vaessen, which is testing a variety of cultural evolutionary models of great relevance to the general research of the group, including its modelling efforts [15-17].

Rijksmuseum van Oudheden

Conference venue: Stadsgehoorzaal

Breestraat 60

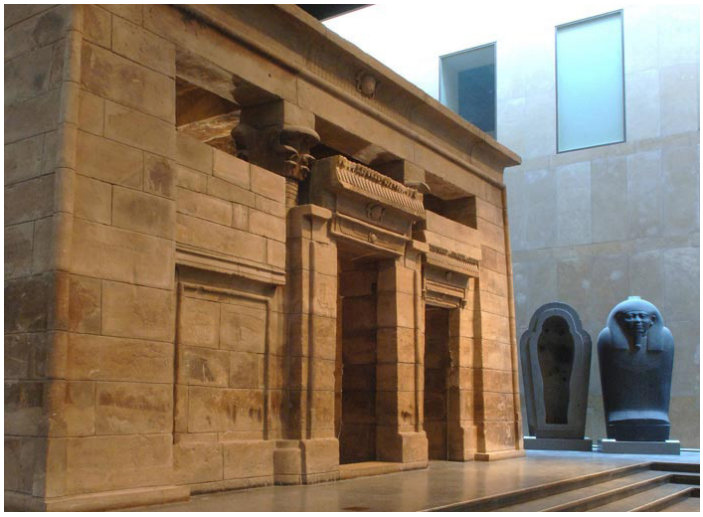
At Leiden University, the academic year starts in the first week of September, hence the ESHE 2017 venue had to be sought outside of the University buildings in a commercial venue. For ESHE 2017 we have chosen the Stadsgehoorzaal (SGZ), the largest concert hall in the city center of Leiden. The Stadsgehoorzaal has a long history in the centre of historical Leiden, a town with occupation traces going back to the Roman era. The Stadsgehoorzaal building is an extension of the Sint-Catharinagasthuis, an early 12th century shelter and hospital for the poor, which included a church and beer and wine cellars. It was rebuilt in 1891, after the original Stadsgehoorzaal was destroyed by a large fire. The Stadsgehoorzaal is a nice example of neo-renaissance architecture, which is hardly present anymore in the Netherlands.

Public Lecture and Closing Party Venue: Rijksmuseum van Oudheden

Rapenburg 28

The Rijksmuseum van Oudheden (National Museum of Antiquities, RMO) in Leiden is the national archaeological museum of the Netherlands, and the venue for both the ESHE 2017 Public Lecture and the closing party of the conference. It is located in the centre of Leiden, on the Rapenburg canal, very close to the Academy Building, the historic central building of Leiden University. The museum grew out of the collection of Leiden University and there are strong links between the museum and the Faculty of Archaeology. The museum focuses on ancient Egypt, the ancient near East, the classical world of Greece, Etruria and Rome and the archaeology (prehistoric, Roman and Medieval) of the Netherlands.

Prominently situated within the central hall is the so-called Temple of Taffeh (pictured below), an ancient Egyptian temple donated by Egypt to the Netherlands for its UNESCO-coordinated help in contributing to the historical preservation of Egyptian antiquities in the 1960s, when the Aswan High Dam was built and its reservoir threatened to destroy many monuments and archaeological sites. The temple, measuring 6.5m x 8m, was built out of sandstone between AD 1 and AD 14 on the orders of the Roman emperor Augustus, and was once part of the Roman fortress known as Taphis. The Temple of Taffeh serves as the backdrop for both the public lecture and the closing party of ESHE 2017.



Universiteit Leiden
The Netherlands

Public Lecture

Wednesday, 20th September, Rijksmuseum van Oudheden

A lecture will be delivered by Marie Soressi at the RMO on the evening before the conference starts. This lecture is aimed to promote the broader research interests of the society to the general public.

Neandertals and us: news from our ancestors, and why it matters

Spectacular developments in ancient DNA studies have revealed that today's European and Asian populations can trace part of their gene pool back to the Neandertals. The study of Neandertal skeletal remains identifies some of their biological adaptations, and analysis of their technology and settlements shows the importance of culture in their everyday life. A new challenge in the study of Neandertal archaeology, pioneered by the speaker, is to unravel the nature of their interactions with our direct ancestors, the first early modern humans in Europe. Using multi-disciplinary tools borrowed from both the humanities and the natural sciences, palaeontologists, geneticists and archaeologists all contribute to the unravelling of the complexity of human evolution.

Marie Soressi is Assistant Professor at the University of Leiden. She has contributed to several discoveries that have impacted our understanding of Neanderthal culture and their interactions with early modern humans. Dr. Soressi has combined high-profile academic research with large-scale commercial projects. She received her PhD from the University of Bordeaux, France.

After a post-doc in Cape-Town, South-Africa, Marie Soressi became a Research Fellow at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany. She also served as head of paleolithic research and large-scale project manager at INRAP (Institut national de recherches archéologiques préventives) for five years. At the Faculty of Archaeology in Leiden, where approaches from the natural sciences and humanities are combined to study the human past, Dr Soressi particularly values her interaction with students. She is convinced that archaeology, and human evolution, offers a unique and challenging academic environment for young people to confidently address the complexity of the modern world.

Marie Soressi's publications can be found at https://leidenuniv.academia.edu/marieSoressi

Excursion

On Sunday the 24th of September (10am-2pm), participants of ESHE 2017 have the opportunity to visit the world famous Dubois/Trinil collection. This collection is housed at Naturalis Biodiversity Center. Naturalis is currently undergoing large scale building works, to be able to house its ever growing collection (over 42 million objects) and visitor stream. This means that the collections are closed, but especially for the participants of ESHE 2017 a special exhibition of the most important objects from the Dubois/Trinil collection will be organized. The exhibition will take place in the monumental 17th century Pesthuis, the entrance building of the Naturalis museum.

The exhibition will showcase the *Pithecanthropus erectus* femur, skull cap and molar, as well as the other femora found at the site, the engraved Pseudodon vondembuschianus trinilensis shell[14], the original manuscript describing Pithecanthropus erectus and some of the fauna from Trinil. During opening hours a continuous slide show will depict photos (scans from glass negatives) originally taken by Dubois himself during his time in Trinil.

Naturalis Biodiversity Center

http://www.naturalis.nl/en/

Naturalis Biodiversity Center is Leiden's natural history museum and biodiversity research institution. It is responsible for a unique collection of some 52 million objects - ranking fifth in the world - focussing primarily on Europe, but South-East Asia, tropical America and Africa are also well-represented. In 2016, the museum received over 400,000 visitors and offered educational programmes to 67,000 school children. Naturalis is building a new and larger museum that will be opened in 2018.

Future Naturalis Building

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Thursday, 21st September	
8:00-9:00	**Meeting Registration**
8:45-9:00	**Official Meeting Opening**
Session 1 • Podium **Stadsgehoorzaal,** *Breestraat 60*	
9:00	**Jacques Jaubert -** Enigmatic Neanderthal structures (Bruniquel Cave, SW France)
9:20	**Viviane Slon -** Recovering archaic human DNA from Pleistocene sediments
9:40	**Ashley Kruger -** Spatial taphonomy and post-mortem disarticulation patterns of the *Homo naledi* assemblage from the Dinaledi Chamber, Rising Star Cave
10:00	**John Hawks -** *Homo naledi* and the evolutionary context of subequatorial Africa
10:20	**Tanya Smith -** Dental Perspectives on Nursing and Weaning
10:40-11:00	**Coffee Break**
Session 2 • Pecha Kucha	
11:00-11:25	**Shara Bailey -** The human remains from Dinaledi Chamber do not belong to *Homo erectus*: Evidence from the deciduous teeth
	Claudio Tennie - A possible explanation for stases in early hominin artefacts using extant primates as an example
	Laurence Dumouchel - The implications of fossil Suidae (Mammalia, Artiodactyla) for the reconstructions of the habitat of *Australopithecus anamensis* in the Omo-Turkana Basin
	Questions
11:25-11:50	**Lou Albessard -** A Brainy High-Browed Hominin: co-evolution of the brain and braincase in *Homo sapiens*
	Alejandra Ortiz - *Homo* or *Pongo*? Trigon morphology of maxillary molars may solve taxonomic controversies over isolated hominoid teeth from the Asian Pleistocene
	Elisa Bandini - Great apes reinvent tool-use behaviour through individual learning - implications for the evolution of human material culture
	Questions

11:50-12:15	**Amanda G. Henry -** Tubers in Winter
	Susanne Haupt - Diet and resource space of *Homo erectus* in Early Pleistocene of Sangiran - an update
	Elodie-Laure Jimenez - Cordial co-existence, competition, or avoidance strategies? Understanding the human ecological niche through the palaeoecology of the top-predators in northwestern Europe during the Late Pleistocene
	Questions
12:15 – 14:15	**Lunch • Poster Session 1 (Odd Numbers) - First Floor, Stadsgehoorzal**
Session 3 • Podium	
14:20	**Bernard Wood -** Bonobo striated muscle anatomy suggests relative stasis and mosaic evolution within panins, and supports bonobos as the most appropriate extant model for the common ancestor of panins and hominins
14:40	**Matthew Skinner -** Premolar root and canal variation in the hominin clade
15:00	**Thomas O'Mahoney -** A virtual reconstruction and volumetric mass estimate of AL288-1, *Australopithecus afarensis*
15:20	**David Raichlen -** Interpretation of Footprints from Site S Confirms Human-like Bipedal Biomechanics in Laetoli Hominins
15:40	**Mana Dembo -** Is *Paranthropus* a good clade?
16:00-16:20	**Coffee**
Session 4 • Podium	
16:20	**Martin Haeusler -** The morphology of the *Homo erectus* pelvis
16:40	**Daniel García-Martínez -** 3D growth changes in ribs during late ontogeny in hominids and its importance for the thorax of KNM-WT 15000: a preliminary approach
17:00	**Mark J. Sier -** Geochronology of the Baringo-Tugen Hills-Barsemoi (BTB) Core, Kenya, of the Hominin Sites and Paleolakes Drilling Project (HSPDP)
17:20	**Julio Mercader Florin -** Early Acheulean Harvesting of USOs at Olduvai Gorge, Tanzania
17:40	**Katerina Harvati -** Marathousa 1: New Lower Paleolithic elephant butchering site from the Megalopolis basin, Greece

Friday, 22nd September	
Session 5 • Podium	
9:00	**Cosimo Posth -** Deeply divergent archaic mitochondrial genome provides lower time boundary for African gene flow into Neanderthals
9:20	**Mateja Hajdinjak -** Population history of late Neandertals
9:40	**Aida Gomez-Robles -** A dental perspective on the divergence time between Neanderthals and modern humans
10:00	**Frido Welker -** A human dentine proteome from Les Cottés, France
10:20	**Lutz Kindler -** The Last Interglacial (Eemian) lakeland of Neumark-Nord (Saxony-Anhalt, Germany). Reconstructing Neanderthal occupations and subsistence opportunities based on estimations of ungulate biomass production
10:40-11:00	**Coffee Break**
Session 6 • Pecha Kucha	
11:00-11:25	**Andrew Sorensen -** MTA bifaces used as percussive fire-making tools by late Neandertals
	Trine Kellberg Nielsen - The Jutland Peninsula of northern Europe: Neanderthal corridor or cul-de-sac?
	Ashleigh L. A. Wiseman - Functional morphology of the hominin foot based upon the early Pleistocene footprints from Happisburgh, England
	Questions
11:25-11:50	**T. Bence Viola -** Living on the edge - new Neanderthals from the Altai Mountains
	Patrick Arnold - Neck mobility in Neandertals compared to modern humans
	Krist Vaesen - Inbreeding, Allee effects and the extinction of Neanderthals
	Questions

11:50-12:15	**Tamara Dogandzic -** Middle and Upper Paleolithic in the Balkans: New Data from Two Recently Discovered Sites in Serbia
	Sahra Talamo - RESOLUTION: Radiocarbon, tree rings, and solar variability provide the accurate time scale for human evolution
	Lorena Becerra-Valdivia - Age modelling of the Middle to Upper Palaeolithic Transition in the Zagros Mountains through AMS radiocarbon dating
	Questions
12:15 – 14:15	**Lunch • Poster Session 2 (Even Numbers)**
Session 7 • Podium	
14:20	**Dirk Hoffmann -** U-series age constraints for cave art in Cuevas de Puente Viesgo (Cantabria, Spain) - new minimum ages for El Castillo and La Pasiega
14:40	**Thibaut Deviese -** New single amino acid radiocarbon dating and DNA analysis of the Vindija Cave Neanderthals
15:00	**Marine Frouin -** A chronological framework for Shanidar Cave (Iraq) based on luminescence dating
15:20	**Alexa Benson -** Investigating palaeoclimate variability in the western Iberian Peninsula during the last glacial period using speleothems
15:40	**Marc Dickinson -** Amino acid racemisation dating of mammalian enamel: a British elephantid geochronology
16:00-16:20	**Coffee**
Session 8 • Podium	
16:20	**Paul D. Bons -** Migration waves resulting from a self-organised critical state as a possible mechanism for hominid dispersal and replacement?
16:40	**Susana Carvalho -** Gorongosa National Park and the biogeography of human origins in the Mio-Pliocene
17:00	**Katerina Douka -** Dating early human adaptation in the tropical forests of southern Asia (Thailand and Sri Lanka)
17:20	**Michael Westaway -** New insights into the peopling of Ancient Australia
17:40	**Robert Anemone -** Geospatial Paleoanthropology: Applying new tools and techniques from GIScience

Saturday, 23rd September	
Session 9 • Podium	
9:00	**Gerhard W. Weber** - Dental morphological heterogeneity in the Late Pleistocene *Homo* from Qafzeh and Amud, Israel
9:20	**Nicholas Stephens** - Trabecular bone patterning across the human hand: Implications for reconstructing behavior and manipulation in past populations
9:40	**Nicholas Conard** - Assessing the role of the Swabian Aurignacian in the debate over the origins of figurative art and music
10:00	**Daniel S. Adler** - The Relevance of Nor Geghi 1 (Armenia) to the Behavioral and Technological Evolution of Middle Pleistocene Hominins in the Southern Caucasus
10:20	**Maria Martinon-Torres** - New dental remains from Atapuerca-Gran Dolina TD6 level: *Homo antecessor* revisited
10:40-11:00	**Coffee Break**
Session 10 • Pecha Kucha	
11:00-11:25	**Manuel Will** - Surf and turf? A comparison of coastal adaptations by modern humans vs. Neanderthals and their evolutionary implications
	Tammy Hodgskiss - The influence of environmental fluctuations on ochre use at Blombos Cave and Klipdrift Shelter, southern Cape, South Africa, during the Late Pleistocene
	Gerrit Dusseldorp - An investigation into the interrelation between environmental change, subsistence and technology c. 40 - 12 kcal BP in southern Africa
	Questions
11:25-11:50	**Alastair Key** - Getting a grip in the Lower Palaeolithic: an empirical analysis of grip diversity and frequencies of employment during stone-tool use
	Paul Kozowyk - Perfect pitch: An experimental comparison of aceramic birch bark distillation and its implications for Neandertal adhesive technology
	Noora Taipale - The weapon system behind the point: Early Gravettian hunting technologies at Maisières-Canal
	Questions

11:50-12:15	**Rachel Hopkins** - To the point: Understanding the chronology of „Aurignacian" osseous point industries and their meaning for the Middle to Upper Palaeolithic biocultural shift
	Malvina Baumann - Bone industry before *Homo sapiens*, a Denisovian perspective
	Thomas Terberger - Early monumental art in Eurasia - new information on the wooden Shigir idol
	Questions
12:15 – 14:00	**Lunch**
Session 11 • Podium	
14:00	**Emma Loftus** - Shellfish harvesting strategies in South Africa across the Later and Middle Stone Ages
14:20	**Oliver Paine** - Exploring C4 plant foods: the nutritional and mechanical properties of African savanna vegetation
14:40	**Kévin Di Modica** - The Middle to Upper Palaeolithic transition in North-West Europe. New results from Belgium.
15:00	**Marco Peresani** - Uluzzian vs Uluzzian: implications of a new site discovered in the north of Italy
15:20	**Nicolas Zwyns** - The Northern Route of human dispersal in Asia: New evidence from the site of Tolbor 16, Mongolia
15:40-16:00	**Coffee**
Session 12 • Podium	
16:00	**Tom Higham** - Finding hominin bones from the Palaeolithic using collagen peptide mass sequencing (ZooMS)
16:20	**Rob Dinnis** - New perspectives on the Kostenki Early Upper Palaeolithic
16:40	**Gianpiero di Maida** - Fontana Nuova (Ragusa, Sicily): a review of its Aurignacian attribution
17:00	**Gregorio Oxilia** - The dawn of dentistry in the Late Upper Paleolithic: A deeper antiquity of biomedical care and surgical intervention
17:20	**Antonin Tomasso** - The Upper Paleolithic site of Les Prés de Laure (France) sheds new light on Palaeolithic weaponry
17:40-18:30	**General Assembly**
18:30	**Closing Dinner • Rijksmuseum van Oudheden,** *Rapenburg 28*

Poster Numbers

The two posters sessions will take place at 12:15-14:15 on Thursday, 21st and Friday, 22nd. Odd numbers will present during the first poster session **(Th, 12:15-14:15)** and even numbers will present during the second Poster session **(Fr, 12:15-14:15)**. All posters will be on display for the duration of the conference.

1	**Joao Marreiros** - Understanding artifact variability and function in the evolution of human behavior: Introducing the Laboratory for Traceology and Controlled Experiments (TraCEr), MONREPOS, RGZM
2	**Shumon Hussain** - Is ESHE a partisan event? A quantitative assessment of differences in visualisation practices among Anglophone and French lithic scholars and the issue of pluralism in palaeo-archaeological research
3	**Thomas Wynn** - The Evolutionary Origins of Autonoetic Thinking
4	**Frederick Coolidge** - The Evolution of Learning and Memory Systems
5	**Marta Pernas-Hernández** - The avian fossil record of BK site (Bell Korongo) at Olduvai Gorge (Tanzania)
6	**Joao Cascalheira** - Systematic sampling survey for Stone Age sites in the Limpopo basin, SW Mozambique
7	**Celia Goncalves** - Reconstructing Stone Age Settlement Patterns in the Elephant river valley, Mozambique
8	**Nuno Bicho** - Txina, Txina, a new LSA site from the Limpopo River Valley, Mozambique
9	**Regine E. Stolarczyk** - Behaviours as mosaics of new and old traits: What's new in in the Middle Stone Age of Southern Africa?
10	**Jerome Reynard** - Comparing fauna from the Still Bay of Blombos Cave with the Howiesons Poort of Klipdrift Shelter: Possible subsistence intensification during the Late Pleistocene in the southern Cape of South Africa
11	**Alison Mant-Melville** - Late Pleistocene Middle Stone Age Technology in the Eastern Lake Victoria Basin, Kenya
12	**Lawrence Barham** - The Deep Roots of Human Behaviour Project - the Early to Middle Stone Age (ESA/MSA) Transition in South-Central Africa
13	**Michaela Ecker** - Excavating the fossil bearing Strata of the lower Vaal River, South Africa - first results from Pniel 6
14	**Daniela de Matos** - Why apply a geoarchaeological approach to the Middle and Late Pleistocene deposits of Leba Cave (Huíla, Southwest Angola)?
15	**Sonja Tomasso** - A techno-functional study of the Aterian technocomplex at Ifri n'Ammar
16	**Alice Leplongeon** - Backed pieces and their significance in the Later Stone Age of the Horn of Africa

17	**Valérie Andrieu-Ponel** - The Acigöl Lake near Denizli, Turkey: a window on the environment of the Kocabas hominin at 1.2 Ma
18	**Galina Levkovskaya** - SEM micrographs of pollen complexes as a source of pollen and palaeobotanical information on the Palaeolithic red earth layers of Atapuerca cave site (Spain)
19	**Domenico Giusti** - Beyond maps: Patterns of formation processes at the Middle Pleistocene open-air site of Marathousa 1, Megalopolis Basin, Greece
20	**George Konidaris** - The *Elephas (Palaeoloxodon) antiquus* skeleton and other large mammals from the Lower Palaeolithic locality Marathousa 1 (Megalopolis Basin, Greece): preliminary results
21	**Gonzalo Linares-Matás** - Preliminary taphonomical assessment of the macromammalian zooarchaeological assemblage at the late Early Pleistocene site of Cueva Negra del Estrecho del Río Quípar (Caravaca, Murcia, Spain)
22	**Michael John Walker** - Preliminary dating of deep layers at Sima de las Palomas del Cabezo Gordo (Torre Pacheco, Murcia, Spain)
23	**Federico Lugli** - Limited mobility of a Middle Pleistocene pregnant woman from Southern Italy: inferences from LA-MC-ICP-MS strontium isotopes analyses of a deciduous human tooth
24	**Giulia Gallo** - Damage morphology, function, and life history of percussive bone tools at the Lower Paleolithic site of Schöningen, Germany: an experimental approach
25	**Ariel Malinsky-Buller** - ALAPARS 1 - A New Middle/Upper Pleistocene Paleoenvironmental and Archaeological Record from Armenia
26	**Patricia Bello-Alonso** - Preliminary use-wear analysis results of the Early Acheulean site of Thiongo Korongo (Olduvai Gorge, Tanzania)
27	**Vangelis Tourloukis** - The lithic assemblage and bone tools from the Lower Palaeolithic site of Marathousa 1, Megalopolis, Greece: first results
28	**Nohemi Sala** - The tempo of the accumulation of hominins from Sima de los Huesos
29	**Martina Demuro** - Single-grain OSL dating of the Middle Palaeolithic site of Galería de las Estatuas, Atapuerca (Burgos, Spain)
30	**Pedro Horta** - The Neanderthal Occupation in Southwestern Iberia: preliminary data from the Gruta da Companheira site
31	**Milena Carvalho** - Lapa do Picareiro: A Paleoenvironmental Reconstruction Using Stable Isotopes of Red Deer (*Cervus elaphus*) Enamel
32	**Andrzej Wisniewski** - New radiometric dating of Micoquian site Pietraszyn 49a (SW Poland) and its consequences
33	**Lena Asryan** - Lithic assemblages of Azokh 1 Cave, a Middle to Upper Pleistocene key site in the Caucasus
34	**Phil Glauberman** - Late Middle Paleolithic technological organization in the Armenian volcanic highlands: a case study from the site of Barozh 12
35	**Jennifer Sherriff** - The River Hrazdan, central Armenia: a context for Middle and Upper Pleistocene hominin expansion and adaptation in the Southern Caucasus

36	**Mareike C. Stahlschmidt** - Interdisciplinary Research into the Impact of Climate Changes during the Last Glacial on Human Behaviour at Satsurblia Cave, Georgia
37	**Christine Verna** - Territorial mobility of early modern humans in Crimea. Strontium isotope analyses of the human remains from Buran-Kaya III
38	**Yannick Raczynski-Henk** - Searching for evidence and missing the camps: Amsterade-Allée, a new Middle Palaeolithic open air site in the Netherlands with indications for the use of red ochre
39	**Marcel Niekus** - Peopling Doggerland: submerged Stone Age finds from the Dutch North Sea
40	**Francesca Romagnoli** - Introducing time in the study of Neanderthals socio-economic behaviour: GIS multi-scalar spatial and temporal approach to dissect occupational patterns at the end of MIS 3
41	**Ilkka Sipilä** - The Evolution of Neanderthal Mobility Behaviour
42	**Ana Abrunhosa** - Neanderthal raw material procurement strategies: spatial analysis of lithic resources available in the Lozoya river valley (Madrid-Spain)
43	**Eli Reuveni** - Genomic signature among Neanderthals unravel adaptation for high protein diet metabolism
44	**Robert Power** - Reviewing evidence of Neandertal and Upper Paleolithic diet
45	**William Rendu** - Hunting seasonality and mobility patterns among late Neanderthals in Southwestern France. A cementochronological approach
46	**Eduard Pop** - The lithics of the Eemian and Early Weichselian find levels of Neumark-Nord 2 (Germany) - techno-/typological developments against a background of environmental change
47	**Viola C. Schmid** - Lithic assemblages from the Middle Paleolithic of Geißenklösterle Cave, Germany: New insights on Neanderthal technology and behaviour from the Swabian Jura
48	**Julia Zastrow** - A small mammal assemblage from Hohle Fels, Ach valley: preliminary indications of the paleoenvironment during the Middle Paleolithic
49	**Sara E. Rhodes** - The taphonomy of small mammals at Geißenklösterle Cave in the Ach Valley of southwestern Germany during the Middle and Upper Paleolithic
50	**Lisa Schunk** - New Evidence for Handedness and Social Learning in European Neanderthals - A comparative study of the Late Middle Palaeolithic assemblages from Balver Höhle and Buhlen, Germany
51	**Ron Shimelmitz** - Variation in Late Lower Paleolithic Blade Production: The Case of Masloukh, Lebanon
52	**Mathieu Duval** - In which extent high resolution μCT-scanning of hominin fossil remains may impact the ESR dating results?
53	**Guillaume Guérin** - Quina Mousterian across the Pyrenees: same of different times? Making the best of single-grain OSL data using newly developed, dedicated Bayesian models
54	**Tobias Lauer** - Optical dating of the Saalian glacial cycle and the onset of the Middle Paleolithic in central Germany

55	**Christelle Lahaye** - Chronology of two Middle Palaeolithic-Châtelperonnian-Upper Palaeolithic sequences in open-air sites in Southwest France: Les Vieux Coutets and Canolle Ferme studies
56	**Maria Schaarschmidt** - Multiple-method luminescence dating of Palaeolithic sequences in Badalinh and Gu Myaung Caves, Myanmar
57	**Jacopo Gennai** - The Laminar Levallois of units A10 - A11 of Grotta di Fumane (VR)
58	**Alessandro Aleo** - A technological and functional examination of the Aurignacian end-scrapers from Grotta di Fumane
59	**Manuela Forte** - Re-examination of marine shells assemblage from Proto-Aurignacian of Grotta di Fumane, Italy. An atelier of jewellery
60	**Tim Matthies** - Hunted or collected? A critical re-evaluation of the Proboscidean remains at the Aurignacian open-air site Breitenbach-Schneidemöhle (Germany)
61	**Maria Joana Gabucio** - High Resolution Spatiotemporal Analysis of Archaeological Fanual Assemblages. The case of Le Sire (Mirefleurs, Puy-de-Dôme), An Early Gravettian Open-Air Site
62	**Andrei Sinitsyn** - Archaeological evidence for complex gathering in the Upper Palaeolithic: East European perspectives
63	**Silvia M. Bello** - Magdalenian mobiliary art from Gough's Cave (UK)
64	**Julia Galway-Witham** - Magdalenian bone tools from Gough's Cave (Somerset, UK)
65	**Grégory Abrams** - An innovative use of gaming technology for the presentation of stratigraphic information: A presentation of the Middle Palaeolithic deposits at Scladina Cave, Belgium
66	**Sebastian Scheiffele** - Assessing tool complexity: Combining approaches from Cognitive Archaeology and Information Theory
67	**Dries Cnuts** - Around the fireplace: heat exposure and adhesive alteration
68	**Femke H. Reidsma** - Diagenesis dissected: A laboratory-based experimental study into the influence of pH exposure on heated bone
69	**Martin Hromada** - A Taste for Honey: On the Co-Evolution of Pyrophilic Primate, Honeyguides and Honeybees
70	**Anna van Oosterzee** - The Social Brain Hypothesis and the Hippocampus
71	**María Asunción Cabestrero-Rincón** - Differential evolution of cerebral and cerebellar fossae in recent *Homo*
72	**Florian Bouchet**- A comparative study of endocranial shape asymmetries in extant and extinct cercopithecoid taxa
73	**Amélie Beaudet**- Cranial vault thickness variation and inner structural organization in Plio-Pleistocene hominids from Sterkfontein Caves, South Africa

74	**Antonio Profico** - The hominin inside: an automatic tool to reproduce the internal and external anatomy of bony structures
75	**Matt Sponheimer** - Unexpected Developments in Early Hominin Diet and a Way Forward
76	**Chrisandra Kufeldt** - Ancestral state reconstruction of dental development in Miocene fossil taxa
77	**Melania Ioannidou** - The cranium of *Ouranopithecus macedoniensis* : virtual reconstruction and comparative analysis
78	**Baopu Du** - Morphology and cross-sectional geometric analysis of Lufengpithecus first metatarsal - implications for its locomotor behavior
79	**David M. Alba** - First record of the fossil great ape *Hispanopithecus* from the late Miocene site of Can Pallars i Llobateres (Sant Quirze del Vallès, NE Iberian Peninsula)
80	**Luca Fiorenza** - Macrowear and biomechanical analyses of great ape molars
81	**Flavia Strani** - MicroWeaR: a new tool for dental microwear analysis and its application to paleoanthropology and paleontology
82	**Raquel Hernando** - Dental microwear pattern of a cannibalized Bronze Age population at El Mirador Cave (Sierra de Atapuerca, Burgos, Spain)
83	**Jenny H.E. Burgman** - Comparison of dental macrowear and microwear of three sympatric rodent species from southern Africa
84	**Miguel Proa** - Random genetic drift and cranial form evolution in Anthropoids
85	**Alessio Veneziano** - Diet, encephalisation and the evolution of the human mandible: a catarrhine approach to mandibular and dental reduction
86	**Lucía Nadal** - Morphometric and topographic variability of molar crowns of hominoid primates: implications for dietary adaptations of *Paranthropus robustus* and *Paranthropus boisei*
87	**Thomas Colard**- Relationship between tooth germs, crypts and the jaw bones: a 3D microCT study
88	**Nancy Tang** - Synchrotron X-ray microtomography in nondestructive adult age at death estimation: visualizing cementum annulations in a historical human assemblage
89	**Emily Hunter** - The effect of dental wear on food processing during development in a hard-object feeding primate (*Cercocebus atys*)
90	**Laura Martín-Francés** - 2D Enamel thickness in Early Pleistocene *Homo antecessor* (Atapuerca, Spain)
91	**Stephanie Melillo** - The Nefuraytu mandible and temporal trends in *Australopithecus afarensis*
92	**Annabelle Lockey** - Characterisation of Sima de los Huesos mandibular incisors dental tissue proportions using microtomography

93	**Alisa Zubova** - The odonoglyphic patterns of the Central Asia and Altai Mountains Middle Paleolithic populations: preliminary results of the comparative analysis
94	**Cristiana Margherita** - 3D enamel thickness in Neandertal and Homo sapiens permanent lower molars and premolars
95	**Almudena Estalrrich** - Dental behavior and long-term dietary reconstruction of El Sidrón Neandertals derived from molar macrowear patterns
96	**Marina Martínez de Pinillos** - *Homo antecessor* lower molars at a glance
97	**Rainer Grün** - Double Blind Direct Electron Spin Resonance Dating of *Homo Naledi* Remains
98	**Adeline Le Cabec** - What can anterior tooth root morphometrics tell us about *Homo naledi*?
99	**Juliet Brophy** - Crown shape and relative cusp analyses of *Homo naledi* deciduous molar teeth from Dinaledi Chamber, Rising Star cave system, South Africa
100	**Scott Maddux** - Climate and modern human nasal evolution: Reassessing the adaptive role of nasal projection
101	**Elisabeth Cuesta Torralvo** - Significance of 3D geometric morphometrics allometry of the masseter muscle with respect to myosin isoform expression in Hominoidea primates
102	**Andrea Eyquem** - Diet consistency, dental malocclusions and the shape of the human face. Preliminary results
103	**Hannes Rathmann** - Can dental morphology be used as a proxy for neutral genomic data in studies of human population relatedness?
104	**Isabelle De Groote** - Methodological approaches to recording in situ fossils
105	**Judith Beier** - Skull trauma probabilities in Neanderthals and Upper Paleolithic modern humans
106	**Ekaterina Stansfield** - Biomechanics of the lower jaw in Upper Palaeolithic and Mesolithic hunter gatherers
107	**Cedric Boeckx** - Genetic changes associated with bone remodeling activity and the origin of the modern human face
108	**Alexandra Schuh** - Ontogeny of the midface in *Homo sapiens:* building an integrative growth model for paleoanthropological studies using bone modelling and geometric morphometrics
109	**Miranda Allain-Chapman** - Head carriage and the stability of neurovascular structures of the hominoid cranial base
110	**Lumila Menéndez** - Differential degree of association between diet diversity, facial and mandible variation: a study case on South American populations
111	**Abel Bosman** - Talking Heads: Morphological variation in the human mandible over the last 500 years in the Netherlands

112	**Maria Mednikova** - Neanderthal Infant Kiik-Koba 2 and a Possible Pathology in the Context of Bioarchaeology
113	**Camille de Becdelievre** - Behavioral Adaptations - Morphological Adaptations: new contributions from Morphometric Mapping for the understanding of Mesolithic-Neolithic transformations (Balkans)
114	**Mirjana Roksandic** - New hominin material from Pesturina cave in Serbia
115	**Michael B. C. Rivera** - Investigations of activity, diet and health on the prehistoric Baltic coast
116	**Montserrat Sanz** - Neandertal remains from Cova del Gegant (Sitges, Barcelona)
117	**Amélie Vialet** - A comparative study of the Late Middle European Pleistocene Montmaurin-La-Niche (MLN). Preliminary results
118	**Claire Terhune** - Early Pleistocene paleohabitats of Eastern Europe: Evidence from the Oltet River Valley of Romania
119	**Marie Matu** - First biological insights on new early Holocene human remains from the site of Hara Idé 3, Republic of Djibouti
120	**Beatriz Gamarra** - Morphometric and diet changes in the Nile Valley during the Middle and Late Holocene
121	**Gabriel Šaffa** - Spatial and Demographic Patterns of ^{15}N and ^{13}C Variation in Late Holocene Human Samples from Central-West Argentina
122	**Jennifer Leichliter** - Stable Carbon Isotope Ecology of Small Mammals from the Sterkfontein Valley: Implications for habitat reconstruction in mosaic envrionments
123	**Oxala García-Rodríguez** - Comparative phylogeography of modern humans and other organisms
124	**Jordi Agustí** - Early Pleistocene human dispersal in Western Europe: East-West or North-South?
125	**Laura Buck** - A colonising niche? Comparing climatic adaptation in Jomon foragers and Japanese macaques.
126	**M. Alejandra Perotti** - Unravelling early human migration in southern South America using Darwin's Fuegian lice
127	**Anna Maria Kubicka** - Do Lifestyle Factors Affect Pelvic Shape in Eastern European Males? A Computed Tomography Comparative Study
128	**Anneke H. van Heteren** - The phalangeal morphology of La Ferrassie 1 compared to modern humans using three-dimensional geometric morphometrics
129	**Timo van Leeuwen** - Anatomical Adaptations in the Bonobo Thumb
130	**Fotios Alexandros Karakostis** - The patterns among human hand entheses are associated with occupational manual activities

131	**Szu-Ching Lu** - Reconstructing hand use in fossil hominins: validating musculoskeletal and finite element models of the third digit for precision grasping and locomotion
132	**Noémie Bonneau** - Functional approach to the lumbar spine : a three-dimensional analysis of articular facet orientation
133	**Christopher J. Dunmore** - Trabecular morphology across the hominoid metacarpus reflects distinct locomotor strategies
134	**Vitale Sparacello** - Inferences on Sicilian Mesolithic subsistence patterns from entheseal changes and cross-sectional geometry
135	**Kim Deckers** - Trabecular Bone Ontogeny in the Human Talus of a 19th Century Dutch Population
136	**Jaap Saers** - Talar trabecular structure strongly correlates with locomotor mode and terrestrial mobility level in modern humans, nonhuman apes, and a Neandertal
137	**Mark Grabowski** - A chimpanzee-sized ancestor of the earliest hominins and unusual patterns of body size evolution in the hominid clade
138	**Adam Gordon** - Direct comparison of postcranial size dimorphism in *Australopithecus afarensis* and *Australopithecus africanus*
139	**Jeffrey Schwartz** - Pelvic morphology and South African australopith taxic diversity: evidence from Sterkfontein, Swartkrans, and Malapa
140	**Luis Ríos** - Growth in height and somatic maturation of Neandertals compared to modern humans
141	**Emma Pomeroy** - Holocene evolutionary trends in South Asian body size: implications for contemporary health
142	**Michelle Cameron** - Small body size phenotypes among Middle and Later Stone Age southern Africans
143	**Rita Sorrentino** - Evaluating behavioral effects on modern human shape talar through GMM
144	**Mathilde Lequin**- Hominin and bipedalism definition: where do we stand?
145	**Adrián Pablos** - Foot remains of the Neandertal Regourdou 1 (Montignac-sur-Vézère, Dordogne, France)
146	**Melissa Tallman** - Modularity in the proximal and distal femur of primates with implications for the evolution of locomotor diversity
147	**Alessandro Riga** - Human deciduous teeth from the Middle Stone Age layers of Sibudu Cave (South Africa)
148	**Federica Landi** - Rethinking foramen magnum position as a proxy for locomotion

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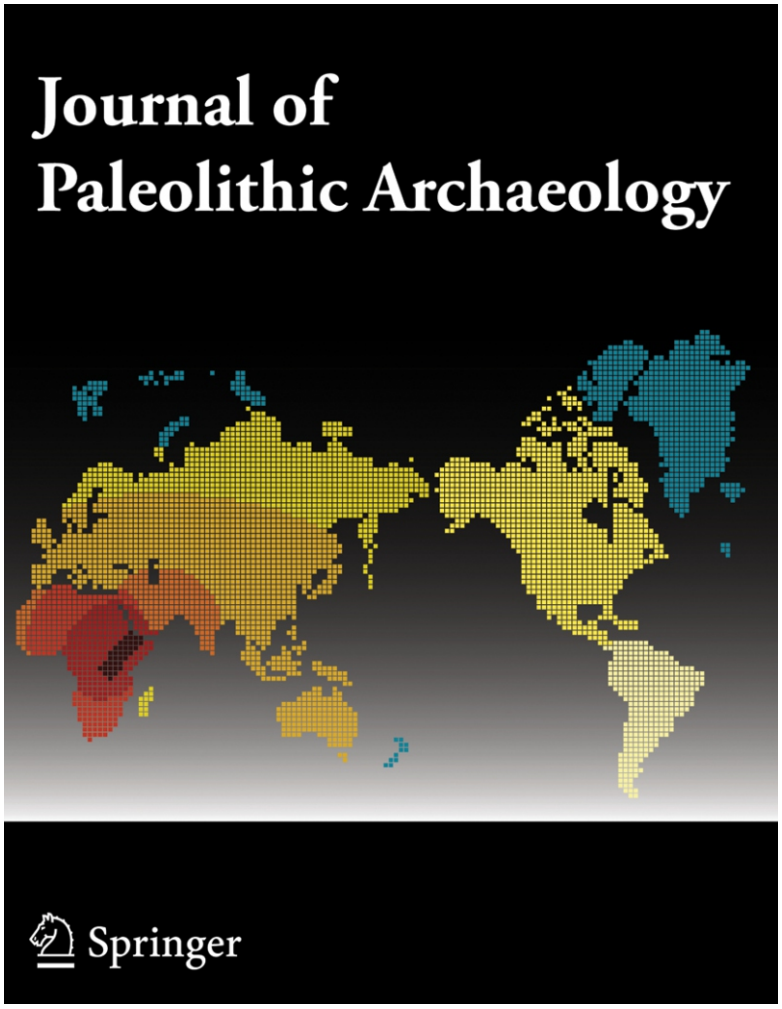

The *Journal of Paleolithic Archaeology* is aimed at all Plio-Pleistocene archaeologists and other scientists researching Paleolithic archaeology. It covers all aspects of Paleoanthropology, including biological and cultural human evolution, paleoecology, dating, site formation processes, diet, paleoclimate, taphonomy, zooarchaeology, geoarchaeology, and many more fields of interest for Paleolithic archaeology. Our focus spans from the earliest paleoanthropological discoveries in Africa to the peopling of Oceania and the Americas.

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Abstracts
European Society for the study of Human Evolution

Leiden September 2017

Poster Presentation Number 65, Th (12:15-14:15)

An innovative use of gaming technology for the presentation of stratigraphic information: A presentation of the Middle Palaeolithic deposits at Scladina Cave, Belgium.

Grégory Abrams[1], Kévin Di Modica[1], Dimitrios Ververidis[2], Frédéric Bezombes[3], Dominique Bonjean[1], Alex Hardy[4], Spiros Nikolopoulos[2], Frédéric Precioso[5], Andy Shaw[3], Christoph Strecha[6], Isabelle Groote[3]

1 - Scladina Cave Archaeological Centre · 2 - CERTH · 3 - Liverpool John Moores University · 4 - Vulcan UAV · 5 - Université Nice Sophia Antipolis · 6 - Pix4D

The DigiArt project is currently in its final year. The main aim of the project is to improve the process of mass 3D digitisation for the cultural heritage sector. This objective includes the creation of a range of software solutions and commercially low-cost hardware to make the process of virtual curation and virtual visits for the public more democratic and more user friendly. These tools are meant for the curators of cultural heritage, be them archaeologists, anthropologists, museum curators or private people with interesting collections, to author dynamic scenarios into 3D cultural worlds with their heritage objects as the objects for composing the stories the public will be told. The project is unique in its consortium partners who are archaeologists, anthropologists, electrical, mechanical, optical and software engineers. The convergence of their ideas means that the aims of the project are driven by the cultural heritage workers. In the project, engineers have been working on finding a balance between capturing large scale sites, data accuracy and visual accuracy. Although the project is still ongoing, the culmination of the innovations made in the project will be the landscape for new immersive experiences to remote and onsite visitors. Although the definition of visitor in this project is considered the general public, as archaeologists and anthropologists we see potential beyond this stakeholder here. The 'Story Telling Engine' software package that is being created as part of this project can easily be adopted for providing more informative and more immersive ways of disseminating site information to the scientific community. The ease of a drag and drop feature to add 3D models of whole archaeological sites or specific stratigraphic sections and associated objects makes for a user-friendly tool. In demonstration of DigiAr's "Story Telling Engine" and its usefulness in academic dissemination, we will present the stratigraphy of Scladina Cave (Belgium). This site has been subject to substantial analyses to further our understanding of its sedimentation processes. Thanks to this new user friendly tool, all stratigraphic records can be easily integrated into a high detailed 3D model of the cave. This system allows archaeologists to follow the evolution of the excavation and to reposition all the discoveries in situ.

Poster Presentation Number 42, Fr (12:15-14:15)

Neanderthal raw material procurement strategies: spatial analysis of lithic resources available in the Lozoya river valley (Madrid-Spain)

Ana Abrunhosa[1], Enrique Baquedano[2], Belén Márquez[3], Alfredo Pérez-Gonzáez[4], Juan Arsuaga[5]

1 - ICArEHB / MAR · 2 - MAR / IDEA · 3 - MAR · 4 - CENIEH · 5 - UCM / ISCIII

There is less information about raw material procurement on the center of the Iberian Peninsula when comparing with coastal areas. By studying lithic raw material choices and the implications it may have on the technological adaptation we are looking to understand the relation between the *chaîne opératoire*, raw materials and how they influence each other. Here we present the first approach to the spatial raw material distribution in the landscape and mobility analysis of an ongoing Ph.D. project aiming to study the exploration and exploitation of the lithic raw materials of the Lozoya river valley by Pinilla del Valle's Neanderthal groups. Pinilla del Valle Late Pleistocene karstic sites are in the Lozoya river valley, c. 1100 m a.s.l. within the National Park of the Guadarrama Mountain Range in the Iberian Central System. The karst is in a pop-down structure of sedimentary rocks with no record of presence of chert surrounded by a pop-up granitic structure that form the Central System, dividing the Meseta. The sites have a collection of lithic tools with a variety of raw materials for the most part available in the valley with a prevalence of quartz representing 80% of the total, 10% chert and the remaining 10% represented by quartzites, sandstones, porphyries and other rock types. In Pinilla del Valle we have within the same area different contexts of human occupation – rockshelter and cave galleries occupied by Neanderthals - within the same paleoenvironment we have different ways of using both space and resources that we can compare between each other to understand Neanderthal behavior and environment adaptation in a continental position where most known sites are located along the coast line. To undertake the spatial analysis of the distribution of raw materials and understand the range of mobility in the region we used two plans of analysis: 1) geological bibliographic study with punctual field surveys to understand the distribution and characterization of the available knapable lithic resources of the region in their different positions – primary (rock outcrops) and secondary (fluvial or slope deposits); 2) petrographic and geochemical characterization of rock types of unknown origin such as chert present in the archaeological collection to perceive its probable geological origin and outcrops. Surveys targeting raw materials in secondary position were performed to map the knapable lithic resources transported by water courses surrounding the valley. This step is very important since secondary position rock known to be used as a resource in the Middle Paleolithic are under-referenced on geological cartography. Petrological and geochemical nondestructive analysis by SEM-EDX and p-XRF of cherts from the archaeological levels led to the determination of their possible formation environments and mapping of probable sources. These analyses concluded in the compatibility with the Lozoya pop-down sedimentary formations which points to a deep knowledge of the available knapable resources and technological adaptation to their physical and mechanical traits. The combined analysis resulted in an integrated database of extended geological information with raw material probable provenance sites in a GIS environment. The mapping of the different available resources distribution and natural routes of accessibility allow interpretation of Neanderthal mobility patterns and their adaptation to the landscape and exploitation. The correlation between lithic resources used and exploited, the analysis of distributional patterns and distances over which raw materials were transported and the frequencies of raw materials available on site will allow to describe how Pinilla del Valle Neanderthal population behaved in the landscape. Accessing their mobility patterns, we hope to better understand Neanderthal cognitive, techno-economic organization, environmental adaptation abilities and behavior traits in the center of the Iberian Peninsula

This research was conducted as part of project S2010/BMD-2330 Funded by the I&D activities programme for research groups run by the Education Secretariat of the Madrid Regional Government. The study was also partly funded by the following organizations: Museo Arqueologico Regional de la Comunidad de Madrid, Grupo Mahou and Canal de Isabel II-Gestion. To the Fundação para a Ciência e Tecnologia (Portuguese Science Foundation) for the doctoral grant SFRH/BD/110511/2015 to Ana Abrunhosa.

Podium Presentation: Session 9, Sat (10:00)

The Relevance of Nor Geghi 1 (Armenia) to the Behavioral and Technological Evolution of Middle Pleistocene Hominins in the Southern Caucasus

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Nor Geghi 1 (NG1) is an open-air site located within the Hrazdan valley 16 kilometers northeast of Yerevan, Armenia. Between 2008 and 2016, several thousand obsidian artifacts were excavated from alluvial sediments deposited on the floodplain and in channels of the paleo-Hrazdan River. The deposits are dated between 440 and 308 ka based on 40Ar/39Ar dating of an underlying lava (Lava 7, 440 ka), an overlying lava (Lava 1, 200ka), and sanidine grains from cryptotephra (Unit 1, 308 ka). The sediments result from a complex process of alluviation, lake formation, and landscape stability, the latter represented by at least four palaeosols. The youngest palaeosol (Units 2-4) dates to MIS 9e and overprints all sediments immediately below Lava 1 across the entire 100 meter-long exposure. The parent material in which this palaeosol formed, and in which the majority of the archaeological material is found, varies in composition and age from one end of the exposure to another, with the southern end of the site representing earlier sedimentation (possibly MIS 11) and the northern end later sedimentation (MIS 9). The northern sediments represent the alluvial infilling of a major erosional unconformity that truncated older sediments still preserved in the south.

Archaeological materials conform to these geological observations, with an earlier (possibly MIS 11) bifacial and core-on-flake technology recovered in the south, and a younger (MIS 9), derived technology of Levallois and hierarchical cores, flakes, and blades, with several bifaces to the north. All artifacts are produced on obsidian, which according to pXRF analyses originate from Gutansar (2-8 km NE), Hatis (12 km E-SE), Pokr Arteni (70 km W), Tsaghkunyats (30 km N), and Sevkar (120 km SE). These sourcing data document the exploitation of territories and environments much larger and more diverse than predicted based on contemporaneous data from other regions, highlighting the deep knowledge hominins had of multiple landscapes, the permanent and seasonal distribution of resources, and the social relationships required to navigate said landscapes effectively.

In addition, the artifacts from NG1 document the variable behaviors and technological evolution of the site's occupants between MIS 11 and MIS 9, and chart the local technological evolution from the Lower Palaeolithic (bifaces) to the early Middle Palaeolithic (hierarchical cores) [1]. Data from NG1 indicate that it is among the oldest Eurasian transitional industries with bifacial and Levallois technology recovered from a secure archaeological and stratigraphic context. At NG1, the gradual change from bifacial to Levallois technology is consistent with the hypothesis that developments in the technological realm of Middle Pleistocene hominins resulted from deep-rooted evolutionary processes based on a common technological ancestry rather than demographic processes.

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Poster Presentation Number 124, Fr (12:15-14:15)

Early Pleistocene human dispersal in Western Europe: East-West or North-South?

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The oldest evidence of human settlement out of Africa comes from Dmanisi, in Georgia, a site dated to 1.8 Ma. Besides the best collection of early Pleistocene hominids, including five skulls of early *Homo* and abundant postcranial remains, this site has provided thousands of archaic stone tools (Oldowan Mode) and abundant remains of the fauna that at that time surrounded those first human newcomers in the Eurasian lands. The commonly assumed scenario is that from Dmanisi hominins dispersed into Europe following a Northern Route: from Southern Caucasus to Anatolia and from there to Central and Western Europe. Against this Northern Route, however, is the fact that after Dmanisi, the oldest evidence of human presence in Europe is found in Spain, at the sites of Barranco León and Fuente Nueva 3 (Guadix-Baza Basin, Granada) and Sima del Elefante (Atapuerca karstic complex, Burgos). Moreover, there is no proven evidence of intermediate early Pleistocene human settlement in sites from Center or Western Europe as old as the Iberian sites. As an alternative scenario, a Southern Route appears as a feasible way to explain the first early human dispersal into Europe. This Southern Route assumes that early humans that peopled Northern Africa in the Early Pleistocene dispersed into Europe directly to the Iberian Peninsula throughout the Gibraltar strait. This scenario can explain some of the inconsistencies of the Northern Route, such as the delay of almost 500.000 years between the first Out of Africa at 1.8 million years ago and the first human evidence in Europe, documented at about 1.4 million years ago. Also, from a faunal point of view, a number of authors have shown the existence of African elements in the Early Pleistocene of Spain. This is the case of large mammals, such as the hippo *Hippopotamus antiquus* and the horse *Equus altidens*, whose first record in Spain dates to 1.4 Ma. Even more compelling is the evidence of non-human primates. This is the case of *Macaca*, recorded for the first time at the late early Pleistocene of Quibas, and the giant African baboon *Theropithecus oswaldi*, recorded at Cueva Victoria, a site dated to 0.8 Ma. There are also examples among the small vertebrates, such as insectivores, amphibians and reptiles. This is the case of the shrew *Crocidura*, an African small mammal first recorded at the sites of Barranco León and Fuente Nueva 3 (Guadix-Baza Basin). There is also evidence of the presence of reptiles and amphibians of African origin in the early Pleistocene of Southern Iberia: lizards (Agamidae) and anurans (the frogs *Bufo viridis* and *Acanthodactylus erythrurus*). Against this Southern Route is the role of the Gibraltar sea way as a physical marine barrier. However, the obstacle which marine barriers pose to human dispersals between continents or islands are minimized at straits such as Gibraltar, allowing human and faunal exchanges among continents. This has been the case of the strait of Bab-al-Mandab, between Africa and Arabia, the Sunda strait, between Java and Flores, and the Bering strait, between North Eastern Asia and North America. According to this scenario, it seems that a main constraint in hominin dispersal was not physiographical barriers but more favorable environmental conditions. In this paper we analyze critically the feasibility of this Southern scenario both from a paleoenvironmental and paleographical point of view.

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First record of the fossil great ape *Hispanopithecus* from the late Miocene site of Can Pallars i Llobateres (Sant Quirze del Vallès, NE Iberian Peninsula)

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Miocene apes (Primates: Hominoidea) are generally scarce and their recovery usually requires a large sampling effort [1]. In the Iberian Miocene, hominoids are restricted to Catalonia, and most of their remains have been recovered from the Vallès-Penedès Basin [1]. Here we report the find of a hominoid dentognathic specimen from the area of Can Pallars i Llobateres (CPL, Sant Quirze del Vallès) [2, 3], where fossil apes had not been previously recorded.

The specimen (IPS102942) was surface collected by ICP technician Josep M. Méndez in March 2017 while prospecting for potentially fossiliferous sediments in the area. The find was reported to the Archaeological and Paleontological Service of the Generalitat de Catalunya and is currently housed at the Institut Català de Paleontologia Miquel Crusafont (ICP). The locality of provenance is located within an uncultivated land parcel west of Ponent Street (UTM coordinates: 421380 E – 4598702 N) and has been labeled CPL-M (for Méndez) so as to distinguish it from the locality of CPL. The latter was sampled in 1999 by Manel Llenas, being located within a field ca. 50 m to the east. Both localities are situated ca. 500 m in NW direction from the early Vallesian (MN9) site of Can Poncic 1 (CP1), which is the type locality of the extinct great ape *Hispanopithecus crusafonti* [1, 4].

IPS102942 was embedded within a small sediment block apparently dug up years ago during some excavation works with heavy machinery. A relative dating is possible thanks to the sample of 350 rodent teeth recovered in 1999 from CPL, which includes 14 species of rodents. Two-thirds of the sample correspond to the cricetid *Cricetulodon sabadellensis*. Coupled with the presence of other taxa (such as *Democricetodon nemoralis* and *Keramidomys pertesunatoi*) and the absence of *Progonomys hispanicus*, this rodent assemblage enables an unambiguous correlation of CPL with the *Cricetulodon hartenbergeri - Progonomys hispanicus* interval local subzone of the Vallès-Penedès Basin (9.98-9.73 Ma, MN10; earliest late Vallesian, late Miocene) [2, 3]. CPL is therefore younger than CP1, which is correlated instead with the *Cricetulodon hartenbergeri* range local subzone (10.30-9.98 Ma, MN9; early Vallesian), and hence more similar in age to Can Llobateres 1 (CLL1; 9.76 Ma) [2, 3], where *Hispanopithecus laietanus* has been recorded [1, 4]. The presence of a relatively humid and forested environment is evidenced by the occurrence of a remarkable diversity of arboreal dormice, two eomyids and a small-sized beaver (*Euroxenomys minutus*) [5]. These taxa are very rare, but the cricetids *Eumyarion leemanni* and *Anomalomys gaillardi*, which may also have been associated with forest environments [5], are relatively common.

IPS102942 is a left maxillary fragment (ca. 1.5 x 2.0 mm) still partially embedded in matrix that preserves the P4 roots and the M1 crown. Except for a missing enamel chip behind the hypocone, the M1 crown is well preserved but relatively worn (with dentine exposure at the apices of the lingual cusps). It is mesially broader than mesiodistally long, it tapers distally to some extent, and lacks any cingula. This molar fits well with the occlusal morphology of *Hispanopithecus* M1 from other Vallès-Penedès localities [1, 4]. However, in both size and proportions, IPS102942 most closely resembles the M1 of *H. laietanus* [4]; the development of cingula is too variable to be diagnostic [4]. Therefore, IPS102942 is tentatively assigned to *H.* cf. *laietanus*, in further agreement with the age of the locality. Coupled with the existence of other fossiliferous outcrops in the surroundings, this find is most promising for the prospect of finding additional fossil hominoid remains in this area.

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Pecha Kucha Presentation: Session 2, Th(11:25-11:50)

A brainy, high-browed hominin : co-evolution of the brain and braincase in *Homo sapiens*

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It is well-accepted that large brains are an evolutionary specificity of *Homo sapiens* and a major contribution to its success, as they allowed this species to perform complex cognitive tasks. Throughout the evolution of the genus *Homo*, endocranial capacity has increased steadily, reaching its highest means in Neandertals and *Homo sapiens*. However, while Neandertals retained an elongated braincase and brain, as seen in earlier *Homo* species, in *Homo sapiens* this growth came with derived features such as a rounded skull and brain. It has been suggested that these differences in adult morphologies between *Homo sapiens* and Neandertals result from a globularisation phase during ontogeny [1]. Overall, although both cranial and endocranial characters are used in order to differentiate *Homo* species and to assign fossils to different taxa, the extent to which cranial and endocranial morphologies co-vary in the genus *Homo* is not known. Both cranial and endocranial morphologies in *Homo sapiens* appear unusual when compared with all other *Homo* species. At the intraspecific level, the organisation of the cerebral lobes within the *Homo sapiens* species has been shown to have changed since the Upper Palaeolithic (for instance in surface area and in the proportions of sagittal measurements for each lobe [2]). In the same time, the average cranial capacity was shrinking and the skulls and skeletons were becoming more gracile. This study addresses the co-evolution of the *Homo sapiens* brain and skull, by analyzing patterns of variation through time (using Upper Palaeolithic, epipalaeolithic and extant samples) and by comparing *Homo sapiens* to other *Homo* species in order to assess its specificities within the genus. The questions we have attempted to answer are: does the morphology of the brain and skull in *Homo sapiens* significantly deviate from the patterns seen in other *Homo* species or not? Can allometry explain the *Homo sapiens* pattern? Can we clarify the timeline of the apparition of the *Homo sapiens* pattern and of its subsequent evolutions? In order to answer these questions, we have used a protocol in 2D geometric morphometrics on the mid-sagittal plane (modified from [3]), as well as traditional morphometrics on the entire skull and endocranium. We used data derived from the inner and outer cranial vaults, as well as morphological loci which allow us to gather data about brain organization, such as the anterior and posterior extension of the frontal, parietal and occipital lobes on the mid-saggital plane. We explored morphometrical variations in a sample of 77 *Homo sapiens* (40 extant, 15 Epipalaeolithic, 22 Upper Palaeolithic) and 22 non-sapiens *Homo* specimens (8 Neandertals, 11 *Homo erectus sensu lato*, 4 other mid-Pleistocene *Homo*). We then cross-examined the results in order to address the questions above. Our results show specificities in *Homo sapiens* morphology compared with other *Homo* species, and differences across *Homo sapiens* groups. For instance, they suggest that there are more differences between the midsagittal morphologies of *Homo sapiens* and the other *Homo* species than there are between any of the other *Homo* species, despite the enlarged brains of both *Homo sapiens* and Neandertals and the morphological changes that this growth caused. Our results also show re-organisations in the relative lengths of cerebral lobes in *Homo sapiens* since the Upper Palaeolithic, suggesting a gradual shift to the pattern seen in extant humans.

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Poster Presentation Number 58, Fr (12:15-14:15)

A technological and functional examination of the Aurignacian end-scrapers from Grotta di Fumane

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End-scrapers are tools widespread during all the Upper Paleolithic; they are manufactured retouching a blade or a flake extremity and used mainly for working hide, bone or wood. The analyzed tools were recovered at Fumane Cave, located in the Monti Lessini, part of the Veneto Pre-Alps, in the northeast of Italy [1].

The cave presents traces of intense and repeated human occupation. Protoaurignacian living floors are documented in A2 and A1, dating 14C: 35850±310 - 34180±270 BP; evidence of Aurignacian occupation is attested in the upper layers of the macro-unit D, dating 14C: 33890±220 BP [3]. In layer A2, dwelling structures are represented by large hearths, dumps of butchered and consumed herbivore carcasses and stone flaking waste. Finds in layers D include bone and antler tools, painted stones, accumulations of ochre and molluscan shells [2].

The studied assemblage consists of 203 end-scrapers. Most of them come from the Protoaurignacian levels, 132 tools; fewer from Ancient Aurignacian ones, 71 tools. Technological, typological and functional analysis were performed on the items. The raw material used is the high quality flint abundant in the Lessini mountains: the main one is Maiolica, followed by Scaglia Variegata and Scaglia Rossa. The tools are manufactured on blanks from the whole laminar débitage especially blade and other regular débitage products but also on shorter flakes. Most of the end-scrapers are made of regular supports with a reduced thickness, slightly convex profile, axial and distal active part mostly characterized by intense resharpening. Typologically long frontal end-scrapers are the most numerous, carinated and nose form (typical of the Ancient Aurignacian) are very less represented.

The functional study has been carried out in collaboration with the Traceolab of Liege. Both macro and microscopic traces were considered; tools were analyzed with a stereoscopic microscope (low power approach) and also with a metallographic microscope using bright field illumination (high power approach). Thanks to the good state of preservation of the tools, a large number of use-wear traces were detected and compared with the reference collection. Traces are comparable with action of shaving and scraping soft material like hide; the analysis of the edges reveals the presence of hafting arrangement on some scrapers [4,5]. The presence of ocher on the front of the scrapers could be related to its use during the process of hide working, the one on the edges may be linked to the hafting.

The study of lithic assemblage shows a continuity among the levels A and the levels D. The scrapers share the same technological, typological, morphological and functional features Therefore it could be possible to attribute the lithic production of levels D at the Protoaurignacian too, instead of Ancient Aurignacian. Use-wear analysis reveals a high specialization of these tools used almost exclusively in the various stages of hide working. The data supports the argument that these scrapers were not involved in the production of bone and ivory tools founded in Aurignacian layers D. Future studies could highlight which kind of tools were used for producing these objects.

Microscopic observations have been done at the TraceoLab, Université de Liège, Belgium. Research at Fumane is coordinated by the Ferrara University in the framework of a project upported by the Ministry of Culture e Veneto Archaeological Superintendency, public institutions (Lessinia Mountain community e Regional Natural Park, Fumane Municipality, Veneto Region e Department for Cultural Heritage), Research Centres (MPI-EVA),Foundations (Foundation Fyssen; Leakey Foundation 2015/2016 General Grant), associations and companies (National Geographic Society Grant 9022-11, Valpolicella-Benaco BCC Bank, Roberto Gardina & C. and others).

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Poster Presentation Number 109, Th (12:15-14:15)

Head carriage and the stability of neurovascular structures of the hominoid cranial base

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The human cranial base has been described as a morphologically stable region that preserves phylogenetic information and reflects head balance. Morphological differences, especially in the position of the foramen magnum (FM), have been described between modern humans and great apes and attributed to encephalization and/or locomotion [1]. Our own study of basicranial variability in modern hominoids indicated that many neurovascular structures were stable with key differences likely related to encephalization [2].

Comparisons with fossil hominins have aimed to identify aspects of basicranial morphology indicative of bipedal locomotion or head carriage [1,3]. Here we test the hypothesis that orthogrady and/or head carriage is reflected in the postnatal development of the hominoid cranial base by considering gibbons whose head carriage is like the chimpanzee [4]. We used aged growth series of 57 humans (*Homo sapiens sapiens*), 46 chimpanzees (*Pan troglodytes, P. paniscus*) and a partial growth series of 16 gibbons (*Hylobates agilis, H. klossi, H. lar, Symphalangus syndactylus*) to study the relative stability of 68 neurovascular and 38 musculoskeletal 3D landmarks (LMs) of the cranial base. Statistical analyses (Generalised Procrustes Analysis, Canonical Variant Analysis, centroid size dependent linear regression and permutation tests) were performed to describe inter and intraspecific form (size and shape) variation.

All neurovascular LMs are stable across species and through ontogeny with two exceptions: the FM in all taxa and the carotid canals (CCs) in humans. The greatest differences in shape (PC1 = 59.4%) separate humans from the other taxa. Differences are statistically significant at birth (Procrustes distance = 0.13, $p<0.05$) and increase during postnatal ontogeny. The growth trajectories of gibbons and chimpanzees are parallel. Humans have a divergent trajectory with most change seen in the first postnatal year. In chimpanzees and gibbons, basion is stable compared to other neurovascular LMs but opisthion migrates superiorly. The human FM (basion and opisthion) is displaced inferiorly. Uniquely, the human CCs move superolaterally. Shape variation between chimpanzees and gibbons correlates with centroid size. The maximum convexity of the occipital condyles develops an inferior projection in humans but a posterior one in chimpanzees and gibbons. During growth, porion is stable in humans but moves superiorly in the other taxa. The plane between the foramen rotundum and porion stays parallel to the Frankfurt horizontal in all taxa.

These results confirm the stability of most neurovascular LMs of the hominoid cranial base. While these basicranial structures are very similar in gibbons and chimpanzees, facial structures are distinct. This implies that chimpanzees retain an essentially primitive hominoid cranial base morphology.

The postnatal shape change to the human FM and CCs is best explained by changes to brain form (FM) and pharyngeal form (CCs). The characteristic globularisation of the modern human cranium occurs early in development and may underlie this [5]. The superior rotation of opisthion in the other taxa may relate to a relative expansion of nuchal muscles and an absence of globularisation [5]. Since the change in CC position in humans (also observed in early hominins [3]) is independent of shifts in FM position, this seems most likely due to encephalization.

Differences in occipital condyle orientation seem to track head carriage during growth, independent of FM position and orientation. Relationships between the porion-foramen rotundum plane, the Frankfurt horizontal and the facial skeleton may also prove useful. Since chimpanzee and gibbon locomotion is distinct, but their head carriage similar, it seems unlikely that locomotion has major effects on basicranial neurovascular landmarks.

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Poster Presentation Number 17, Th (12:15-14:15)

The Acigöl Lake near Denizli, Turkey: a window on the environment of the Kocabaş hominin at 1.2 Ma

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On the Anatolian plateau, which is one of the major migratory axis of hominin populations from Africa, the oldest *Homo erectus* of Turkey was found in the Kocabaş locality of the Denizli Basin [1,2] and dated to ca 1.6–1.2 Ma. Numerous fossils from fauna were discovered in the same geological formation of this fragmentary skull attesting to the presence of wild herbivorous mega-mammal herds (*Archidiskodon meridionalis, Stephanorhinus etruscus*, several species of *Equus, Metacervoceros, Cervalces, Palaeotragus*, a *Bovinae* undetermined, *Paracamelus, Gazellospira torticornis, Leptobos...*) in the local environment of these *Homo erectus*. To go deeper in the reconstruction of their ecological context, we used an exceptional lacustrine archive (more than 1000 m of sediment cores) from the Acigöl Lake, 40 km east of the Kocabasş travertine site. Three lake sediment cores of ca 600, 400, and 150m in length, respectively, were collected in different parts of the basin, from the center to the edge. These cover, and extend well beyond the time period of Kocabasş Man, as the base of the core is estimated at 2-3 Ma, and they provide a unique opportunity to accurately reconstruct the biotope, and assess the resources available in the environment for subsistence activities.

The sedimentological, geochemical, and mineralogical properties of the 601m-long core from the Acigöl basin were subjected to a coarse preliminary study. The first palynological results show an arid landscape alternately wooded and non-wooded. The forested landscapes are diversified and comprise a mixture of coniferous forests within which the Mediterranean pines are dominant. There is also the presence of fir, cedar, spruce, deciduous oak forests, sempervirent oaks, and riparian forests dominated by alder. Arid grasslands include heliophilous and halophilous taxa (e.g. *Chenopodiaceae, Atriplex*, different *Compositae, Calystegia, Convolvulus, Linum, Plantago*). A fairly wide variety of spores of coprophilous fungi has been identified including *Sporormiella, Podospora, Delitschia* and *Valsaria variospora*. These indices are consistent with the observation done on large mammals.

By reconstructing the paleo-environmental context of the Kocabaş hominin, we assessed his living conditions and we test whether the SW of Turkey could have played a refuge role or was a pathway to Europe and Asia.

This research is result of the "TUBITAK-CNRS bilateral cooperation (grant number 114Y723)". It is also a contribution to the ECCOREV project ACIGOL. And we thank the two mining companies, ALKIM and Sodas, which have made available to our consortium an exceptional sedimentary archive of more than 1000 m long.

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Podium Presentation: Session 8, Fr (17:40)

Geospatial Paleoanthropology: Applying new tools and techniques from GIScience

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Paleoanthropology has long been an interdisciplinary science whose practitioners rely on analytical methods and conceptual approaches borrowed from related scientific fields. It is becoming increasingly clear that the location, collection, and analysis of fossils in different field settings can benefit from the current and ongoing revolution in the geospatial sciences. Yet biological anthropologists and paleoanthropologists have been slower to employ modern tools of geospatial science and remote sensing in the field than colleagues in archaeology and geology. During the past 5 years, our fieldwork in Paleocene and Eocene deposits of the Fort Union, Green River, and Wasatch formations in Wyoming's Great Divide Basin has utilized a series of such methods to develop a new, geospatially informed paleontology. We discuss these tools, data sets, and analytical methods and demonstrate that they have improved our ability to locate fossils and to understand fossil deposition in a remote field area. While all of these methods currently have limitations, we demonstrate that the near term potential of this work is substantial, and suggest that these methods can and should be applied in many paleoanthropological settings. We utilized different remote sensing sampling strategies (e.g., medium and high resolution satellite imagery, drone based photogrammetry, terrestrial LiDAR, spectral radiometry) to visualize sediments and predict the presence of fossil-bearing deposits Our approaches are multiscalar, ranging from supervised and unsupervised classifications of basin-wide Landsat imagery, to a more local approach involving high resolution commercial satellite imagery, to highly-local, low elevation reconnaissance flights using an unmanned aerial vehicle (UAV) equipped with an HD video camera, and terrestrial LiDAR scans of a single locality. Using these various approaches, we then developed artificial intelligence based predictive models to guide ongoing search for new localities in the field, and ground-truthed the resulting models. We visited 40 predicted locations over two field seasons and collected vertebrate fossils at 20, resulting in 30 new fossil localities, a significantly higher rate of success than standard prospecting techniques yields. We also tested the utility of two unmanned aerial vehicles from DJI (Phantom Vision 2+ and Inspire 1) for "remote prospecting" of sediments, although the distances involved were seriously limited by US regulations governing the flying of drones. We developed 3D virtual models of a particularly rich fossil bearing sandstone locality using photogrammetry derived from drone-based photography, and from a terrestrial LiDAR scan: both virtual models reveal intriguing aspects of microstratigraphy, geomorphology, and taphonomy. These approaches from the geospatial sciences can help us locate additional fossil resources, share spatial and fossil data with colleagues and the public, and better understand the geomorphological nature and taphonomic history of individual fossil localities.

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Pecha Kucha Presentation: Session 6, Fr (11:25-11:50)

Neck mobility in Neandertals compared to modern humans

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The cervical spine not only bears the head but is also its main actuator in daily life. Comparative knowledge on its posture and mobility is crucial for understanding modifications and adaptations in axial morphology during Neandertal and modern human evolution. Although their overall body posture looks similar, differences in the shape of the cervical vertebrae [1] and bony labyrinths [2] suggest that neck motion and mobility in Neandertals was potentially different from that of anatomically modern humans. Given these findings, we tested whether morphological differences also result in functional differences in terms of neck range of motion (ROM). Virtual experiments with anatomical bone models provide a powerful approach for the quantification and visualization of the potential posture, motion patterns, and mobility limitations of fossil skeletons. We re-aligned μCT derived surface representations of Neandertal (n=3) and Neolithic modern humans (n=25) cervical (C1-C7) and first thoracic (Th1) vertebrae using a recently published approach [3]. Scientific Rotoscoping tools [4] were subsequently used to build up a hierarchical bone marionette in a virtual environment. Adjacent vertebrae were connected via virtual joints. The intervertebral ROM is measured by anatomically defined coordinate systems are placed in the instantaneous centers of rotation and aligned according to facet orientation. Thus, morphological differences among the vertebrae and between specimens are actually represented by the kinematic model. To infer limits of motion, we moved each vertebra until minimum zygapophyseal overlap or until bone-to-bone contact. The Neandertal cervical spine shows a less lordotic posture compared to modern humans due to the long spinous processes. Its range of flexion/extension is nevertheless similar to what is found in modern humans. However, neck yawing and pitching are complex motions in which vertebral lateral bending and axial rotation are coupled (see [5]). Taken individually, absolute values for lateral flexion and axial rotation are in the same range for Neanderthals and modern humans. In contrast, the coupled motion differs between them. This result indicates a slightly lower mobility, but increased stability in the coronal plane in Neandertals. The limited mobility is related to the mediolaterally wide cervical vertebrae and an overall bulkier neck. This neck morphology is in accordance with the generally broader shoulders and longer skulls in Neanderthals.

We are grateful to Serge Bahuchet, Aurélie Fort, and Antoine Balzeau (Musée de l'Homme, Paris) as well as Yoel Rak and Alon Barash (Sackler School of Medicine, Tel-Aviv University, Israel) for access to specimens and CT data of Neanderthal vertebrae. We thank Peter Schueler (Landesamt für Denkmalpflege und Archaeologie, Thüringen) for the access to modern humans sample, Alexander Stoessel and Romain David for conceptional and methodological help as well as David Plotzki for CT scanning. This research is funded by the Max Planck Society.

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Poster Presentation Number 33, Th (12:15-14:15)

Lithic assemblages of Azokh 1 Cave, a Middle to Upper Pleistocene key site in the Caucasus

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The Caucasus is an important migratory route between Africa, Asia and Europe, and provided a significant refugium for hominins and other fauna during the Pleistocene. Hominin presence in the region is attested by rich paleoanthropological and cultural remains found throughout the Early to Upper Pleistocene; however, as yet, it is difficult to obtain complete information for some important sites in the Caucasus given the limited quality of excavations conducted in the past and practical difficulties in accessing either the published reports or recovered artefacts from those works today.

The focus of this study is the Azokh Cave site in the Southern Caucasus. The main entrance passage [Azokh 1] has provided evidence of repeated occupation by human groups during the Middle and Late Pleistocene and, at present is the only well-stratified and dated sequence from this time-period in the wider region. Renewed excavations of Azokh 1 showed the presence of well-contextualised lithic and faunal assemblages dated between 300–100 Ka associated with hominin remains (*H. heidelbergensis* and *H. neanderthalensis*) found in the site.

Detailed and systematic analyses have been completed of the raw material and techno-typology of the lithic assemblages recovered during the 2002–2012 excavation seasons from the upper sedimentary sequence of Azokh 1 (Units V–I). The raw material study indicates that chert, flint and basalt are the most abundant rock types used in the lithic exploitation in all units. These lithologies are all locally available, although artefacts made of rocks from more distant sources are also present. Techno-typological analysis of lithic assemblages suggests an incomplete operative chain for all raw materials with a general absence of knapping debris, natural bases, rare cores and refits. Techno-culturally, these are considered to be from late Acheulean, or early Mousterian, to Levallois Mousterian.

The faunal and lithic assemblages were recovered from a marginal area preserved at the rear of the cave passage. Research results, including some preliminary data on lithic use-wear, along with spatial distribution, and post-depositional modification analyses, indicate that occupation of the cave was short and seasonal in character. Cave bears were an important factor affecting the timing and duration of hominin occupation of the cave.

We thank the authorities of Nagorno Karabakh for their support and permission to excavate at Azokh Cave. L. Asryan is grateful to a grant from Wenner-Gren Foundation (WIF-212). This work was developed within the general framework of the Spanish MINECO-FEDER project CGL2015-65387-C3-1-P, the Catalan AGAUR project 2014 SGR 899 and by the URV projects 2014/2015/2016 PFR-URV-B2-17.

Pecha Kucha Presentation: Session 2, Th (11:00-11:25)

The human remains from Dinaledi Chamber do not belong to *Homo erectus*: Evidence from the deciduous teeth

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1 - New York University · 2 - Loiusiana State University · 3 - University of Florence

In 2013 and 2014 new human remains were uncovered in the Dinaledi chamber of the Rising Star cave system in South Africa. In 2015 Berger and colleagues identified these remains as belonging to a new species *Homo naledi*. Subsequent cladistics, phenetic and comparative analyses of the skull and permanent dentition have supported this taxonomic affiliation. The deciduous teeth can offer unique insights into hominin evolution. Due to their early onset and rapid development their morphology is thought to be under stronger genetic control, less influenced by environment and more evolutionarily conservative than are the permanent teeth. In this study we compared the *H. naledi* deciduous teeth (n=21) to samples representing most of the hominin clade including *Australopithecus afarensis, A. africanus, Paranthropus boisei, P. robustus, Homo habilis, H. floresiensis, H. erectus, H. antecessor, H. neanderthalensis*, early *H. sapiens* and recent *H. sapiens* from South Africa. We aimed to place the Dinaledi hominins into a comparative context to further assess the validity of their taxonomic assignment. We were especially interested in addressing whether or not they can be comfortably incorporated into the *H. erectus* taxon. Our analysis of the deciduous teeth reveals a mosaic of features that mirrors, to some extent, that which was found in the permanent teeth. The lower canine is *A. afarensis*-like and the upper deciduous first molar is *A. africanus/Paranthropus*-like. Meanwhile, the upper deciduous second molar is *Homo*-like but the lower deciduous first molar is *Paranthropus*-like. The lower deciduous second molar is particularly enigmatic, being elongated and lacking Cusp 6, Cusp 7 and protostylid (*Homo*-like), but possessing a relatively wide talonid, a posterior fovea and a pinched in buccal border (*Australopithecus/Paranthropus*-like). Interestingly, the morphological similarities between *H. naledi* and *Paranthropus* are not linked to crown size, as the *H. naledi* teeth are significantly smaller. The derived crown simplification of the lower and upper dm2s supports its assignment to the genus *Homo*. However, the mosaic of primitive and derived features is unique to *H. naledi*. Although the deciduous dental sample of *H. erectus s.l.* is small, we did not find support for including *H. naledi* into this taxon and conclude that the most parsimonious explanation for this unique mosaic of features is its status as a distinct species.

We thank Matt Skinner and Luke Delezene for inviting us to participate in the *H. naledi* dental workshop, which was funded by the Wenner-Gren Foundation. We also thank Lee Berger and Bernard Zipfel for allowing access to the *H. naledi* and comparative South African early hominin material. We further thank all those either currently or formerly affiliated with the institutions from which the comparative data were collected for allowing us access to the material and for their kind assistance.

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Pecha Kucha Presentation: Session 2, Th (11:25-11:50)

Great apes reinvent tool-use behaviour through individual learning — implications for the evolution of human material culture

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The cognitive mechanisms behind the evolution of material culture in the hominin record are still a matter of debate. Examining the origins of novel tool-use behaviours in non-human great apes (hereafter: great apes) may help identify how these behaviours first emerge in naïve individuals and then spread to the rest of the population. Previous studies have suggested that great ape behaviours spread primarily via social learning mechanisms, such as emulation and imitation [1]. However, a more parsimonious approach is advocated by Tennie and colleagues [2] with their "zone of latent solutions" (ZLS) hypothesis, which instead argues that great ape behaviours are primarily a product of individual learning, and that each individual (given the appropriate ecology and developmental stage) is able to independently "reinvent" behaviours within their ZLS, without social learning. Once a behaviour is reinvented, its release across the rest of the population is facilitated via low-fidelity forms of social learning, such as stimulus and local enhancement.

In order to test for the roles of individual and social learning in the emergence of novel behaviours, naïve individuals (who have never seen the target behaviour before) are provided with all the ecological materials necessary for the behaviour, but no social demonstrations, to observe whether they will reinvent the target action through individual learning, or whether social learning is required for the behaviour to emerge (so called "Latent Solutions" (LS) testing methodology). We present data from one such LS test on "marrow picking", a behaviour common in both modern chimpanzees and early hominins. All four species of great apes: chimpanzees (*Pan troglodytes*), western lowland gorillas (*Gorilla gorilla gorilla*), Bornean orang-utans (*Pongo pygmaeus*) and bonobos (*Pan paniscus*), held at zoological institutions in the UK and Italy (N=38), were tested. All species reinvented the same 'picking' tool-use technique, without any prior experience of the behaviour or social demonstrations. Thus, we conclude that the picking tool-use behaviour is within the great ape ZLS, and emerges mainly via individual learning (although low-fidelity social learning facilitates the release of the behaviour in other members of the population once it is reinvented). It is therefore likely that many, if not all, of the other great ape tool-use behaviours are also mainly the product of serial reinventions and, accordingly, some of the earliest human tool-use behaviours may have also emerged primarily via individual learning mechanisms.

The authors thank Twycross Zoo for its collaboration in this project, in particular Sharon Redrobe, Charlotte Macdonald, Manuela Townsend, Simon Childs, and all the ape keepers for all their much appreciated help during testing. The authors also sincerely thank Il Bioparco di Roma for allowing access to their chimpanzees, in particular Yitzhak Yadid and Massimiliano Di Giovanni, Maria Ravagli and all the ape keepers for being so accommodating during testing. EB is also very grateful to Clare Williams, Polly Cowdell and Ryan Tinsley for all their help with filming during the initial testing sessions at Twycross Zoo and Alice Cope for reliability coding.

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Poster Presentation Number 12, Fr (12:15-14:15)

The Deep Roots of Human Behaviour Project — the Early to Middle Stone Age (ESA/MSA) Transition in South-Central Africa

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The invention of composite (hafted) tools made of multiple parts marks a major technological change in the Palaeolithic record [1] . The idea of hafting was conceptually new and the process of making such tools was more cognitively demanding compared with existing reductive strategies of tool-making [2]. In Africa, the appearance and spread of hafting occurred before the evolution of Homo sapiens, and correlates with the Early to Middle Stone Age transition. The African database, however, is too fragmented spatially and too poorly dated to enable us to address basic questions of how, when and why hafting emerged [3]. This poster introduces a new four-year research project based in Zambia which targets the ESA/MSA transition. An interdisciplinary team will be working at Victoria Falls, Kalambo Falls and in the Luangwa Valley on known transitional sequences. This research aims to understand the chronology of the transition in this region of south-central Africa and what advantages hafting offered over older ways of making tools. More generally, the project format provides a model for researchers wanting to study the transition in regions outside the East African Rift Valley where the dating of deposits remains a primary concern. Expert crafting, local knowledge and educational resources The project team ethnographer will gather information from local communities about plants and stone resources that were used historically for making tools. Our embedded primitive technologist will incorporate this knowledge into the making of replicas, including hafted tools for experimental use by our use-wear and residue analysts, with the aim of tracking changes in tool use across the ESA/MSA transition. The project results will be incorporated into educational resources for schools in the UK and Zambia. Our team Our international team of researchers includes:

- archaeologists - expert in innovative approaches to the study of stone tool use, notably use-wear and residue analyses
- geographers - to understand the formation of the sites and associated landscapes
- geoscientists - to date the deposits using OSL, TT-OSL, post-IR IRSL, ESR quartz grain and cosmogenic nuclide dating of artefact bearing terraces...

We are (alphabetically):

- Larry Barham (PI, Liverpool, UK),
- Geoff Duller (Co-I, Aberystwyth, UK)
- Andy Hein (Edinburgh, UK)
- Karl Lee (professional technologist, UK)
- Geeske Langejans (Leiden, Netherlands),
- Francis Musonda (University of Zambia)
- Perrice Nkombwe (Moto Moto Museum, Zambia)
- Veerle Rots (Co-I, Liège, Belgium)
- Dave Thomas (Oxford, UK)
- Sumiko Tsukamoto (Hannover, Germany).

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Pecha Kucha Presentation: Session 10, Sa (11:50-12:15)

Bone industry before *Homo sapiens*, a Denisovian perspective

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The production of bone industry is currently seen as a cognitive step belonging to *Homo Sapiens*, despite some spectacular artefacts from the Middle and the Early Paleolithic, such as the bifaces of Fontana Ranuccio or Castel di Guido. Time to time papers are published underlying that Neandertal was also able to make some bone tools and anticipate on the Upper Paleolithic as shown by the bone burnishers of Pech-de-l'Azé I and Abri Peyrony 50 000 years ago [1]. However there is little to compare with the archetypal production of his successor, when bone material (bone, antler, ivory) started to be used for categories of items which didn't exist in the European Middle Paleolithic: hard tips of projectile, ornaments, animal and human figurines, not to say about decorated implements. Nonetheless an anthology of the state of art of bone manufacturing across the Upper Paleolithic does not enlighten on the peculiarity of each culture. This has been obvious with the Solutrean assemblages of South Western France, well known for their amazing lithic leaf points, in which part of the bone industry staid unseen until very recently because of an unexpected use of percussion for blanks production and tools shaping: they were simply confused with faunal remains [2]. Such type of bone industry, not or sparsely involving grooving, scraping and polishing, has been underestimated not only for the Upper Paleolithic but also probably earlier. This does not mean that an apparently simple technique excludes cultural specificity, as suggested by the very numerous Solutrean pressure tools made from bone and antler. For testing this postulate, we started the research on bone industries in the long stratigraphy of the Denisova cave, in the Altai low-mountain. We focused on technological and traceological features rather than on typology, on the basis of an experimental and a taphonomic framework. This context is particularly suitable, not only because of the exceptionally good preservation of the bone material but also because of the occurrence of different human species in the region and in the cave itself, that even perhaps periodically co-existed. At the base of Stratum 11 (~50 000 - 40 000BP), famous for the discovery of the first known Denisovian remains, start the Initial Upper Paleolithic with large prismatic blades, bladelets, numerous ornaments from mineral and hard organic matters, and several bone needles, along with the persistence of a Levallois flaking [3]. A preliminary analysis of the faunal remains from the eastern gallery puts in evidence a flaked bone industry aiming at producing elongated blanks used for different purposes with axial active edges. In the prior Stratum, with a typical Mousterian lithic industry based on Levallois blanks and side scrapers, bone tools are also present but involving lateral edges and surface of the flakes. It is tempting to draw a parallel in the geometry of bone and lithic artefacts. With a probable succession of short time occupations, all the range of activities may be not represented in the Denisova Cave (eg. bone or lithic projectile points are missing in the inventory of the lower deposit of Stratum 11), what prevents from making a direct comparison between the periods. However, it appears that bone material can be part of the technical system without a sophisticated shaping of the artefacts, when not requested by their functional or social design.

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Poster Presentation Number 73, Th (12:15-14:15)

Cranial vault thickness variation and inner structural organization in Plio-Pleistocene hominids from Sterkfontein Caves, South Africa

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While extensively investigated in the human fossil record, notably for evaluating the potential value of a thickened cranial vault as an autapomorphic trait in *Homo erectus* [1, 2, 3], cranial vault thickness variation and bone composition has been poorly explored in early hominids. Nonetheless, the application of high-resolution 3D imaging techniques to the abundant cranial fossil specimens found at the Plio-Pleistocene hominid-bearing site of the Sterkfontein Caves offers the unique opportunity to add insights into the inner structural condition of the fossil non-human hominid cranial vault.

Our sample consists of three *Australopithecus* specimens from Sterkfontein Member 4 (Sts 5, Sts 71, StW 505) and two comparative samples representing *Homo* (n=6) and *Pan* (n=6) from the Pretoria Bone Collection (Pretoria, South Africa) and the Royal Museum for Central Africa (Tervuren, Belgium) respectively. Crania were scanned at the Palaeosciences Centre (Johannesburg, South Africa), the Centre for X-ray Tomography of the Ghent University (Ghent, Belgium), the Little Company of Mary Hospital (Pretoria, South Africa) and Necsa (Pelindaba, South Africa). Thickness variation as well as the structural organization of the inner and outer cortical tables and the diploë have been automatically assessed at regular intervals along one parasagittal and one coronal sections positioned to avoid any sutures [4].

The assessment of cranial vault thickness variation along the two sections reveals a distinct peak in thickness around the parietal eminence in the three *Australopithecus* specimens and extant humans. Moreover, a specific second peak is identified in the portion of the extant human parasagittal section documenting the frontal bone. In contrast, the cranial vault thickness remains relatively constant in chimpanzees along both sections. Among *Australopithecus*, the three structural bone layers are accurately identifiable in Sts 71 and the relative contribution of the diploë to the structural properties in this specimen is higher in terms of proportions (>60%) than in extant humans (<60%) and chimpanzees (<20%).

Our study provides previously unreported features in early hominid cranial inner structures and opens up valuable perspectives for the investigation of Pliocene hominid crania. In this context, the analysis of the prominent specimen StW 573 ('Little Foot') from Sterkfontein Member 2 and the StW 578 cranial vault from the Jacovec Cavern will contribute to the reconstruction of evolutionary changes in the structural arrangement of the cranial vault [4]. Moreover, as previous studies suggested a potential covariation between topography of the endocranial surface and cranial vault thickness [5], the combined analysis of the endocast and the cranial vault structural organization will be critical in future studies.

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Pecha Kucha Presentation: Session 6, Fr(11:50-12:15)

Age modelling of the Middle to Upper Palaeolithic Transition in the Zagros Mountains through AMS radiocarbon dating

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The Middle to Upper Palaeolithic (M-UP) transition, dating to between 50,000 and 30,000 years BP, marks a pivotal point in late human evolution. In simple terms, it involves the dispersal of anatomically modern humans (AMHs) outside of Africa, the concomitant replacement of Neanderthal populations across Eurasia, and the emergence of what is widely termed as the Early or Initial Upper Palaeolithic (IUP) - a period often associated with novel symbolic and behaviourally mediated artefacts suggested to represent an important change in the cognitive processes of modern humans [see 1 and references therein]. It is axiomatic that a reliable chronology, which allows us to compare archaeological sites and material culture across space, is key to our understanding of the biological and cultural developments occurring at this time. So far, however, the vast majority of archaeological and chronometric research concerned with the M-UP transition has largely focused on Europe. Elsewhere, the archaeological record is not only less abundant, but chronometric data is often absent. Such is the case with the Zagros Mountains, a region which assumes importance in discussions concerning the M-UP transition as its geographic location is central to all pertinent hominin migration areas, pointing to both east and west. The establishment of a reliable chronology in the Zagros Mountains is, therefore, essential to our understanding of large-scale spatiotemporal processes associated to modern human dispersal. Due to political circumstances within the region and the poor preservation of organic material extracted from its archaeological sites, however, a clear chronological definition of the M-UP transition for the Zagros Mountains has not yet been achieved. Indeed, very few dates obtained through the application of absolute chronometric methods have been secured and subsequently published [e.g., 2, 3, 4, 5]. To improve this situation, we obtained new archaeological samples for AMS radiocarbon dating from Kobeh Cave, Kaldar Cave, and Ghār-e Boof (Iran), and statistically modelled previously published radiocarbon determinations for Yafteh Cave (Iran) and Shanidar Cave (Iraqi Kurdistan) using the OxCal 4.3 platform. The latter allowed us to improve the chronological resolution for the two sites, and compare the resulting age models with the new dataset. In brief, results show that, on the basis of current chronometric data, the M-UP transition in the Zagros Mountains region dates to 45,000-40,250 (68.2% probability) cal BP. Moreover, the pre-screening of faunal bone material indicates that for Kobeh Cave and Ghār-e Boof, preservation is poor and collagen yields are insufficient for radiocarbon dating. This suggests that chronometric efforts for the Zagros Mountains region ought to focus on dating other organic remains, such as charcoal, using rigorous pretreatment methods which reliably decontaminate Palaeolithic-aged material. Further archaeological and chronometric investigations in the Zagros Mountains will allow for higher resolution in the definition of the M-UP transition, yet these results provide the basis for a reliable chronology to an important region in the study of modern human dispersal.

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Poster Presentation Number 105, Th (12:15-14:15)

Skull trauma probabilities in Neanderthals and Upper Paleolithic modern humans

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For decades, Neanderthals have been depicted as living dangerous, exhausting and stressful lives, contrary to anatomically modern humans (AMHs). This view is, among others, based on traumatic lesions found on skeletal remains of Neanderthals [1, 2]. However, recent work expressed doubts about the prevailing view that Neanderthals show high frequencies of traumatic injuries [3, 4]. This research project scrutinizes whether Neanderthals and Upper Paleolithic AMHs differ in the incidence of traumatic injuries. We here present the results of a preliminary study focusing on skull trauma prevalence. Our dataset consists of published cranial remains with and without traumatic lesions from 144 classical Neanderthals (ca. 80-30 ka BP) and 88 early- and mid-Upper Paleolithic AMHs (ca. 35-20 ka BP) from all over Europe. In order to account for the differential skeletal preservation, we rated cranial element completeness in four categories (25%, 50%, 75%, and 100% complete). This allowed us to factor in that traumatic injuries are more likely visible on well-preserved elements. Our dataset comprised 799 quantified cranial elements (Neanderthals: n = 309, AMHs: n = 490). Of those, only 37 elements exhibit traumatic injuries (Neanderthals: n = 12, AMHs: n = 25). We tested for differences in skull trauma prevalence among Neanderthals and AMHs using a generalized linear mixed model (GLMM). This approach enabled us to examine the effects of species, skeletal element, and preservation category on trauma probabilities, while taking into account variation between excavation sites in trauma occurrences by including 'site' as a random factor. We found no indication for differences in cranial trauma probabilities among Neanderthals and AMHs. Instead, trauma probabilities significantly increased with the preservation status of the skeletal remains. In conclusion, we cannot confirm a higher skull trauma prevalence in Neanderthals and we caution against performing population-wide trauma analyses without considering skeletal preservation. In the near future, we will increase sample sizes and run further analyses to also include effects of sex, age, and time, as well as their interactions, on trauma probabilities.

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Poster Presentation Number 63, Th (12:15-14:15)

Magdalenian mobiliary art from Gough's Cave (UK)

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Engraved bones usually associated with intellectual creations of *Homo sapiens* spread across Europe, from the Atlantic coast to the Urals, at the beginning of the Aurignacian (∼ 40,000 BP) and reached a peak during the Magdalenian (∼18,500-11,500 BP). Throughout this latter period we see the development of rich decorative forms, with many portable objects made from bone, antler, or ivory, and engraved with animal representations or geometric designs.

Gough's Cave is a large show-cave opening on the southern side of Cheddar Gorge, south-western England. Several excavations have highlighted the exceptional richness of the deposits with notable finds of butchered human and non-human bones, a dense cluster of refitting flint debitage, and mobiliary art. New ultrafiltrated radiocarbon determinations demonstrate that the cave was occupied by Magdalenian hunters for a very short span of time, possibly no more than two or three human generations, at the onset of Lateglacial Interstadial 1 (GI-1e, Bølling chronozone of the European record) at about 14,700 cal BP [1].

Mobiliary art at Gough's Cave includes three *bâton percé* made from reindeer antlers, worked and engraved fragments of hare tibiae and the rib shaft of a horse, amber pebbles, and minute fragments of ivory with groups of incisions [2]. We present here detailed analyses of these objects using micro-morphological techniques. To understand the *chaîne operatoire* adopted to engrave the bone, amber, and ivory surfaces, the objects were examined using a LEO1455VP scanning electron microscope (SEM) operated in variable pressure mode (chamber pressure 15 Pa). The topography of surface modifications was recorded using a Focus Variation Microscope (FVM), the Alicona InfiniteFocus optical surface measurement system. This system was used to produce three-dimensional (3D) micro-morphological models of the incisions according to the methodology described by Bello et al. [3]. The results of our analyses suggest that the manufacture of the tools and the engraved designs on the bone, ivory, and amber artefacts at Gough's Cave are close parallels to those found at other European Magdalenian sites. All the bone artefacts, but in particular the three *bâton percé*, are considerably weathered and smoothed, suggesting they had been carried and handled for a considerable period of time before being disposed of. Overall, the mobiliary art at Gough's Cave suggest that the carvers were competent and experienced in working and engraving different raw materials; with some traces indicating advanced technical expertise, consistent control of the tool, and gestural precision.

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Poster Presentation Number 26, Fr (12:15-14:15)

Preliminary use-wear analysis results of the Early Acheulean site of Thiongo Korongo (Olduvai Gorge, Tanzania)

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African Early Stone Age lithic industries have been rarely analyzed through functional analyses [1-2] due, basically, to preservation issues and the absence of experimental references on use-wear development in non-flint raw materials. This situation has been changing in the last decade with the introduction of new experimental works and assemblage analyses [3]. These studies on lithic industry of African sites provide us an exceptional opportunity to analyse the economic activities development by the first hominids and, at the same time, to incorporate into the traceological discourse raw materials than have been scarcely studied.

In this work we will present the preliminary results obtained through the use-wear analysis of flakes belonging to the Early Acheulean from TK archaeological site (Upper section of Olduvai Bed II, ca. 1353 $\pm$ 0.035 Ma.). TK is an open settlement with several archaeological units characterized by the presence of Acheulean stone tools (i.e. LCT's and flakes) and large mammal's remains (i.e. Sivatherium and Palaeoloxodon recki). Our work hypothesis is that these lithic artifacts could be reflecting more activities than knapping and processing of animal carcasses [1]. These activities have been already revealed through the study of the chaîne opératoire [4] and the identification of some butchery marks on the faunal remains recovered at he site [5], but the variability of formats and tools suggest that other tasks could also have been made at the site (e.g. wood working, digging, tubers / vegetable processing, etc.). To verify our working hypothesis we have created a use-wear reference collection. For this we have used flakes made on the same raw materials found in the archaeological record of TK, Naibor Soit quartzite and basalt. These flakes have been used on different materials (i.e. *Querqus sp., Bos Taurus* and *tubers*), performing also different kind of activities (i.e. cutting, scraping, slicing and peeling). This experimental program provides us the necessary information for the identification of use-wear on the archeological material results.

First results on archaeological materials have revealed, through the comparison with this experimental collection, the presence of butchery-related traces in quartzite and basalt flakes. These results confirm the evidence obtained from taphonomic analysis and suggest that the carcass processing activities were made at the site. Also, we have identified traces that could be related with vegetal processing, but further exploration on this line of evidence is needed to incorporate this kind of tasks to the repertoire of activities made at the site. These preliminary use-wear results offer new insights for the discussion about the function of early technology.

Our work carried out in the framework of The Olduvai Paleoanthropological and Paleocological Project (TOPPP). We are grateful to the Spanish Ministry of Culture and the Ministry of Science and Technology for the financing of the project (HAR2013-45246-C3-2-P). Finally, we would like to thank Centro Nacional de Investigación de la Evolución Humana (CENIEH) for providing us the facilities and technical equipment necessary for our study.

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Podium Presentation: Session 7, Fr (15:20)

Investigating palaeoclimate variability in the western Iberian Peninsula during the last glacial period using speleothems

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Climate is one of many powerful driving forces for faunal and human migration; however, with regards to the Iberian Peninsula, there are no extensive terrestrial records which limits our understanding of the palaeoenvironmental boundary conditions for early modern human (EMH)/Neanderthal occupation or migration during the last glacial period. Based on Greenland ice core data, the last glacial period encompasses a time of increased abrupt and significant climatic variability, when known bursts of migration occurred throughout Eurasia. Previous arguments for climatic influences on modern human migration into Iberia have been largely substantiated by marine cores, which can only provide a vague understanding of terrestrial vegetation and climate. Here, we will present a new terrestrial climate record spanning most of marine isotope stage (MIS) 3 (58-30 ka) and part of MIS 4 (68-60 ka). Here, we will present a new terrestrial climate record (22-68 ka) spanning most of marine isotope stage (MIS) 3 and part of MIS 4. We use direct Uranium-series dating, stable oxygen and carbon isotopes as well as spatially-resolved trace element analysis on two speleothems (FB1102 and FB1103) from Gruta Figueira Brava, Portugal, to establish a precisely dated high-resolution palaeoclimate archive record. The site provides a direct link of palaeoclimate reconstruction to a place with human occupation since it is also home to a Mousterian industry, rich in denticulates, with Levallois, Discoid and Kombewa debitage. The stone tool assemblage is associated with Neanderthal remains (Pais and Legoinha, 2000).

We aim to constrain the local palaeoclimatic conditions at Gruta Figueira Brava, as well as provide a regional perspective for the western Iberian realm. Both stalagmites exhibit consistent growth, with the exception of two hiatuses (FB1103 between 45-40 ka and FB1102 between 69-63 ka, respectively). The close proximity of Figueira Brava to the coast will allow to investigate the impact of marine events like Heinrich (H)-events, Dansgaard-Oeschger-Oscillations or southward movement of the polar front on the terrestrial climate and thereby assess, for example, a previously claimed relationship of H-events with extinction of Neanderthals.

In this presentation, we aim to discuss the following: To what extent did the Atlantic climate affect the Iberian Peninsula? How drastic were the fluctuations in climate throughout our area of interest in the Iberian Peninsula? How do the conditions compare to records in the Mediterranean realm during the same time?

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Poster Presentation Number 8, Fr (12:15-14:15)

Txina, Txina, a new LSA site from the Limpopo River Valley, Mozambique

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Southeast Africa has become an important region to better understand the development of Stone Age and Anatomically Modern Humans. Finally, in the last decade, Mozambique has received some attention from various researchers [1,2,4,5] probably because it is located between the earliest finds of Anatomically Modern Humans in the Omo Kibish formation and those with early evidence for cognitive complexity in coastal South Africa.

Starting in 2011 we carried out a series of field seasons in various regions of Mozambique [1,3], including the lacustrine settings of the Niassa Lake in the north and the fluvial environments of the Elephant and Limpopo Rivers in the Massingir area, and the southern coast of the Maputo lands. Non-systematic survey was carried out by foot, directed to specific areas where geomorphology and geology increased the chances to find open air and cave/rockshelter Stone Age sites. The team was able to locate over 200 Stone Age new sites.

Since 2015, we have worked in the Massingir area, in the Elephant River valley (Limpopo basin). Although east of the Massingir dam, we have located mostly MSA sites, including at least one HP location, some 20 kms from the dam we were able to find various LSA sites, mostly in the Machampane Gorge, a small stream that runs to the major Elephant River to the south. One of these locations is Txina Txina, found in 2016. The site is over 2500 sq meters in area and seems to be deposited over a small stream fan than runs to the Machampane.

Here, we present data from testing, dating and material analyses (lithic, faunal and ornaments) from the Txina Txina LSA location. Three test pits recovered, from at least a 1 meter long sequence dated to the Late Pleistocene and early Holocene, a wide range of lithic raw materials (cherts, quartz, quartzite, silcrete, rhyolite and other volcanic local rocks), mammal bones, terrestrial gastropods and ostrich egg shell as well as some beads. The lithic assemblage is based on the production of flakes and bladelets mostly from centripetal, bipolar and prismatic cores. Formal tools are rare, but nevertheless there are a few microlithic crescents, backed bladelets, scaled pieces and denticulates and notches. Raw materials seem to be local and are mostly rhyolite (a very fine and a coarse grain type), quartzite, quartz and cherts. Raw material frequency is very different among the three tests, indicating a great diversity in raw material use from area to area within the site boundaries. We hope that during the June 2017 field season new elements can be added to those listed here and to be presented in this poster.

We would like to thank Fundação para a Ciência e Tecnologia (PTDC/EPHARQ/4168/2014), the Wenner-Gren Foundation for Anthropological Research and National Geographic Society for grants # Waitt Grant - W373.15 and HJ-033R-17 for funding the research in Mozambique. Permits were issued by the Direcção Nacional do Património Cultural, Maputo.

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Poster Presentation Number 107, Th (12:15-14:15)

Genetic changes associated with bone remodeling activity and the origin of the modern human face

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Examining the origin of aspects of the modern human face, Lacruz et al. [1] suggest that the facial morphogenesis of H. sapiens represents a derived trait. They build their argument around changes in bone remodeling activity during development. The resorptive remodeling in parts of the maxillary clivus they found appears to be an evolutionary novelty only shared by the type specimen of H. antecessor and modern humans, and stands as a good explanation for the absence of prognathism in modern human faces. Advances in paleogenomics allow us to identify modern-human-derived alleles associated with osteoclast and bone remodeling activity. Among them, we highlight two RUNX2-related changes and their targets. Early comparisons of the genomes of Neandertals and Denisovans with present-day human genomes have suggested that the gene RUNX2, which encodes a transcription factor that is crucial to the differentiation of osteoblasts and osteoclasts, may have been positively selected during early human evolution. Although no amino acid differences exist between the RUNX2 protein in present-day humans and the Neandertal and Denisova genomes, RUNX2 is transcribed from two promoters, the second of which contains two modern-specific changes associated with bone remodeling and bone mass. Kuhlwilm et. al. [2] overexpressed the RUNX2 isoform expressed from the P2 promoter in ten human cell lines and identified numerous genes that were affected by RUNX2 expression. Here we examine the target genes whose expression levels were seen to change in several of these cell lines. Based on the existing literature about these genes, and expression profile data, we report that many of them are associated with bone remodeling activity/bone mass. In addition to RUNX2, we suggest that several other amino acid substitutions in Neandertals and present-day humans reported in [3] may have also shaped the unique bone remodeling pattern of modern humans. Upon investigating the interactions between these genes and the pathways in which they are involved, we identified that some of these genes, such as Schnurri-2/3 (HIVEP2/3), have been shown to interact with oxytocin, as does RUNX2 [4]. Though best known for its role in social bonding, Oxytocin is a direct regulator of bone mass. Changes in the oxytocinergic system, associated with self-domestication in our species [5], could then be related to other bone remodeling modifications that led to the modern human face.

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Poster Presentation Number 132, Fr (12:15-14:15)

Functional approach to the lumbar spine : a three-dimensional analysis of articular facet orientation.

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The double S-shaped curvature of the spine and particularly the lumbar lordosis is the hallmark of human bipedalism. It brings the centre of body weight backwards above the hip joints and is thus essential for an efficient sagittal balance. The morphology of the lower vertebral column is therefore of high interest for the study of bipedal acquisition in human evolution [1, 2]. Different methods have been used to determine the degree of lordotic curvature in early hominid fossils, including analysis of the wedging angle of the vertebral bodies. A more accurate method that also takes into account the contribution of the intervertebral discs uses the orientation of the inferior articular processes with respect to the vertebral body [3]. Alternatively, lumbar lordosis has been inferred from the pelvic incidence angle that measures the orientation of the superior sacral surface with respect to the hip joint [4]. However, all current methods are based on two-dimensional data and have a wide standard error of the estimate. In this study, we propose a new measure to analyse the lumbar lordosis angle. The facet orientations of the articular processes are known for their functional importance as they have implications for the segmental mobility and stability. In the lumbar spine, the articular facets are more or less sagittally oriented to allow flexion-extension mobility and confer rotational stability, but they are also important to transfer body weight from the trunk to the lower limb. In this study, we analyse the three-dimensional orientations of the articular facet of the low back vertebrae in a preliminary sample of 35 modern humans and 10 chimpanzees in the lumbar spine (L1-L5 in humans and L1-L4 in chimpanzees). Least squares regression planes were computed for each articular facet according to Bonneau et al. [5]. The normal to this plane represents its three-dimensional axis, which was then compared to the pelvic incidence as a measure for lumbar lordosis. Our results demonstrate a significant change in the successive orientation of the facet joints along the from L1-L5 in humans, while no significant change was detected within chimpanzees from L1 to L4. There was also a significant correlation in humans between the three dimensional orientation of the articular facets of L5 with the pelvic incidence. This provides a new approach to investigate posture and locomotor adaptation in fossil hominids, such as, for example, La Chapelle-aux-Saints.

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Podium Presentation: Session 8, Fr(16:20)

Migration waves resulting from a self-organised critical state as a possible mechanism for hominid dispersal and replacement?

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How and why hominids differentiated, interbred and/or replaced each other remains subject of debate. External factors, such as climate changes, have been invoked, in particular for the emergence and spread of anatomically modern humans. Human evolution occurred via mutations, which we define here as both genetic change, but also new inventions and cultural traits. Successful mutations spread in a diffusive way by mating and cultural exchange. Alternatively, mutations can spread when one population wipes out another and replaces it. We developed a stochastic model to investigate the dynamic interaction patterns resulting from mutation, interbreeding and replacement. In the model, each element or deme on the map stands for a population with a single string of genetic and/or cultural traits. Each trait has two "alleles", either "0" or "1", whereby "1" is regarded as fitter than "0" and, therefore, more likely to spread to neighbouring demes. Mutations are random changes (occurring with a frequency M) of one allele in one deme. Interbreeding between demes is simulated by a probabilistic rule that determines the chance that a deme copies an allele from its neighbour. This is similar to a diffusion-reaction process, where a diffusion coefficient (D) controls the general rate of allele jumps in a random walk, and together with a fitness-related drift parameter (F) determines the velocity and direction of the reaction front, i.e. the boundary between areas occupied by different alleles. A further "aversion parameter" (A) controls the decrease in interaction with increasing difference between two demes, leading to effective speciation. The spatial pattern of trait distribution depends on the balance between M, D, F, A and the area of the model. In general, contiguous areas (continents) evolve the fastest in the centre, where the chance of fit alleles joining is the greatest. One or more (depending mainly on D) fitness peaks develop in the centre of continents. At a constant population density, more mutations occur in large continents, where fitness grows faster than in smaller continents. A high aversion factor leads to the establishment of regions occupied by homogeneous populations, but strong gradients with neighbouring regions. When the fitness gradient between two demes exceeds a critical threshold (E), the fitter deme copies its whole trait list to the other deme, implying a replacement of that population. As soon as gradients get too high, replacement events occur that can lead to avalanche-like chain reactions that may sweep large areas. Varying the relative values of the five governing parameters, in relation to area, results in a wide range of evolutionary system behaviours. Our simulations show that the system can evolve to a self-organised critical state. Variation and gradients increase with time until E is reached and large areas can be swept and replaced by a single population type. Afterwards, variation by new mutations builds up again and the process can repeat itself in a semi-cyclical fashion. In case of multiple continents that are connected by narrow bridges, sweeps are most likely to emanate from the largest continent. They typically do not initiate from the centre of that continent (where fitness tends to be highest), but usually more towards the coast where the highest gradients are to be found. Applying this to human evolution suggests that an African origin of an expansion wave of modern humans is statistically the most probable scenario, even without considering population density and external factors, such as climate. If human evolution indeed reached a self-organised critical state, avalanche-like sweeps were bound to happen. Even the smallest external factor could have triggered such a sweep in a non-deterministic way. Trying to find an external "cause" for an out-of-Africa event could then actually be a futile exercise that disregards the true internal dynamics of the system.

Poster Presentation Number 111, Th (12:15-14:15)

Talking Heads: Morphological variation in the human mandible over the last 500 years in the Netherlands.

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The primary aim of this research was to assess patterns of morphological variation in the mandible to investigate changes during the last 500 years in the Netherlands. Three-dimensional geometric morphometrics were used on digital data collected from adults (18-60 years of age) from three populations living in the Netherlands during three time-periods. The first was a modern sample obtained from MRI structural scans of 34 modern Dutch individuals. The other two samples came from Dutch archaeological sites (Alkmaar, 1484-1574 CE, n= 37; and Middenbeemster, 1829-1866 CE, n= 51) and were digitized using a desktop 3D laser scanner. These scans were used to create digital models, on which we subsequently placed 27 fixed landmarks and 86 curve semi-landmarks. These landmarks were then subjected to Procrustes superimposition, while the semilandmarks were slid according to the minimized bending energy criterion. Areas of interest were specifically the mandibular symphysis, the gonial angle and the mandibular condyles. After superimposition, geometric morphometric analyses were used to investigate the shape and size variation within and between these samples. These analyses include principal component analysis, linear discriminant analysis, analysis of allometry, and general linear models. We found that differences between the mandibles are dominated by size. Significant differences in size were found, with, on average, males from Alkmaar having the largest mandibles and females from Middenbeemster having the smallest mandibles. These results might be linked to a general softening of the diet, due to an inclusion of different food types, such as the potato and more dairy products. Differences in shape were most noticeable between the males from Alkmaar and Middenbeemster. Shape differences between males and females are concentrated in the mandibular symphysis and mandibular ramus, which is mostly the consequence of sexual dimorphism. This study represents the first time that geometric morphometrics have been applied to archaeological skeletal samples in the Netherlands and sheds light on variation in the shape and size of human mandibles from the archaeological sites of Alkmaar (1484-1574 CE) and Middenbeemster (1829-1866 CE), and a sample from currently living individuals. The results show that external factors such as diet could play an important role in the anatomical variation in the human skeletal record, even during recent periods. However, since we could not be sure about the homogeneity of the populations over time, other factors, such as genetic drift, could have played an important part. Furthermore, by showing that there was a general lack of sexual dimorphism in the shape of the mandible, this study has also confirmed an earlier proposed hypothesis, which suggested that the accuracy of sex estimation using female mandibles from the Netherlands is quite low. The wider relevance of this research is a better understanding of the anatomical variation of the mandible that can occur over an evolutionarily short amount of time, as well as possibly supporting research that has shown plasticity of the mandibular form related to diet. This plasticity of form must be taken into account in phylogenetic research and when the mandible is used in skeletal sex estimation.

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Poster Presentation Number 72, Fr (12:15-14:15)

A comparative study of endocranial shape asymmetries in extant and extinct cercopithecoid taxa

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Because of their implication in critical cognitive function, cerebral shape asymmetries have been extensively explored in human (paleo)neurology [1,2]. In contrast, although previous studies provided critical evidence of cerebral asymmetries in monkeys, and particularly in cercopithecoids [3,4], the pattern of asymmetries among extant non-hominoid primate taxa and their diachronic changes in the fossil record are poorly documented. In this context, and given their prominent role as comparative outgroup in paleoanthropology, our study aims at describing endocranial shape asymmetries in both living and fossil cercopithecoid taxa.

We investigated a representative sample (n=13) of 10 extant cercopithecoid species as well as 9 cranial specimens representing 7 extinct papionin and colobine taxa from the Plio-Pleistocene South African sites Makapansgat, Sterkfontein, Swartkrans and Taung. The extant and fossil crania were detailed by X-ray microtomography at a spatial resolution ranging from 33 to 104 μm at the Centre Inter-Universitaire de Recherche et d'Ingénierie des Matériaux in Toulouse (France), at the Muséum national d'Histoire naturelle in Paris (France), at the Palaeosciences Centre of the University of the Witwatersrand in Johannesburg (South Africa) and at the South African Nuclear Energy Corporation in Pelindaba (South Africa). Virtual endocasts were extracted by combining manual and automatic segmentation techniques [5].

To appreciate the topographic differences between the two hemispheres and visually render the extent of asymmetry, the endocranial surface of each specimen has been mirrored along a sagittal plane of symmetry defined as the best-fit plane passing through landmarks positioned along the middle of the interhemispheric cleft from the frontal pole to the confluence of the transverse sinuses. From the superimposition of the original and the mirrored surfaces, the distances have been computed between the two hemispheres and represented by color maps and vectors.

On the whole, the most asymmetric endocranial regions detected in the extant cercopithecoid taxa are localized inferiorly to the rectus sulcus in the prefrontal cortex, inferiorly to the lateral fissure in the temporal lobe and around both the central sulcus and the posterior extremity of the lateral and superior temporal sulci in the parietal lobe. The pattern of asymmetries reported for the fossil sample is consistent with the extant cercopithecoid condition.

The presence of a common pattern of asymmetries in various African cercopithecoid lineages needs to be further explored by integrating additional taxa. Moreover, given the lack of strict correspondence between sulcal and cytoarchitectural areas in the primate brain, careful analyses will be required to assess the functional significance of these anatomical asymmetries.

*Presenting Author

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Poster Presentation Number 99, Th (12:15-14:15)

Crown shape and relative cusp analyses of *Homo naledi* deciduous molar teeth from Dinaledi Chamber, Rising Star cave system, South Africa

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Deciduous teeth are increasingly playing a significant role in examining taxonomic differences and creating phylogenetic hypotheses in hominins. This study presents the results of morphometric analyses of *Homo naledi* deciduous teeth from the Dinaledi Chamber, Gauteng Province, South Africa. The morphometrics include crown shape and relative cusp analyses (RCA) of the maxillary and mandibular deciduous molars. The Dinaledi fossils were compared with deciduous molar teeth from hominins classified as *Australopithecus africanus*, *A. afarensis*, *Paranthropus robustus*, *P. boisei*, *Homo* sp., *H. erectus*, early *H. sapiens*, Upper Paleolithic *H. sapiens*, recent *H. sapiens*, and Neandertals. The purpose of this study is to test whether the deciduous teeth support the Dinaledi fossils being placed into a new taxonomic designation, *H. naledi*. Crown shape of the maxillary and mandibular dm1 and dm2 of a sample of hominin teeth from the Plio-Pleistocene was assessed using elliptical fourier analysis. The principal component analysis (PCA) suggests that the mandibular teeth are more diagnostic than the maxillary teeth. The mandibular dm1 and dm2 crown outlines do not overlap with any species in the sample. A RCA was performed on the maxillary and mandibular dm2. The PCA of the relative cusp scores for maxillary dm2 discriminate well between Neandertals and Recent *H. sapiens* and UP *H. sapiens* but does not differentiate well between the other groups. The three *H. naledi* maxillary dm2 exhibit a wide range of variation overlapping with both *Homo* and australopiths suggesting these teeth share cuspal proportions with both of those genera. While the mandibular dm2 teeth tend to separate well from each other on a generic level, the *H. naledi* specimens fall closest to australopiths due to its large metaconid, a primitive trait for the genus *Homo*. The *H. naledi* teeth do not consistently align with any species in the comparative sample in either the crown shape or relative cusp analyses supporting their taxonomic designation as a new species in the genus *Homo*.

Poster Presentation Number 125, Th (12:15-14:15)

A colonising niche? Comparing climatic adaptation in Jomon foragers and Japanese macaques

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Extensive phenotypic variation observed in our species may reflect plasticity in response to diverse environmental stresses, given global human distribution. Potential adaptations enabling dispersal are intriguing as *Homo* is suggested to inhabit a colonising niche. Could relatively plastic size/shape have been important to *Homo* adapting to novel climates? If so, at what point did enhanced plasticity arise? We seek to establish a base-line for human skeletal climatic adaptation by comparing *H. sapiens* to a non-human primate (NHP) outgroup to better understand relative variation in humans. We analysed postcranial skeletal differences associated with latitude between groups of Japanese macaques (*Macaca fuscata*) and between groups of Japanese prehistoric foragers (Jomon). *M. fuscata* have amongst the greatest latitudinal spread, and the greatest variation in climate, of any NHP. They also overlap in habitat with the Jomon, making them an excellent comparison. Climatic influences on postcranial size and shape have been reported both within both species, but systematic exploration is lacking. Crucially, to date, no study has used comparable methods on both species to allow a comparison of adaptation. We used linear morphometric measurements of postcrania on a sample of 80 *M. fuscata* from 4 different latitudes and 117 Jomon from 5 different latitudes throughout the Japanese Archipelago. In order of increasing latitude, the samples originated from Yakushima/Kyushu, South Honshu, Mid Honshu, North Honshu and Hokkaido (macaques are not found on Hokkaido, the most northerly Japanese island). We compared intraspecific differences in limb lengths, body breadths, estimations of body mass and indices of body proportions between latitudinal groups for both species. Sexes were considered separately as well as pooled to preserve sample sizes. In pooled-sex analyses, male measurements were corrected to the female mean. ANOVAs/Kruskall-Wallace tests (depending on the Shapiro-Wilk test for normality) were used to test for differences between latitude groups in the measurements and indices between species, and post-hoc comparisons were made using Tukey's Pairwise or Mann-Whitney tests. Bonferroni correction was applied to the results. Canonical Variates Analyses were used to assess the ability of the combined limb measurements and combined body proportions to distinguish between conspecific groups. Results show that size seems to be more labile than shape in both species, and limb lengths may be more plastic than body breadth. In the macaques there are latitudinal patterns in limb bone lengths, particularly in the humerus, femur and tibia. Macaque body breadths show a different pattern, but the northern groups can still be separated from the southern groups, with the former having greater breadths. For the Jomon, the humerus and radius length show some latitudinal pattern with greater values at higher latitudes, although not all differences between groups are significant. There is no discernible latitudinal pattern in body breadth among the Jomon, contrary to macaque results. Counter to expectations, in separate sex samples, Jomon from the northernmost island of Hokkaido have the lowest body mass. This may echo the extremely small size of the southern-most macaque sample (Yakushima); both samples come from islands of much smaller size than their conspecifics, suggesting perhaps the effect of resource scarcity. Overall, our results to date suggest that, although the specific patterns differ, there is no obvious deviation of the human from the NHP results, suggesting that humans follow a generalised primate pattern in their skeletal climatic adaptation. In fact, it seems that macaques may show a slightly greater latitudinal effect, indicating that cultural and behavioural plasticity could have been of greater importance in human colonisation of novel habitats than skeletal plasticity.

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Poster Presentation Number 83, Th (12:15-14:15)

Comparison of dental macrowear and microwear of three sympatric rodent species from southern Africa.

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Reconstructing paleoenvironment is critical for understanding the context in which hominins evolved during the Plio-Pleistocene. Dietary preference reflects food availability within a given habitat. As such, dietary proxies such as dental macrowear and microwear hold the potential to aid in environmental reconstruction. Dental macrowear examines the gross wear patterns that alter the topography of a tooth, while dental microwear records variation of fine-scale surface texture that presumably reflects the mechanical properties of food items and abrasives consumed prior to death. Few studies have utilized both proxies simultaneously, particularly for their environmental-related signals.

To better understand the relationship between micro- and macro- dental wear, we utilized sympatric rodent species from three varying habitats within the Central Free State of South Africa and Lesotho. Rodents were chosen for analysis given their sensitivity to environmental change. We hypothesized that in areas of greater exposure to grit, we would see an increase in the amount of gross wear due to greater exposure to abrasive materials. We further predicted that these differences would be reflected in dental microwear texture variation.

Specimens were randomly chosen from among a wild-caught collection from the Nama-Karoo shrublands, the Dry Highveld grasslands, and the Lesotho Afromontane highlands. Using a blue-light Sensofar plu NEOX scanning confocal profiler, we examined the lower second molars of *Mastomys coucha*, *Micaelamys namaquensis*, and *Rhabdomys pumilio* specimens at 150x magnification for the presence of microwear on the occlusal surface of the medial lophs. Scale-sensitive fractal analysis (SFFA) methods were then applied following convention. A Leica MZ8 Stereozoom microscope using a Dino-Eye Digital Eye Piece Camera attachment was used to examine the first and third molars for macrowear. Snapshot images were obtained of under 20x magnification with specimen occlusal surfaces oriented perpendicular to the objective to ensure constant measurements. The relative wear of each molar was then calculated by subtracting the area of dentin exposure from that of the entire occlusal surface. General linear models were used to assess effects of species and habitat on microwear texture and gross wear variables.

Results for both the microwear and macrowear analyses showed clear environmental signals. Microwear texture variables differed between species within the Nama-Karoo and Lesotho highlands. There was also evidence of variation in the texture variables for *Ma. coucha* and *Mi. namaquensis* among the different habitats. There were no differences in ratio of first to third molar wear; however, individual wear measures for both the first and third molars of *Ma. coucha* and *R. pumilio* were lower in the Nama-Karoo than the other habitats. Gross wear values were lowest in the shrublands, where higher abrasive loads are presumed. Hence, the high degrees of wear evinced by these samples cannot be explained by dietary grit levels alone. That molar microwear also showed specific diet-related variation among these three rodents in the higher grit environments, which further implies that molar wear on the micro-scale is influenced by the composition of available foods in each habitat rather than by grit load alone. We expect that future research into the dietary nuances of these species, and those of other micromammals, will provide greater detail for future paleoenvironmental reconstructions.

We would like to thank Jennifer Leichliter (University of Colorado Boulder) and Nico Avenant (Bloemfontein National Museum) for their contributions and aid in obtaining specimens for this study.

Poster Presentation Number 71, Th (12:15-14:15)

Differential evolution of cerebral and cerebellar fossae in recent *Homo*

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Once the locomotion evolutionary processes were completed, the inner surface of the occipital bone became increasingly important: specifically, the endocranium is more related to cognitive evolution than the ectocranium, as it shows the influence of the shape and development of brain tissues, the meningeal layers' attachments, and overall brain modifications. During the late Upper Pleistocene and Holocene smaller brains appeared [1] in extant humans and, moreover, the higher position of endinion relative to inion might indicate a reshuffle of the cerebrum-cerebellar complex, with changes in the relative position of cerebellar and occipital lobes. This is something characteristic of recent evolution [2]. The cerebral and cerebellar fossae are related to the size and shape of the brain. In previous studies, the depths of the fossae were not specifically considered; new tools for quantitatively measuring these problematic curved areas need to be developed, mainly because of the irregularities of the internal occipital area. This paper's main objective is to investigate to what degree have occurred changes in the depths of cerebral and cerebellar fossae of extant humans with respect to fossil Anatomically Modern Humans (AMH) and older *Homo* species. The proportions of the occipital and nuchal planes are compared measuring the inner and outer surfaces of the bone. Additionally, this paper proposes a quantitative geometric methodology based on endocranial landmarks that create a geometric surface or plane with which to measure the position of the deepest part of the fossa: it represents a curvature maxima -concavity in this case - associated with local structures. The four points thus obtained could be framed in Bookstein's Type II landmarks [3], but without biomechanical implication.

Through univariate, bivariate and multivariate analysis (Principal Components Analysis, PCA) of raw and size-corrected data we look at the differential evolution in recent *Homo* species, which present a more vertical or elongated occipital area than ancient fossils. Our results corroborate these derived traits in recent *Homo*; additionally, we observed a tendency towards a relative decrease in the profundity of the cerebral fossae and maintenance of the cerebellar ones.

This study confirms that, in cognitive terms, in certain areas of the skull the internal structures may yield additional information than the external side.

Acknowledgements: Dr. José Miguel Carretero Díaz (Universidad de Burgos) for valuable remarks, and Anthropologist Sarah Brierley for comments on the English manuscript.

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Poster Presentation Number 142, Fr (12:15-14:15)

Small body size phenotypes among Middle and Later Stone Age southern Africans

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Southern African Later Stone Age (LSA) individuals and their contemporary descendants, the KhoeSan peoples of southern Africa, have small adult body sizes and gracile builds [1]. These unique proportions are documented from historic times through to the early Holocene [1]. Genetic analyses of contemporary KhoeSan groups in southern African indicate that they diverged from non-Khoesan groups approximately 110–160 kya [2]. This divergence dates to the Middle Stone Age (MSA), where skeletal remains are scarce in southern Africa. While postcranial skeletal elements are available from De Kelders Cave 1 (Klipgat), Border Cave, and Cave of Hearths, the most diverse group of MSA postcranial fragments come from the Klasies River Main Site (KRM) on the southern Cape coast near Knysna, with relatively firm dates to MIS 5 [3]. This region features a temperate Mediterranean climate. The KRM materials include a lumbar vertebra, a left clavicle, a left proximal radius, a right proximal ulna, and left first metatarsal [3]. Studies across multiple sites suggest that a range of body sizes existed in the MSA [4]. However the KRM postcrania were noted as appearing similar in size to LSA southern Africans [5].

A substantial number of southern African LSA skeletal elements are available for comparison. This paper compares the external linear dimensions, shape characteristics, and cross-sectional geometric properties (CSGP) of the KRM postcrania to those of LSA southern Africans to assess if distinctive small body sizes are evident in the MSA. This will clarify if small adult size may represent an early, presumably adaptive, trait in the KhoeSan lineage. Discriminant function analyses (DFAs) are used to compare each of the KRM elements to adult LSA southern African individuals (n=108) as well as to other Holocene groups that encompass a range of body sizes (Andaman Islanders, n=32; northeastern Native Americans, n=23; eastern African LSA groups, n=31; Iberomaurusian individuals, n=52; and Australian Aborigines, n=11). This approach differentiates individuals based on assumed and predicted group membership.

All of the DFAs are statistically significant ($\alpha < 0.01$), and the dimensions of the KRM materials consistently overlap with LSA southern Africans. All DFA models group the KRM elements with LSA southern Africans when predicting group membership. The first discriminant function is highly significant in all DFAs for the groups analysed, so the similarities between KRM and LSA southern African materials are likely driven by size. Despite the similarities in size and shape, those KRM elements where CSGP can be assessed (clavicle, metatarsal) have greater torsional and compressive strength properties than analogous elements from the LSA southern Africans.

These results demonstrate that small southern African adult body sizes may have great temporal depth. This paper provides further evidence for biological continuities between MSA and LSA southern Africans, consistent with genomic studies. These comparisons extend the presence of small body sizes associated with contemporary KhoeSan peoples into the Pleistocene.

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Poster Presentation Number 31, Th (12:15-14:15)

Lapa do Picareiro: A Paleoenvironmental Reconstruction Using Stable Isotopes of Red Deer (*Cervus elaphus*) Enamel

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Neanderthals and anatomically modern humans (AMH) adapted to a series of environmental changes during the Late Pleistocene that affected their subsistence strategies, technology, mobility and settlement patterns. Explanatory models such as the Ebro Frontier Model propose that Neanderthals were adapted to woodland environments while AMHs preferred open landscapes. Late Neanderthal survival in southern Iberia may have been possible due to relatively mild conditions during MIS 3. Heinrich Events, especially H4, created harsh climatic conditions that may have reduced Neanderthal populations below survival thresholds. Thus, reconstructions of paleoenvironmental conditions to which Neanderthals and AMHs were subjected are key to understanding the adaptive behavior of both groups. This poster presents preliminary stable isotope results from intra-tooth enamel samples to assess paleoenvironmental changes during the Late Pleistocene using red deer (*Cervus elaphus*) teeth recovered from Lapa do Picareiro, located in central Portugal. Picareiro is a cave site in Portuguese Estremadura that contains evidence of late Neanderthal survival after H4, and AMH occupations dated after 34 ka cal BP. These occupations have large archaeofaunal assemblages that provide adequate samples of ungulate teeth. Using carbonate carbon and oxygen isotope values, we offer an initial assessment of shifting environmental context of red deer diet, a significant prey species at the site, and compare these results with other paleoclimate indicators such as magnetic susceptibility and sediment particle size for paleoenvironmental reconstruction. As a ubiquitous species among western European Paleolithic archaeofaunas, isotopic analyses of red deer tooth enamel present the opportunity for comparison with similar paleoenvironmental studies conducted in other Paleolithic sites. In addition, the red deer's relatively small territory (a few kilometers) coupled with the fact that red deer do not have large scale migrations like reindeer render it a good species for assessing local paleoenvironments. We use these results to consider implications for both Neanderthal and AMH adaptation.

Podium Presentation: Session 8, Fr (16:40)

Gorongosa National Park and the biogeography of human origins in the Mio-Pliocene

Susana Carvalho[1,7,10,16], Vera Aldeias[2,10], Zeresenay Alemseged[3], William Archer[2], Marion Bamford[4], Dora Biro[1], René Bobe[1,5,10], David R. Braun[6], Christian Capelli[1], Eugénia Cunha[7], Joana Ferreira da Silva[8,9], Jörg Habermann[10,11], Tina Luedecke[12], Hilário Madiquida[13], Felipe Martinez[14], Enquye Negash[6], Luis M. Paulo[15], Maria Pinto[15], Marc Stalmans[16], Frederico Tátá[10,15], Jonathan Wynn[17]

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A major question in human origins research pertains to the patterns of origination and migration of our lineage in Africa and the underpinning environmental conditions associated with them. Answers to this question are hampered by major gaps in the geographic distribution of Mio-Pliocene (8 to 5 Ma) paleontological sites. With few exceptions, known sites of this age are largely limited to regions north of the Equator and the southern tip of the continent, with relatively little between these two regions. To help fill this gap, our team initiated a multi-disciplinary long-term research project at Gorongosa National Park in central Mozambique. The Paleo-Primate Project (PPP) adopts a new methodological approach, integrating data from paleontology, ecology, archaeology, geology, primatology and genetics. Gorongosa is located at the southernmost extension of the East African Rift System, where the Urema Graben is flanked by Mount Gorongosa to the west and the Cheringoma Plateau to the east. The development of the East African Rift System proceeded from north to south and the Urema Rift represents its youngest component. The Cheringoma plateau exposes Eocene limestone formations that underwent extensive karstification during the Quaternary, and carved numerous caves that our team is beginning to explore for their archeological and paleontological potential. Discontinuously exposed across the Cheringoma Plateau is the Mio-Pliocene Mazamba Formation. Potential outcrops of this formation, which was found to record repeated shifts in continental and shallow-marine conditions, were first identified on satellite imagery and were subsequently surveyed in the field. Systematic ground surveys revealed a fossil vertebrate record associated with the continental sediments that mainly consist of river-dominated coastal plain and deltaic deposits. During our first field season in 2016, we identified fossiliferous sediments and discovered three paleontological localities that yielded ~100 fossil vertebrate specimens, including the first fossil teeth reported from this part of the African Rift Valley. Among the vertebrate fossils are proboscideans, suids, crocodiles, and turtles. The teeth are fragmentary but indicate that the mammals were mostly low crowned. This would be consistent with a Mio-Pliocene age for the Mazamba Formation, but it may also indicate that the specimens derived from closed and wooded palaeoenvironments. These fossils indicate that terrestrial mammals and other fossil vertebrates from the Mazamba Formation may be abundant in the region, though patchily distributed. Several were found in situ associated with paleosols. Preliminary stable carbon and oxygen isotope data from carbonate nodules retrieved from fossil sites indicate a woodland/shrubland ecosystem, which was dominated by C3 vegetation and only moderately influenced by evaporation. The Mazamba Formation has also yielded abundant silicified wood, and our preliminary analyses indicate the presence of at least one monocot (palm tree) and four species of dicots. To calibrate the paleoecological and paleontological data, our project is also investigating the modern ecology of Gorongosa National Park, with a focus on stable isotopes in relation to canopy cover, and more recent evolutionary history of non-human primates (i.e. baboons) with an emphasis on their genetic diversification and hybridization processes and on socioecology in relation to highly complex and heterogeneous ecosystems and varying degrees of predation pressure. With heterogeneous environments including tropical forest, woodlands, and grasslands in a young rift valley, the Gorongosa ecosystems present an ideal analogue to the hypothesized environments of early human evolution. The presence or absence of hominins among the fossil vertebrates and their paleoecological context will contribute important new data to better understand the patterns of origination and migration of our lineage.

The Paleo-Primate Project Gorongosa would like to thank the Gorongosa Restoration Project, the National Geographic Society, the John Fell Fund, and the Leverhulme Trust, for the generous support with starting this interdisciplinary endevour. Our work is only possible due to the visionary approach of Greg Carr and the dedicated staff from Gorongosa National Park, guided by Dr. Mateus Mutemba. We are very grateful to all the Park rangers, our students, and colleagues across all our institutions who have been very enthusiastic about this project.

Poster Presentation Number 6, Fr (12:15-14:15)

Systematic sampling survey for Stone Age sites in the Limpopo basin, SW Mozambique

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This poster presents the methods and results of an archaeological survey project conducted in 2016 in the Limpopo river basin, in southwestern Mozambique. The project aimed to better understand the Stone Age settlement system in the region and thus a systematic sampling methodology was required that would allow to characterize: the distribution across the landscape of stone age dense occupations and areas with none or very few artifacts; the relationship of these occurrences with the surrounding landscape and geology; and the dispersion of specific classes of lithic artifacts throughout the territory to infer mobility patterns or chronological differences in space use. Additionally, since most of the work involved the identification and characterization of hundreds of surface lithic scatters among which thousands of stone tools must be analyzed, a digital recording system was required that would allow to: 1) register information of each scatter, including context description and geographical coordinates; 2) do on-site lithic analysis using custom data entry forms and allowing direct input from digital calipers; 3) rapidly organize, visualize and share survey data with survey teams at a daily basis. Following methods by McPherron et al. site and artifact recording were done using smartphones and two self-authored Android mobile applications [2,3], the first recording contextual information of each location, the second allowing the on-site analysis of lithic artifacts, using digital calipers directly connected to the devices. The Apps use the built-in GPS chips and direct mini-USB (OTG) input capabilities of smartphones to, respectively, get sites coordinates and gathered lithic measurements data from digital calipers. The system also allows to easily export site and lithics data into Google Fusion Tables cloud-based service, where team members can visualize and manage data, including photographs of each scatter or stone tool, and create custom maps. Survey was carried out by two teams of three to four individuals using two transect lines separated by a modern human settlement. Following the methodology applied by Olszewski et al. [4], at every 200 meters of each transect a 1 m radius circle was placed on the ground and all stone tools, if present, were analyzed. A total of 106 locations were inspected across both transects of which 28 were identified as containing Stone Age archaeological materials. Most of these locations, however, revealed low to very low frequency of materials, contrasting sharply with the contexts identified in previous campaigns in the eastern section of the Limpopo River basin. In fact, survey results indicate that archaeological materials are only visible in areas where the Tertiary Mapai formation (a conglomeratic sandstone layer) is exposed, and do not appear in the surface of the areas where this formation is covered by Quaternary eolian sands.

These results are very relevant for future works in the region since it allows to predict areas with higher or lower potential for the location of Stone Age archaeological sites.

Field work was conducted by permission of the Governmental Authority for Cultural Heritage of Mozambique, Direcção Nacional do Património Cultural. Major funding was provided by the Fundação para a Ciência e Tecnologia with additional funding from the Wenner-Gren Foundation.

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Poster Presentation Number 67, Th (12:15-14:15)

Around the fireplace: heat exposure and adhesive alteration

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Currently, there is no agreement about the timing of the habitual use of fire in the Palaeolithic. Some researchers [1] situate the control of fire in North-western Europe around 400ka and question the early claims of fire structures (before 400 ka) since these traces could also be produced by natural events. The only other available line of direct evidence, strike-a-lights, appear only to occur later in the Palaeolithic record [2-4]. The lack of convincing evidence has forced researchers to use indirect evidence as adhesives to estimate the timing of control of fire. It is assumed that a synthetic adhesive like birch tar, which was already in use from at least 120ka [5], cannot be produced without an extensive pyro-technological knowledge. The link between fire control and adhesive technology is evident since fire is required for a range of activities related to hafting technology: the production of birch bark, mixing of resin with other materials, dehafting of stone tools. Moreover, archaeological evidence indicates that dehafted stone tools may have been thrown into the fire when discarded. Once the tools are buried, they may be subjected to heat from an overlying fireplace. The effect of heat exposure on these fragile organic substances has never been investigated, and it is hypothesised that this might be a possible explanation for the rare survival of these adhesives in the archaeological record. Our study aims at monitoring the effect of heat exposure by combustion on a range of experimental compound adhesives on flint tools. The results of the combustion experiments are presented and it is demonstrated that the vertically transferred combustion heat is responsible for the loss of adhering adhesives. A correlation between the degree of loss and the specific adhesive mixture could be observed. The combustion experiment also leads to a wide range of accidental residues deposited on the stone tools. Our results stress the importance of identifying the processes that might be responsible for the formation or degradation of residues adhering to a stone tool surface.

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Poster Presentation Number 87, Th (12:15-14:15)

Relationship between tooth germs, crypts and the jaw bones: a 3D microCT study.

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Dental growth is extensively covered in published anthropological studies. The majority of studies are based on panoramic radiographs and focus on describing stages of tooth growth and eruption in 2D. Jaw bones growth, size and shape have been often interpreted from a biomechanical perspective related to dietary and feeding behavior [1]. However, within the masticatory apparatus, the ontegenetic trajectories of the teeth can be reasonably hypothesized to closely interact and relate with the jaw bones. The development of non-destructive and high resolution imaging technologies allows researchers to investigate the relationships between these structures in three dimensions. Medical computed tomography (CT), and conventional micro-CT – which latter reaches the sub-micron resolution – provide means to produce 2D slices and 3D rendered volumes. Thus far, few studies have used 3D medical imaging to analyze dental growth stages, mainly for the estimation of age at death in forensic cases [2]. However, Fukase et Suwa [3] studied two Japanese populations and showed that tooth size and spacing conditions have substantial effects on the growth of the anterior mandibular corpus. In this project, we study a modern human sample of six neonate skulls and 30 complete mandibles of immatures aged between 0 and 12 years. The neonate skulls were scanned at 50 μm using an Ultratom microscanner (RXSolution, Annecy, France) while the mandibles were scanned on a medical Cone Beam CT (CS9300, Carestream Dental, France) at 180 μm. We analyzed the position of each tooth germ in the jaw bones, quantified the volume of the germs, of their crypt and of the available bone space limited by the surrounding anatomical structures such as the maxillary sinus or the inferior alveolar nerve canal. Our results show a link between the available space in the jaw bones and the volume of the germs and their crypt. Moreover, we present preliminary results of 3D growth trajectories of these structures between birth and 12 years of age. These growth trajectories are not only based on genetic factors, but are also surely modified by environmental factors during child growth. Their characterization will be of particular interest for improving our understanding of the major evolutionary trend in the hominid masticatory complex, especially regarding its progressive reduction combined with a gradual increase in dental growth duration.

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Podium Presentation: Session 9, Sat (9:40)

Assessing the role of the Swabian Aurignacian in the debate over the origins of figurative art and music

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In late 1990s new radiocarbon, luminescence and ESR dating demonstrated that the Swabian Aurignacian dated back to 40,000 years [1-3]. These results suggested that the caves of the Ach and Lone valleys and the region of the Upper Danube played an important role in the development of Upper Paleolithic technological and symbolic innovations. Since that time the importance of the Swabian Aurignacian has been the focus of considerable debate related to its age, its relationship to the Protoaurignacian, and origins of figurative art, mythical imagery, music and personal ornaments with a three dimensional form [4, 5]. So far the Danube Corridor Hypothesis for an early arrival of modern humans in southwest Germany and the Kulturpumpe Hypotheses for early innovations in the Upper Danube have yet to be refuted. Recent work has highlighted the importance of the region for our understanding of the spread of modern humans across Eurasia.

For 21 years, annual excavations in the Ach and Lone valleys, most notably at Hohle Fels and Vogelherd, have added to the assemblages of all classes of artifacts and yielded many new examples of artworks, musical instruments and personal ornaments. This paper presents the results from recent excavations and underlines the exceptional richness of the Swabian Aurignacian. These finds include hundreds of examples of personal ornaments with an arbitrary three dimensional form, scores of new fragments of ivory figurines, and over a dozen fragments of musical instruments made from bird bones and ivory. While not long ago researchers viewed finds of figurative ivory carvings, and many other classes of symbolic artifacts as exceptional, recent fieldwork demonstrates that these finds are the norm rather than the exception in Aurignacian deposits from the Swabian caves. The number and diversity of these finds necessitates a new assessment of the mode and tempo of symbolic innovation during the Swabian Aurignacian. This presentation summarizes the state of research on these issues and provides an up-to-date synthesis of the available data from the Swabian Aurignacian.

Excavations in the Ach and Lone valleys have been funded by the Minstry of Science of Baden-Württemberg, the Deutsche Forschungsgemeinschaft, the University of Tübingen, the Heidelberg Academy of the Sciences and Humanities, the Verein für Eiszeitkunst im Lonetal and by the Heidelberg Cement cooperation.

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Poster Presentation Number 4, Fr (12:15-14:15)

The Evolution of Learning and Memory Systems

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There have been few attempts to explain the ultimate origins of learning and memory systems such as the most common dichotomy, non-associative and associative learning. Non-associative learning consists of sensitization (an organism responds to relevant stimuli with increasing strength or reliability) and habituation (irrelevant stimuli are ignored). Associative learning consists of classical and operant conditioning. In classical conditioning, a novel stimulus is paired with an unconditioned stimulus and comes to elicit a conditioned response. In operant conditioning, a response either increases or decreases in probability based on a subsequent reinforcing or punishing stimulus. Evolutionarily, non-associative learning appeared even before the advent of life, as molecules have affinities (sensitization) or disaffinities (habituation) for other elements and molecules based upon chemical and atomic predilections for elements to coagulate in the first place to create stable energy states (minimizing free energy and forming stable subatomic ratios). A homeostatic balance between sensitization and habituation has been proposed by Eisenstein and Eisenstein [1] who purported that organisms have an innate tendency to be either sensitizers or habituators, which explains the chicken in the system (an evolutionary tendency to sensitize or habituate), but ignores the egg (how did an organism develop either tendency in the first place). According to the "selfish metabolism" proposal [2], the survival and replication of the earliest molecules before four billion years ago was predicated on their ability to exploit new chemical landscapes in the interest of their own metabolism. Only subsequently, with metabolic and autocatalytic abilities, were these molecules more successful than competing forms at replication and diversification in the gene pool. Thus, even in prebiotic conditions, the affinity of a molecule for another molecule which enhances its survival (metabolism) is a protoform of sensitization. The disaffinity of a molecule for another molecule (which does not enhance its metabolism) is a protoform of habituation. These initial molecular coagulations were subject to Darwinian natural selection, likely based on the selfish metabolism hypothesis. It may assumed that other molecular forms failed to perpetuate and expand because they were not able to enhance their own metabolic processes and subsequently replicate. The bacteria, E. coli, are used as a model for studying the first walled-cells, prokaryotes, which appeared about 3.9 billion years ago (although the first prokaryotes contained only RNA and not DNA like modern bacteria). E. Coli possess flagella, which when coordinated approach relevant stimuli (sensitization) and when uncoordinated, they tumble away from irrelevant stimuli (habituation). Scientists currently study flatworms as models for the first bilaterians (multicellular eukaryotes, which have a nucleus and DNA), which appeared about 545 million years ago, and flatworms are capable of both forms of associative learning. Further, Ginsburg and Jablonka [3] proposed that the explosion in the numbers and diversity of life during the Cambrian period (545 to 525 million years ago) occurred specifically because of the bilaterians' ability to exhibit associative learning. The ability to use previously memorized experiences allowed bilaterians to anticipate future events and rewards and to discriminate among various stimuli. Finally, in the present article, it is hypothesized that because non-associative learning involves the ability of a molecule or organism to form a stable relationship between a stimulus and a response that associative learning was an exaptation of this core principle of non-associative learning. Thus, the ultimate origin of learning and memory systems may reside in the chemical and atomic affinities and disaffinities of basic elements for one another.

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Poster Presentation Number 101, Th (12:15-14:15)

Significance of 3D geometric morphometrics allometry of the masseter muscle with respect to myosin isoform expression in Hominoidea primates

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Cranial and facial shape variability has been shown to vary with economic patterns in modern human, hunter-gatherer populations [1]. A comparative variability analysis of facial morphology has also been made in chimpanzees and gorillas [2], showing significant differences between the two species and a significant allometric component with size, mostly related to ontogenetic variability. Loading strength of the masseter muscle has not been shown to reflect differences in bite force and biomechanics [3]. However, myosin isoform expression has been shown to reflect muscle function [4]. Since the masseter muscle elevates the mandible causing a powerful jaw closure, it is expected to reflect changes in both shape and myosin composition in relation to biomechanical function. The aim of this research is to analyze the shape of the masseter muscle insertion area in a representative sample of extant great apes, including humans, in order determine if muscle composition (myosin isoforms) and shape are significantly correlated. The studied sample consisted of 17 adult specimens of extant great apes (*Homo sapiens*, *Gorilla gorilla*, *Pan troglodytes*, *Pongo pygmaeus*) for which data of the different myosin isoforms (MHC-I, MHC-IIa, MHC-IIx and MHC-16) were available. An eight-landmark configuration protocol was used to define the main insertion points of the masseter muscle onto the zygomatic arch, the cranial base, and the mandibular corpus in the articulated skull-mandible 3D structure. The two bones were scanned separately and articulated with MeshLab. The 3D Geometric Morphometrics analysis was performed in *Geomorph* R package. Significant differences in the masseter shape were shown between the robust species (gorillas and orangutan) compared to the chimpanzees, while humans showed distinct traits in the base of the skull. Muscle shape was significantly correlated to the centroid size, reflecting differences in the masseter shape among species. A significant allometric relationship was also detected between overall muscle shape and myosin typed I and IIa, whereas type IIx was much less expressed in the most robust species. However, no allometric association was observed between muscle weight and overall shape, suggesting that the strength of the muscle might not be directly related to the shape of the insertion areas. Rather, both muscle weight and myosin composition might be directly involved in the fulfillment of the masticatory demands in the robust taxa. The increase in muscle diameter might have evolutionary limitations in relation to facial prognathism and dental morphology. Thus, a further increase in masticatory bite forces might be achieved through myosin muscle composition, expressing higher proportions of slow isoforms, such as type I, in the robust species, in which the demand for increased bite forces cannot further rely on muscle diameters. In contrast, the fast isoforms IIa and IIx, less resistant to fatigue, are expressed in much higher proportions in humans. The results obtained show that although the differences in myosin composition seen among the Hominoidea species studied are significantly correlated with the shape of the insertion area of the masseter muscle, the phylogenetic limitations in the craniofacial morphology and muscle structure might have been compensated by myosin expression in the masseter muscle in relation to biomechanic demands of the studies species, not necessarily related to dietary habits, since both chimpanzees and gorillas show thin enamel, indicative of consumption of soft diets, but significantly differ both in myosin composition of the masseter muscle and in the shape of the muscle insertion area.

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Poster Presentation Number 113, Th (12:15-14:15)

Behavioral Adaptations - Morphological Adaptations: new contributions from Morphometric Mapping for the understanding of Mesolithic-Neolithic transformations (Balkans; 10 000 - 5000 BC).

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A major transition occurred during the Early-middle Holocene: Humans entered a new adaptive niche by settling in favored environments and by domesticating other species. Today, a growing body of archaeological evidence documents the timing of this transition and the study of prehistoric human remains relates this process to specific bodily adaptations. However, it is noteworthy that: 1. varying methodologies and heterogeneous markers have been used; 2. these different markers of physical activity - of different nature and relating complementary biological information - have barely been compared; 3. because of the availability of well-preserved samples, these markers could not always be applied to ecologically homogeneous population or to population for which multiple archaeological line of evidence on subsistence strategies were available. The context of Danube Gorges prehistoric sites (Balkans, 9500-5500 BC) - where the remains of more than 500 human skeletons have been discovered - well-contextualized and covering a sequence spanning the whole Mesolithic and the Early Neolithic - provides the opportunity to analyze jointly behavioral and morphological adaptations on an homogeneous Early Holocene population. The sites of the Lepenski Vir culture document the gradual transformations of mobile hunter-gatherers and fishermen (Early Mesolithic) toward a population of sedentary fishermen (Late Mesolithic - Early Neolithic), which adopted ceramics and finally practiced animal husbandry (Neolithic). Recent results of geochemical analyses indicate that a number of Neolithic individuals were non-locals, originating in some geologically differentiated areas outside the Danube Gorges; these migrants may have brought Neolithic socio-cultural novelties in the gorges (ceramics, polished axes, new type of flint used for tools, different adornments, new funerary gestures...). Therefore, in this study, bone markers of physical activities (enthesopathology, osteoarthrosis) have been analyzed on a sample of 200 adults individuals, together with a new technique of virtual analysis specifically applied on humerus and femurs: morphometric mappings. This technique considers the diaphyses of long bones as "tubes" which can be virtually unrolled and read like maps; measurements of the external topography of diaphyses (the robusticity of muscles attachments), of the thickness of cortical bone (bone robusticity) and of the internal geometry of bones (second moments area) are virtually taken all along the diaphysis and then projected like maps. These morphometric maps enable thereby to locate with precision along the whole diaphysis the main differences in term of muscle attachments, cortical thickness and bone geometry. Plus, the technique also enable to obtain "average maps" of groups of individuals, which makes possible statistical comparisons. Results: 1. confirm long bone morphological adaptation to sedentism, especially a gradual and diachronic trend of systematic decline in lower limbs robusticity, a trend toward more circularity in the geometric sections of lower limbs mid-shaft diaphyses, a reduction in the robusticity of specific entheseal sites and a decline in the extent of pathological entheseal sites located on the lower limbs; 2. suggest a sexual dimorphism possibly correlated to the first development of a sexual division of labor; 3. indicate that the inner bone morphology as well as outer topography of muscle-attachments of non-locals individuals are different from locals foragers (migrants from neighboring farming communities?). These results demonstrate the value of the Human Behavoral Ecology approach to our understanding of the broad process of human bio-cultural adaptations.

Poster Presentation Number 135, Th (12:15-14:15)

Trabecular Bone Ontogeny in the Human Talus of a 19th Century Dutch Population

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Variation in trabecular bone structure in non-human primates and modern humans has been used to reconstruct locomotion and behavioural patterns of fossil hominins. However, little attention has been paid to how variation in adult skeletal morphology may be influenced by mechanical loading patterns experienced during ontogeny. Ontogenetic analyses of the tibia, femur, and os coxae of modern humans have indicated that the response of trabecular bone to mechanical loading is not uniform throughout the body. Greater insight into the structure and variation of trabecular bone during ontogeny is needed for each skeletal element involved in locomotion before comparisons of adult trabecular bone morphology in non-human primates and modern humans can be used to infer behavioural patterns in fossil hominins. This study reports new ontogenetic data on the trabecular microarchitecture of the modern human talus, represented by an archaeological sample of a 19th century Dutch population. High resolution X-Ray computed tomography data were collected for the talus of 55 individuals. The sample consisted of 37 subadults between 3 weeks and 17 years and 18 adults between 18 and 65+ years of age. Bone volume fraction, trabecular number, trabecular thickness, trabecular spacing, structural model index, connectivity density, and degree of anisotropy were calculated for all samples using ScancoMed IPS software and compared across the sample. Bone volume fraction is highest at birth and decreases until approximately 2 years of age before increasing until skeletal maturity. Connectivity density is highest at birth and decreases rapidly around 1 year of age, and is most likely linked to the onset of bipedal walking in human infants. Trabecular number and degree of anisotropy is highest at birth and decreases as age progresses, with the adult samples having the lowest values. Trabecular thickness is lowest at birth and highest at skeletal maturity and is most likely related to an increase in body mass throughout ontogeny. The lack of statistically significant results when comparing trabecular variables between adolescents (12-17 years) and adults (18+ years) indicates that these changes occur before adulthood is reached. The results of this study suggest that the trabecular microarchitecture of the modern human talus reflects changes in mechanical loading patterns throughout growth and development and can be used to provide a reference for bipedal locomotion in future comparative studies.

Poster Presentation Number 104, Fr (12:15-14:15)

Methodological approaches to recording *in situ* fossils.

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Advances in cost-effective three-dimensional model creation have pioneered methodological approaches to analysing fossilised remains [1]. In an attempt to preserve and conserve fragile fossils numerous palaeoanthropological studies utilise three-dimensional models that can be assessed extensively post-excavation [2,3]. Highly exposed and erodible sites where fossil extraction can be difficult often necessitates the need to record fossils *in situ* [4]. Fossilised footprint localities are a prime example. In this study we attempt to identify the best practise for recording fossils *in situ*. We test the applicability of using unmanned aerial vehicles (UAV) as a non-destructive and non-invasive method to record a selection of experimentally generated footprints as a proxy for fragile fossils. We hypothesize that the use of a DSLR camera attached to a UAV will produce higher resolution images and models with greater point cloud density than that of data collected from an action camera (we tested the use of a GoPro), although this will come at the expense of a reduced flight time due to greater payload that may prove problematic for recording large-scale fossil sites. A set of experimentally generated footprints were created in homogenous sand. Eight flights were designed with four flight paths. The UAV was flown initially at 3-5 metres high, then at 1-3 metres high following each specific flight path (a circular path, a raster, an arched path, and a linear path). Each flight was completed twice, once with a GoPro and then a DSLR. Each flight path was then repeated using a handheld GoPro and DSLR. Three-dimensional models were created using photogrammetry in Pix4D. Unfortunately DSLR data from the flights produced poor photograph overlap, resulting in many of the models failing to calibrate despite high resolution images. Preliminary results indicate that GoPro data produces low point cloud density compared to data collected from a DSLR in both handheld and flight capture. Data collected from a handheld DSLR produced the highest point cloud density. We then tested if there were any statistically significant changes in shape or size per model using geometric morphometric techniques. Analyses were computed in Geomorph, an R package. The same footprint from each model was selected and was analysed to study changes in shape or size. Results demonstrate that regardless of payload there were statistically significant changes in shape for flights at 3-5 metres high compared to lower flights or handheld methods. However, regardless of flight height, data collected from the GoPro consistently displayed shape change. This may be the result of a wide lens distorting mesh optimisation. Choice of flight path also significantly affected shape for all methods of data capture. Footprint size was significantly affected by flight height from both payloads. Both handheld and UAV GoPro data consistently displayed statistically significant changes in size. Data from the DSLR flights also displayed significant changes in size, despite shape remaining static. Further flights were designed to incorporate the applicability of using stills from a GoPro and video from a DSLR. Results were more promising: data from GoPro stills did not exhibit any significant changes in shape or size. DSLR video capture produces greater calibrated models and model accuracy. However, both of these methods come at the expense of reduced point cloud density. Preliminary results have demonstrated that a non-invasive UAV can be used to record *in situ* fossils. However, only DSLR video or GoPro still capture should be used. If models are required to be high resolution then it is advised to use a handheld DSLR following a specific flight path. Further experiments refining flight optimisation are required.

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Poster Presentation Number 14, Fr (12:15-14:15)

Why apply a geoarchaeological approach to the Middle and Late Pleistocene deposits of Leba Cave (Huíla, Southwest Angola)?

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Angola is located in the intertropical zone of low pressures influenced by the subtropical regimen of high pressures from North and the arid influence from the Namibe Desert in the South. Global climate changes and tectonics over the Pliocene and Pleistocene altered the geomorphology and landscape of the region affecting the preservation of either geological or archaeological remains. However in the high altitudes of the Leba Formation, the Paleozoic limestones preserve materials from the last 1 mya in the karstic sedimentation. Previous fieldwork in Leba Cave provided a multiple Early, Middle and Late Stone Age record of lithics and faunal remains from which updated analysis has posed a new set of questions about the nature and context of the deposits. Cultural markers indicate that the site was occupied by humans and scavengers several times at least over the last 150,000 years. Yet the geochronology of the lithic sequence remains unclear, with a hiatus between the Sangoan handaxes and the MSA lithic points, lacking absolute dating beyond the MSA/LSA interface of hearths and bones dated from 80,000 years ago. The study of morphogenetic alterations in the karst and micromorphological signatures in the cave's bedding will help describe the formation processes that produced the biogenic, geogenic and anthropogenic inputs preserved in the stratigraphy. Southwestern Angola is a key region to understand the chronostratigraphic framework of the Middle and Late Stone Age not only because of its peculiar geographic and geological conditions but also due to the potential shown by updated research and analysis of lithic collections and documentation from past studies in the region. Presently, the Western corner of Africa has almost any information on the Pleistocene human patterns whilst other similar regions of the inter-tropical zone have provided long and well-dated cultural sequences related with relevant issues like the emergence of modern humans. This poster aims to present the objectives of my doctoral research while discussing the main methodological and scientific challenges of applying a geoarchaeological approach to the deposits of Leba Cave.

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

Is *Paranthropus* a good clade?

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The phylogenetic placements of the three species in the genus *Paranthropus* remain contentious . One hypothesis contends that *P. aethiopicus*, *P. boisei*, and *P. robustus* are a clade, and so share a most recent common ancestor to the exclusion of all other hominin species. The main alternative hypothesis is that *P. boisei* and *P. robustus* are more closely related to *Australopithecus africanus* and *Homo* than either is to *P. aethiopicus*. While both hypotheses have been supported in previous phylogenetic analyses, the hypotheses have yet to be formally compared in a phylogenetic framework. Here we present such a formal analysis.

We conducted a series of dated Bayesian analyses using a large craniodental character matrix from 24 hominin species that span the last seven million years. The oldest specimen from each taxon was used to fix the tip dates. Various evolutionary hypotheses of *Paranthropus* species were converted into partially constrained tree models, and we then used Bayes Factors to evaluate the relative likelihood of these models given the fossil evidence. We ran stepping-stone sampling for 20 million generations to estimate the marginal likelihoods in Mr.Bayes 3.2.5. The model with the strongest support (ln=-2544.04; BF=28.14) was one where (i) *Paranthropus* species form an exclusive monophyletic clade and (ii) this clade is sister to a clade of species in the genus *Homo* and *Australopithecus sediba*.

It has been argued that similar morphology in the masticatory system in the three *Paranthropus* species may be due to convergent evolution [3-5]. We therefore reran our tests after removing all the masticatory characters from the matrix. The best-supported model remained one where *Paranthropus* is a clade, though with reduced support (ln=-2108.07; BF=12.54). Thus, even if the masticatory similarities among the three species are convergent, the phylogenetic signal from other cranial regions support their close affinity.

Together, our analyses provide strong support for the hypothesis that the three *Paranthropus* species form a clade to the exclusion of other hominins.

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Poster Presentation Number 29, Th (12:15-14:15)

Single-grain OSL dating of the Middle Palaeolithic site of Galería de las Estatuas, Atapuerca (Burgos, Spain)

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Galería de las Estatuas is located within the Sierra de Atapuerca archaeological complex, northern Spain. This extensive karstic system has produced several important Early and Middle Pleistocene palaeoanthropological and archaeological records that have been dated with luminescence techniques (e.g., Gran Dolina, Sima del Elefante and Sima de los Huesos). However, Galería de las Estatuas is the first Middle Palaeolithic (<150 ka) site to be systematically excavated within the Atapuerca karst system, and it is invaluable for providing new insights into Neanderthal subsistence histories and exploitation strategies in the region. This newly excavated site is situated in the uppermost level of the Cueva Mayor-Cueva del Silo karst system, adjacent to a palaeoentrance now sealed by a stalagmitic crust. Two test pits (<2 m-deep), GE-I and GE-II, have been excavated in the clayey detritic sediments underlying the stalagmitic crust, and have enabled the identification of 5 stratigraphic levels within the sedimentary profile . Radiocarbon dating of faunal remains has yielded ages of 43.5 14C kyr BP to at least 46.3 14C kyr BP and a U-series age of ∼ 14 ka has been obtained on the base of the capping stalagmitic crust . These initial ages indicate the accumulation is likely of Late Pleistocene age . The aims of this study are to: (i) provide the first detailed chronological constraint on the various sediment layers at Galería de las Estatuas using single-grain OSL dating; (ii) compare single-grain optically stimulated luminescence (OSL) results with replicate thermally transferred (TT) OSL and post infrared (IR) infrared stimulated luminescence (pIR-IRSL) results to improve the robustness of the final chronological assessments, and to assess the applicability of extended-range luminescence dating approaches to the younger infill karst deposits at Atapuerca. In total, seven luminescence dating samples were collected; 5 from pit GE-I and 2 from pit GE-II. We present equivalent dose (De) distributions and ages for OSL, TT-OSL and pIR-IRSL signals. We assess the luminescence signal bleaching patterns of these endokarstic deposits and use additional TL experiments to investigate single-grain TT-OSL signal characteristics. The single-grain OSL chronologies for Galería de las Estatuas are discussed in relation to the broader Atapuerca archaeological record, other published Middle Palaeolithic records for the region, prevailing climatic conditions, and the nature of Neanderthal occupation in the Sierra de Atapuerca.

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Podium Presentation: Session 7, Fr(14:40)

New single amino acid radiocarbon dating and DNA analysis of the Vindija Cave Neanderthals

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The period between ~45,000 and 35,000 ^{1}4C years BP in Europe witnessed the 'biocultural' transition from the Middle to early Upper Palaeolithic, when anatomically modern humans coming from Africa displaced Neanderthals across the continent [1,2]. Significant questions remain regarding how this transition happened, for example to what extent Neanderthals and modern humans overlapped temporally and spatially, if modern humans or Neanderthals were responsible for various 'transitional' early Upper Palaeolithic industries, and when the last Neanderthals disappeared. Previous dating of Neanderthal remains from Vindija Cave (Croatia) led to the suggestion that Neanderthals survived there as recently as 28,000-29,000 ^{14}C years BP [3]. Subsequent dating of Neanderthal specimens Vi-207 and Vi-208 from level G1 yielded older dates, interpreted as being at least ~32,500 BP, but probably older [4]. We have redated the same specimens using a different approach, developed at the Oxford Radiocarbon Accelerator Unit, which is based on the extraction of the amino acid hydroxyproline that occurs in mammalian collagen using preparative high performance liquid chromatography. This method is more efficient than other methods in eliminating modern carbon contamination. We also applied Zooarchaeology by Mass Spectrometry (ZooMS) on 383 unidentified bone samples to discover additional hominin remains and we identified one bone as Neanderthal based on its mitochondrial DNA. We also attempted to date some of the early Upper Palaeolithic bone points from stratigraphic units G1, Fd/d+G1, Fd/d, Fd, with mixed success owing to low levels of collagen. In the current presentation we report all the new radiocarbon dates and DNA results. In contrast to previous suggestions, these data show that there is no reason to assume that the Neanderthals in Vindija Cave survived substantially later than at other places in Europe. Rather, they seem to pre-date the arrival of anatomically modern humans in Eastern Europe.

The research leading to these results has received funding from the European Research Council under the European Union's Seventh Framework Programme (FP7/2007-2013) / ERC grant agreement n^{o} [324139] 'PalaeoChron' awarded to Professor Tom Higham.

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

Amino acid racemisation dating of mammalian enamel: a British elephantid geochronology

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Establishing a robust chronology is imperative for our understanding of hominin evolution and migration. Directly dating mammalian remains older than the limit of radiocarbon dating (~50 ka) is extremely challenging, but recent advances in amino acid racemisation geochronology (AAR; using the predictable breakdown of proteins and amino acids), has been a powerful tool for Pleistocene age estimation (back to ~ 2.5 Ma) of a wide variety of calcium carbonate (CaCO3) based biominerals. By targeting a proteinaceous fraction found within the crystalline structure of biominerals (the intra-crystalline fraction), the difficulties associated with contamination, leaching and environmental influences are circumvented. Tooth enamel (which is composed of a form of calcium phosphate) may provide an environment complementary to that found within the CaCO3 subfossils and thus has potential for AAR dating.

We have assessed the suitability of enamel for intra-crystalline protein decomposition (IcPD) dating by testing both the protein breakdown and the intrinsic properties of the inorganic crystal structure of enamel. This has allowed us to build an AAR geochronology based on elephantid enamel, with an age range that shows the technique successfully dates material from the UK up to Late Pliocene in age. It is therefore now possible to provide direct age estimation for unknown age elephantid material from the same temperature region (likely to be Northern Europe). However, this technique has the potential to be expanded to a range of mammalian species, including hominins, and can be developed for additional geographic regions. The focus of this framework has been on Quaternary age samples, but due to the slower breakdown of the enamel proteins, the dating range of this method may extend much further back in time. This novel application of AAR dating has the capacity to improve our understanding of mammalian fauna during this time period and their response to palaeoenvironmental change.

Podium Presentation: Session 12, Sa (16:40)

Fontana Nuova (Ragusa, Sicily): a review of its Aurignacian attribution

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In his recent seminal book *The Making of the Middle Sea*, Cyprian Broodbank claims that Riparo di Fontana Nuova provides us with indisputable evidence for an Aurignacian occupation of Sicily. If correct, this would have major implications for what we know about Aurignacian culture and its spread, which in the case in question would imply that early Upper Palaeolithic hunter-gatherers may have habitually undertaken crossings, such as that necessary to get from Calabria to Sicily.

The presence of the Aurignacian at Fontana Nuova has been proposed by numerous scholars, which based this attribution largely on the typology of the lithic industry from the site [1, 2, 3]. The complicated research history on Riparo di Fontana Nuova raises serious doubts on the cultural attribution of the site, given that the lithic industry was recovered, in the first half of the 20th century, as part of an unsystematic excavation conducted by a local nobleman, Vincenzo Grimaldi di Calamenzana, who donated the assemblage to the Archaeological Museum in Syracuse and reburied (!) the human and other faunal remains. These were later excavated in 1949 by Bernabò Brea, who located the spoil heap of Baron Calamenzana's excavation and retrieved the unstratified finds to have a record of what had been present at the site. The lithic assemblage is suspected to have been the object of a selective process [4], which may have contributed to its attribution to the Aurignacian. In fact, recent reviews of the Palaeolithic assemblages from Sicily have assigned the lithics from Riparo di Fontana Nuova to the Epigravettian.

Moreover, no other Aurignacian site is known on the island and the oldest reliably-dated Upper Palaeolithic site in Sicily is Riparo del Castello, where the date at the base of the sequence is 13,485 ± 80 BP (OxA-10040, 16,500-16,000 cal BP, [5]), well after the LGM and several millennia after the Aurignacian.

All the above-mentioned issues justify a re-evaluation of the cultural and chronological attribution of Fontana Nuova. For this purpose, we sampled faunal and human remains (i.e. 2 teeth, a talus and a cranial fragment) to perform radiocarbon dating, stable isotope and aDNA analyses.

The results of our interdisciplinary research have important implications not only to verify whether Sicily was colonized in the Aurignacian, but also to understand whether groups belonging to this culture were likely to undertake sea crossings in their spread across Eurasia.

The authors would like to thank dott. Anita Crispino and the Museo archeologico regionale Paolo Orsi for the friendly collaboration.

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Podium Presentation: Session 11, Sa (14:40)

The Middle to Upper Palaeolithic transition in North-West Europe. New results from Belgium.

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Two research programs on the Middle Palaeolithic in Belgium have resulted in new reflections on the Middle to Upper Palaeolithic transition (MUPT) in North-West Europe. The first project concerns Scladina cave and focusses on field investigations. The second project deals with a revision of the chronocultural context of the Late Middle Palaeolithic (LMP) combining a reappraisal of museum collections and dating of anthropogenically modified bones. In Scladina, the stratigraphic sequence covers mainly the period from MIS 5 to MIS 3 and yielded essentially Middle Palaeolithic occupations. Since the beginning of the excavations in 1978, only a few artefacts attributed to the Upper Palaeolithic have been discovered. However, they are associated with problematic stratigraphic contexts.

In 2017, an end-scraper of Upper Palaeolithic character has been discovered within the sedimentary unit T (sub-unit T-RO), a stratigraphic context just overlying the last Mousterian occupation of the cave (Unit 1A, ca 40-38 ky uncal BP). A multidisciplinary analysis combining stratigraphy, depositional and post-depositional processes, lithic technology, taphonomy, palynology, and a series of radiocarbon dates suggests an age between ca 37 and 34 ky uncal BP to the deposition period of the T-RO sediments.

Beside the fieldwork, zooarchaeological analyses on the T-RO collections led to identify two anthropogenically modified horse bones. As these bones are perfectly preserved, it suggests no or limited reworking and therefore a penecontemporaneity of these bones with the deposition of the T-RO sub-unit. These horse bones were recently dated around 35 ky uncal BP. Considering its stratigraphic context overlying the Mousterian, and the radiocarbon age of the associated anthropogenic bones, this end-scrapper may represent the earliest evidence for the Upper Palaeolithic in North-West Europe in a secure stratigraphic context.

In addition, investigations on the regional MUPT sites led to date two retouchers from the 19th Century excavations at Trou du Diable in Hastière. Results obtained are similar in age with the Spy Neandertals (around 36 ky uncal BP), for which an association with the so-called "transitional" Lincombian-Ranissian-Jerzmanowician (LRJ) has been suggested [1]. In Hastière, just as in Spy, a precise stratigraphic context is lacking given the age of the excavation. However, the cultural material from Hastière is related exclusively to the Mousterian or the Middle Aurignacian, with no presence of the LRJ [2]. Considering both the date and the archaeological context, an association of these retouchers with the Mousterian is more likely than with the Aurignacian. Moreover, the presence of phtanite chunks embedded in one of the retouchers reinforce this association with the Mousterian stone tools, as this specific raw material was used exclusively for Middle Palaeolithic artefacts at this site.

These preliminary results suggest that the a fully Middle Palaeolithic culture persisted up to 36 ky uncal BP while the Upper Palaeolithic started around 35.5 ky uncal BP. Regarding the wider North-West European area, it indicates a contemporaneity between the Late Mousterian, the LRJ and the Chatelperronian southernmost. In addition, it considerably shortens the chronological gap previously observed between the Late Mousterian and the Early Upper Palaeolithic [3] and casts new light on the issue of contact between AMH and Neandertals in North-West Europe.

This work was partly supported by the Natural Environment Research Council [NF/2015/1/3]. We are grateful to the NRCF and the Oxford Radiocarbon Accelerator Unit for the radiocarbon dates obtained within the program "Dating the demise of Neanderthals and the appearance of anatomically modern humans (AMH) in Northwest Europe: New data from Belgium"

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Podium Presentation: Session 12, Sa(16:20)

New perspectives on the Kostënki Early Upper Palaeolithic

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With its multiple multi-layered sites, the Kostënki complex has been described as a "Rosetta Stone" for the Early Upper Palaeolithic (EUP) of Eastern Europe [1], and hence for early occupation of the region by anatomically modern humans (AMHs). Incorporating Kostënki into the wider European EUP record has, however, proved difficult, in part due to the presence of archaeological phenomena unique to Eastern Europe. These include the Streletskian, often seen as Eastern Europe's "transitional industry" and suggested by some to represent a very early AMH occupation [e.g. 2, 3]. Furthermore, the chronology of some of the Kostënki sites remains problematic [4, 5], despite a well-documented sedimentary sequence that includes the CI tephra and abundant material suitable for radiocarbon dating.

We have reassessed collections from Kostënki's key EUP sites (Kostënki 1, 6, 11, 12, 14 and 17), focusing on lithic assemblages and excavation archives. In addition, we have carried out a program of radiocarbon dating, which has so far produced >35 new dates. Our results indicate that EUP-age bones from mid 20th century excavations can produce erroneous radiocarbon ages, perhaps due to routine post-excavation application of preservatives. In order to overcome this problem we have in some cases dated bone using the single amino acid (hydroxyproline) radiocarbon dating method.

Our work confirms the presence of AMHs at Kostënki by at least 41,000 cal BP, associated with an assemblage that shares important techno-typological features with the Proto-Aurignacian. Later material (c.39,000 cal BP) is instead similar to the Early Aurignacian. Our reassessment of Kostënki Streletskian assemblages underscores their techno-typological variability across different sites and layers. New dates confirm the diverse ages of assemblages that have previously been described as Streletskian, with the oldest being $\geq$ 43,000 cal BP. Overall we urge caution over use of the term "Streletskian". In particular, careful consideration of the stratigraphic association between dated material and diagnostic Streletskian points is always necessary.

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Pecha Kucha Presentation: Session 6, Fr (11:50-12:15)

Middle and Upper Paleolithic in the Balkans: New Data from Two Recently Discovered Sites in Serbia

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The processes of population replacement during the Middle to Upper Paleolithic transition followed regionally different scenarios across Europe. The Balkan peninsula is one of the key regions for understanding human biogeography and cultural changes during this time period. As a refugium for flora, fauna, and potentially hominins during glacial periods, this region may have witnessed, as suggested by chronology in Vindija, late survival of Neandertals. On the other hand, the Danube valley in the northern parts of the peninsula, a geographical corridor between the southwest Asia and Europe, represents a route of early modern human dispersal into Europe [1].

Nevertheless, the spatial and temporal patterns of hominin occupations during the Middle and Upper Paleolithic in this region are still poorly understood due to the relative small sample of sites. The low number of long sequences and high density sites, however, may likewise support the hypothesis that the Balkans was a region with low population densities and discontinuous occupation [2]. The scarcity of Paleolithic sites from MIS 3, unless they result from lack of research, may imply occupational discontinuities. Therefore, the questions of spatial and temporal presence of Neandertals and the timing and extent of modern human dispersals during the MIS 3 still merit further investigation in the Balkans.

To address these questions we initiated a survey project in Serbia designed to discover new stratified Paleolithic sites [3]. The survey targeted the wide valley of Velika Morava river, a tributary of the Danube and one of the main river corridors in the Balkans. The valley represents a transitional zone between the Pannonian lowland and the mountainous regions, a zone where most of the known stratified sites in the Balkans containing Middle and early Upper Paleolithic occupations are located. The survey of cave sites in limestone-rich areas along Resava river, a tributary of Velika Morava, discovered numerous potential habitation sites. Initial tests at two of these, Bukovac and Orlovača, revealed Pleistocene deposits with artifacts of Paleolithic provenance. Thus far three seasons of excavations were conducted to generate high-resolution contextual data using modern excavation methodologies. Our interdisciplinary approach incorporates radiocarbon and OSL dating techniques, lithic and faunal analysis, and the studies of site formation processes.

The two sites together document successive levels of Middle and Upper Paleolithic occupations. The highest occupation intensity is encountered in the Gravettian level at Bukovac cave and demonstrates the presence of hearths, abundant faunal material, bone tools, and lithic assemblages consisting of numerous backed bladelets. Earlier occupations reveal lower density of archaeological finds. Of these, levels with small assemblages consistent with Aurignacian are present at both sites and they bring new data on different phases and the chronology of this technocomplex. Along with the Middle Paleolithic occupations at Orlovača, these levels contribute to understanding the spatial and temporal distributions of hominin populations in the Middle and Upper Paleolithic, potential to address differences in occupational intensities, and to relate the population replacement events to climatic changes.

We are grateful to Max Planck Society and Serbian Ministry of Science and Education (project no. 177023) for supporting this project.

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Podium Presentation: Session 8, Fr (17:00)

Dating early human adaptation in the tropical forests of southern Asia (Thailand and Sri Lanka)

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The discovery of a new Pleistocene member of the *Homo* lineage from Siberia (Denisovans) (1), whose closest relatives currently live in island Southeast Asia (2), as well as other discoveries in Laos [3], Indonesia [4] and Borneo [5], have overturned common perceptions on the role southern and southeast (SSE) Asia has played in late human evolution. Since the inception of the "Movius line" that divided the Palaeolithic Old World into two separate technological zones SSE Asian lithic technology has been characterised as crude, unchanging and of little interpretive value. While the contribution of genetics is starting to elucidate the settlement of Asia by moderns and other human species, the spatio-temporal dimension and archaeological signature of such processes is poorly documented. Over the last 5 years, our team has worked towards revising the chronological framework of several Palaeolithic sites in Thailand and Sri Lanka, in order to provide a better temporal understanding of human occupation in these SSE Asian regions during the late Pleistocene. Here we present more than 40 new AMS dates from 5 sites in north and south Thailand (Tham Lod and Moh Khiew, respectively) and in Sri Lanka (Fahien lena, Batadomba lena, Kitulgala Beli-lena). The new dates, obtained using state-of-the-art methodologies for the decontamination of old charcoal samples (ABOx-SC), indicate that humans, presumably modern humans at all sites, were fully able to inhabit tropical forest and tropical ecotone environments as early as 45,000 years ago. The results allow comparison of the current chronological framework to previous such records from the regions, while at the same time allowing palaeoenvironmental proxies and other relevant information (sea level change, grassland coverage) to be integrated in a more reliable and precise framework. SSE Asia is a very promising and exciting region in the study of human evolution; with the appreciation of a more complicated demographic history, improved models are clearly needed to explain the origin and dispersal of *Homo sapiens*, their adaptation to rainforest ecologies and a broader subsistence behaviour. For these to be achieved, a better understanding of the timing factor is critical.

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Poster Presentation Number 78, Fr (12:15-14:15)

Morphology and cross-sectional geometric analysis of *Lufengpithecus* first metatarsal: implications for its locomotor behavior

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A right first metatarsal (PA1274) was unearthed from the fifth layer at Section D, Shihuiba locality in 1983. Early work demonstrated that this *Lufengpithecus* first metatarsal possesses a weak gripping ability and is likely to be capable of buttressing on ground for walking bipedally [1]. Considering this view is limited by the lack of comparative data, and the diaphyseal structure is known to respond to mechanical demand. Thus, we provide expanded morphological analyses within a broad comparative context, and a quantitative analysis of the diaphyseal structure for refining interpretations of its locomotor mode and positional behavior. The PA1274 displays a reduced dorsal mediolateral head dimension and an ellipsoid-shaped central articular surface, which is similar to those of other Miocene apes. The roughening area appears as a thin band just under lateral ridge of the distal half shaft in PA1274 attached the *M. flexor hallucis brevi*, which is sometime presented in African apes. Based on the above features, we suggest a widely range of abduction-adduction movement appears at the first metatarsophalangeal joint, probably as well as plantarflexion. Given the straight shaft and the lack of a plantarflexed head, PA1274 does not appear to a powerful grasping foot compared with orangutan and chimpanzee. Additionally, the gracile metatarsal shaft and the broader and shallower plantar condylar may demonstrate it cannot be regularly subject to significant load-bearing for acting as a propulsive lever during walking on the ground. Cross-sectional geometric properties were measured at 35%, 50% and 65% of bone length after the micro-CT scanning. As for the metatarsal head surface area to mid-shaft strength (Zp) comparison, Lufengpithecus has a median value within the range of African apes and is significantly different from those of human and orangutan2. For polar moment of area, it shows greater bending strength and be closer to chimpanzee than other extant hominoids3. Thus, these resemblances to African apes that commonly use both arboreal and terrestrial substrates, may indicating Lufengpithecus is would like have had a positional repertoire emphasizing arboreal and terrestrial quadrupedalism. Moreover, the discrepancy between internal and external features in PA1274 and hominins does not support *Lufengpithecus*was already adapted for habitual terrestrial bipedalism.

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Pecha Kucha Presentation: Session 2, Th (11:00-11:25)

The implications of fossil Suidae (Mammalia, Artiodactyla) for the reconstructions of the habitat of *Australopithecus anamensis* in the Omo-Turkana Basin

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Australopithecus anamensis lived in eastern Africa *c.* 4 million years ago. Three main fossil sites in the Omo-Turkana Basin (Kanapoi, Allia Bay and Mursi) preserve sediments of this age. The abundance of hominin fossils at these sites is extremely variable: the majority of the fossils attributed to *A. anamensis* have been found at Kanapoi (*c.* 70% and *c.* 5.4% of within-site mammal remains), some have been discovered at Allia Bay (*c.* 30% and *c.* 1.3% of within-site mammal remains) and no hominin remains have been found so far at Mursi. What explains the differences between these three Omo-Turkana Basin sites in the relative abundance of *Australopithecus anamensis*? The site of Kanapoi has been reconstructed in published literature as a relatively open environment , and Mursi as a wetter environment. Based on these published data, we hypothesize that *A. anamensis* were the least abundant in the wetter environments.

We chose to focus our study on fossil from the family Suidae to investigate this hypothesis because multiple lines of evidence have shown the association of the members of the suid genera *Nyanzachoerus* and *Notochoerus* with the presence of closed and humid environments during the East African mid-Pliocene [3,4]. More aquatic animals such as Hippopotamidae and Crocodylidae would give a biased signal in terms of abundances because of differential preservation and diverging sampling strategies between the teams that worked at all three sites (e.g., some teams only collected mammals). Suids are also well represented at all three sites, being the most abundant mammalian taxonomic family at Mursi (*c.* 30% of mammal remains), and the second most common at both Kanapoi and Allia Bay (each *c.* 20% of mammal remains). We analyzed Suidae fossils for faunal abundance patterns, stable isotope ratios (using published and new values) and surface modification patterns on postcranial remains (> 5 cm).

We expected the distribution of carbon isotopic compositions in dental enamel of all suid taxa to be generally more 13C-depleted at Mursi relative to the same taxon at Kanapoi, with samples from Allia Bay generally intermediate between these end-members. Instead, we found clearly overlapping values at Kanapoi (n=11) and Allia Bay (n=17), and more 13C-depleted isotopic ratios at Mursi (n=40). In addition, although fossils attributed to mixed-feeding *Nyanzachoerus*, and specifically *Ny. kanamensis*, clearly dominate Suidae all three assemblage, the more grazing *Notochoerus* is proportionally more rare at Mursi than at the other two sites. However, these differences may be due to the fact that the sites are not strictly contemporaneous. Our analysis of the surface modification patterns on the three collections also supported the important presence of humid settings at Mursi (higher abrasion levels, a larger variety of weathering levels, etc.) comparatively to Allia Bay and Kanapoi.

In sum, the analysis of suid remains revealed the presence of similarities between the sites of Allia Bay and Kanapoi, with the results from Mursi differing from the two former sites. In addition, data from isotope ratios, taxonomy and surface modification processes support the presence of more humid settings at Mursi than at Allia Bay and Kanapoi, which may explain why the former did not seem to be inhabited by hominins. The ecological niche of *A. anamensis* seems to be restricted to more open and less humid settings, as would have been found at Allia Bay and Kanapoi.

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Poster Presentation Number 133, Th (12:15-14:15)

Trabecular morphology across the hominoid metacarpus reflects distinct locomotor strategies

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Modern humans are unique among extant hominoids as their hands are primarily used for manipulation rather than locomotion. However the tempo and mode of the evolution of hand use in our lineage has been subject to decades of debate. Plio-Pleistocene hominin hand morphology includes many traits that are associated with arboreal locomotion in modern apes, including relatively curved and/or long fingers. This fossil evidence has been interpreted equivocally by researchers as either the result of functional, arboreal adaptation or phylogenetic inertia. Trabecular morphology has been shown via both *in vitro* and *in vivo* studies to remodel according to Wolff's law and thus can reflect the loading experienced during life. Therefore fossilized trabeculae may be used to distinguish functional, adaptive morphology from non-functional morphology that persists simply due to ancestry. Previous comparative studies have shown that trabecular structure in the third ray of extant primates accords well with the assumed hand positions adopted in differing locomotor strategies. Similarly, trabecular structure has been argued to reflect a manipulative signal in both modern humans and fossil hominins. Here we build on these studies by analysing the trabecular structure in the heads and bases of metacarpals (Mc) 2-5 in extant great apes (*Pan paniscus, Pan troglodytes, Gorilla gorilla* and *Pongo sp.*). Micro-CT scans of disarticulated metacarpals (n=112) were segmented using the Ray-Casting Algorithm [1] and the trabecular structure of each epiphysis was analysed using medtool 4.1 [2] following the methods outlined by Gross and colleagues [3]. We demonstrate that whilst there are common trabecular patterns across the hominoid hand, when taken together the metacarpals show distinct patterns that reflect differential loading of the palm in arboreal and terrestrial locomotor modes practised by these species. *Pan* shows high concentrations of trabecular bone along the dorsal surface of the metacarpal head, typically highest on the Mc2 and Mc3, which is consistent with an extended metacarpophalangeal joint and a pattern of digit loading during knuckle-walking. *Gorilla* displays a similar pattern, although trabeculae are more consistently distributed across the metacarpal heads. In contrast, *Pongo* demonstrates a clear palmar concentration of trabeculae within the metacarpal head, consistent with a flexed hand posture during arboreal grasping. This evidence is crucial in forming a coherent comparative sample with which to infer hand function in fossil hominin remains; particularly isolated metacarpals.

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Pecha Kucha Presentation: Session 10, Sa (11:00-11:25)

An investigation into the interrelation between environmental change, subsistence and technology c. 40-12 kcal BP in southern Africa

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We know little of human ways of life in southern Africa between 40-12 kcal BP, a period of considerable social, technological, and environmental change centred on the Last Glacial Maximum (LGM)(c. 28-17 kcal BP). One of the major technological changes during this time is the shift in emphasis from prepared-core based technologies to lithic miniaturization [1, 2]. Archaeologists invoke a range of environmental and social explanations for lithic miniaturisation in other regions (i.e. Northern Asia, North America, Europe, and Australia). Dietary changes, shifting land-use strategies, and palaoenvironmental change feature prominently in discussions. Their relevance to processes of lithic miniaturization in southern Africa remains under-examined. We present the results of an analysis of changing animal exploitation patterns between 40-12 kcal BP. Our analysis demonstrates important shifts in commonly exploited prey types at sites from the Southeast and Central interior during this period of regionally variable climates. Low-ranked resources are well represented in levels with technologies organized around the production of both miniaturized and prepared-core components. From 24 kcal BP the prepared core elements diminish and high-ranked prey becomes better represented. We place results of the faunal analysis into the context of the recent redating of the key highland rock shelter of Sehonghong (Lesotho) that suggests occupation within the period between 40 and 12 kcal BP was pulsed and the site may have been abandoned for extended periods of time during the LGM [3]. This analysis allows the formulation of more explicit hypotheses about the interplay between climate change, subsistence choices, and the organization of technology. We synthesise current understandings of technological change to suggest that the trend towards increased lithic miniaturization must consider not just the types of resources that are exploited, but also their function in mitigating ecological risk [cf. 4].

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Poster Presentation Number 52, Fr (12:15-14:15)

In which extent high resolution μCT-scanning of hominin fossil teeth may impact the ESR dating results?

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Fossil human teeth are nowadays systematically μCT-scanned by palaeoanthropologists prior to any further analysis. It has been recently demonstrated that this non-invasive technique has, in most cases (i.e., with conventional instruments), virtually no influence on ancient DNA preservation [1]. However, it may have nevertheless an impact on other analytical techniques, like Electron Spin Resonance (ESR) dating.

To thoroughly assess this impact, we μCT-scanned several modern enamel fragments with a GE Phoenix v/tome/x s 240 instrument in accordance with the standard analytical procedure employed by the Dental Anthropology Group (GAD) at the Centro Nacional de Investigación sobre la Evolución Humana (CENIEH), Spain, and then performed ESR dose reconstruction for each of them. The results of our experiment demonstrate that the systematic high resolution μCT-scanning of fossil hominin remains introduces a non-negligible X-ray dose to the tooth enamel, between 15 and 30 Gy depending on the parameters used. This laboratory dose is strongly device and procedure dependent: it can simply not be universally extrapolated to any μCT-scan analysis but have instead to be specifically assessed for each device and set of parameters employed. This variability was assessed by running several additional experiments, i.e. without a metallic filter, and also using another μCT-scan instrument.

The impact on the ESR age results is directly dependant on the magnitude of the geological dose previously accumulated in fossil enamel, but could potentially lead to an age overestimation up to 40% in case of Late Pleistocene samples if not taken into consideration (see further detail in [2]). Basically, this impact will be greater if the ESR equivalent dose measured in tooth enamel is smaller.

Although it is recommended in first instance to avoid any previous μCT-scanning of fossil remains if the sample is intended to be dated by ESR, we understand this may not be always possible given the value of those remains. Therefore, we recommend scanning a modern tooth together with the human fossil using the same device and acquisition parameters: this is so far the best option to obtain a fair estimation of the X-ray dose given to the fossil sample that could then be subtracted from the geological dose.

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Poster Presentation Number 13, Th (12:15-14:15)

Excavating the fossil bearing Strata of the lower Vaal River, South Africa – first results from Pniel 6

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For a century fossil fauna and stone tools from the Early and Middle Stone Age have been reported from the banks of the lower Vaal River near Kimberley in the Northern Cape Province of South Africa, mainly from deposits disturbed by diamond miners. Indeed, the Vaal River terraces revealed the first stratigraphy of Early Stone Age artefacts in Africa [1] and are therefore a key sequence for understanding this time period. Previous excavations have shown the enormous potential of these Acheulean and Fauresmith period sites (c. 1,000,000 - 200,000 BP) [2], but they lack modern documentation, analysis and publication. This project aims to locate and excavate the archaeologically significant fossil bearing gravels at the site of Pniel 6. Other local excavations at the sites of Canteen Kopje and Rietputs have focused on sites rich in lithics and have begun to clarify the age of the deposits [3,4]. However, there has been no comprehensive analysis of the rich sites along the Vaal that include both stone tools and the remains of extinct fauna, and reconstructions of the past environment have been neglected. Indeed, the precise archaeological context of the fauna and associated lithic artefacts from the Vaal River gravels has not been confirmed by modern excavations. Our 2017 field season is the first with results from a modern excavation of a locality with potential to make a major contribution to the archaeology of early humans in the arid interior of southern Africa, a region where organic preservation in Pleistocene sediments is rare. The first step towards a sustained project at Pniel 6 has included comprehensive survey across the area and detailed mapping of the topography with the total station for use in a Geographical Information System (GIS). Further spatial analysis derives from piece-plotting of all finds and screening of all sediments, followed by sorting by hand. This contribution showcases the results from the 2017 field season. Further research at Pniel will provide the basis for understanding the environmental context of human occupation along the Vaal River.

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Poster Presentation Number 95, Th (12:15-14:15)

Dental behavior and long-term dietary reconstruction of El Sidrón Neandertals derived from molar macrowear patterns.

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Molar macrowear is a cumulative process which occurs during the individuals' lifetime. Its study provides strong insights into long term dietary and dental behavior. In this study we analyze the occlusal macrowear pattern by applying the Occlusal Fingerprint Analysis (OFA) method to reconstruct the wear facet distribution and occlusal pathways on the maxillary first and second molars (both right and left) from 11 Neandertal individuals from El Sidrón cave in Northern Spain [1], and place the individuals in the context of other Neandertals previously published [2]. Wear facets on the occlusal surface of molar crowns were quantified from digitized high-resolution casts, and functional parameters such as the area, orientation, and inclination were measured. 3-D occlusal dental compasses of single molars indicate major movements during mastication [3]. The relative facet areas show that the overall power stroke pattern of the group is characterized by a dominance of buccal and lingual Phase I, whereas Phase II is less developed. In this respect the macrowear pattern is similar to that of other Neandertals characterized as mixed diet consumers who occupied deciduous woodland habitats [2]. This is expected since paleoenvironmental reconstruction from the El Sidrón deposits suggests a temperate phase of Marine Isotope Stage (MIS) 3, with temperate Atlantic oceanic conditions, and a mix of both coniferous and deciduous forests with some meadows. Moreover, all adult and sub-adult individuals from the group, reflect a common occlusion pattern with a prevalence of vertical motion, indicating no ontogenetic changes within this familial group on the overall dental food processing. The results here presented are part of a multidisciplinary approach to the reconstruction of the paleodiet and dental behavior on the El Sidrón Neandertals, and complement the previous studies based on the analysis of dental calculus [4] and dental microwear [5], and enlarge the dietary signals variability within Neandertals with a mixed diet.

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Poster Presentation Number 102, Fr (12:15-14:15)

Diet consistency, dental malocclusions and the shape of the human face. Preliminary results.

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The origin of dental malocclusions and maxillomandibular discrepancies in modern humans has been linked to dietary changes during later human evolution. Specifically, it has been argued that a reduction of bite and muscle forces has resulted in a lower mechanical stimulus on the bone leading to smaller jaws. The present study presents the preliminary results and conclusions of a larger project that aims to investigate the relationship between masticatory function and normal and altered facial morphology. Using geometric morphometric tools on CT-based 3D reconstructions, we compared the shape of the upper face (including orbits, nasal region, maxilla and zygomatic arches) in 36 adult individuals: 10 hunter-gatherers (HG; hard/tough diet), 10 agriculturalists (AG; medium food consistency), 10 urban individuals (UR; soft diet) and 6 individuals with maxillomandibular discrepancies (AL; altered occlusion due to prognathic or retrognathic jaws). All individuals came from current Chilean and Argentinean territories, and each group contained individuals from more than one location within these territories, in order to control for a potential geographical effect. It was hypothesised that the HG and AL groups would have been subjected to higher functional constraints, and thus their shape would be more distinctive compared to that of the AG and UR groups. A principal components analysis revealed overlaps between the HG and AG groups, and between UR and AL. A canonical variate analysis showed that the shape of all groups was significantly different from each other, but UR and AL tended to cluster together. Compared to UR and AL, HG and AG had a more prognathic (i.e. more anteriorly placed) maxilla and a vertically shorter and wider face, with taller orbits and more robust zygomatic arches. HGs had a relatively narrower maxilla than AG. Within the face, the shape of the maxilla alone, which is directly involved in sustaining bite forces, tended to separate AL from the other three groups. AL individuals had a narrower and antero-posteriorly elongated maxilla, with AGs showing the opposite features. The face size of the HGs was significantly larger than that the other groups, but the isolated maxilla of ALs was significantly smaller than that of the other groups. Yet, there was no allometry involved in shape changes. In line with previous studies [1, 2], these results suggest that the uppermost part of the face is largely influenced by factors other than diet (e.g. climate, population history, etc). The shape of the mastication-relevant portion of the face, however, may not be reflecting diet in a specific way. Its shape might be varying normally within a wide range, influenced by the shape of the uppermost part of the face and the effect of normal masticatory loads. But, when subject to altered masticatory forces, it might adopt a different shape, independent from the stuctures above it. This suggests that the maxilla is an anatomical, plastic boundary that acts as a mechanical buffer between the mandible and the uppermost part of the face, as it has been suggested previously [3].

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Poster Presentation Number 80, Fr (12:15-14:15)

Macrowear and biomechanical analyses of great ape molars

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Dietary diversity in primates is reflected in their dental morphology, with differences in size and shape of teeth . This is particularly noticeable if we look at great ape lower molars. For example, while orangutan molars are characterized by a low and blunted cusps morphology with a highly crenulated surface and thick enamel layer, gorilla thin enamel molars show a high relief with sharp cusps joined by long shearing crests. This dental morphological difference seems to be an adaptation for the intake of completely different foods: hard and brittle in orangutans, and pliant and tough in gorillas . In this study, we want to investigate if molar morphology of *Pongo pygmaeus*, *Gorilla gorilla* and *Pan troglodytes* is biomechanically adapted to resist certain types of foods. We employ a completely new digital approach that combines dental macrowear studies with Finite Element Analysis using high-resolution models generated from micro-computed tomography. Our preliminary results on lower second molar (M2) show significantly different wear patterns between these three species. *Pongo pygmaues* displays a flat occlusal surface characterized by similar proportions of chewing phase areas (Buccal Phase I, Lingual Phase I and Phase II). In contrast, macrowear of *Gorilla gorilla* is dominated by steep facets and highly developed Lingual Phase I and Phase II areas, with small Buccal Phase I facets. *Pan troglodytes* occlusal wear is intermediate between the ones of gorilla and orangutan. Tensile stress in *Pongo pygmaues* is low, probably because the occlusal surface is horizontally loaded with a chewing surface almost compressed. In contrast, because of the high cusps of gorilla molars, the pressure on cusps causes high tensile stress along the tooth grooves. *Pan troglodytes* is characterized by the largest loaded area and therefore, the pressure (and compression stress) on its enamels is the smallest. Molar macrowear results are strongly linked to dietary diversity found in great apes, with a homogeneous flat occlusal surface typical of a diet consisting of hard foods, and a steep pattern dominated by Lingual and Phase II areas typical of a diet rich on tough vegetable foods. Our biomechanical analysis suggests that while molars of gorillas are better suited for shearing, the tooth morphology of orangutans is more adapted for crushing. This new approach can be further used to advance our understanding of the diet, morphology and evolution of extinct hominins.

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Poster Presentation Number 59, Th (12:15-14:15)

Re-examination of marine shells assemblage from Proto-Aurignacian of Grotta di Fumane, Italy. An atelier of jewellery.

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The making and the use of personal ornaments is one of the main debates about the systematic human behaviour that occurred during the Upper Palaeolithic [1] and, in particular, shells beads complexes found in Aurignacian deposits play a key role. The Proto-Aurignacian levels of Fumane Cave (Northern Italy) [2] are a valid example in which it is possible to observe evidence of the main cultural symbolic features of European Anatomically Modern Humans [3]. The aim of this contribution is to improve data on the Aurignacian ethno-cultural diversity, as observed in the previous work [4], on the base of a large reexamination of the assemblages doing the taxonomical, palaaeoecological and taphonomical analyses. In fact, the Cave have yielded an extremely rich and varied collection of personal ornaments, composed of four grooved red deer incisors and over 900 shell beads that belong to 73 different taxa in total, 62 of which are representative of the class of Gastropoda, 10 of the class of Bivalvia and 1 of Scaphopoda. Direct AMS dating of perforated shells belonging to *Homalopoma sanguineum*, *Nassarius circumcinctus*, and *Glycymeris insubrica* are consistent with other ^{14}C ages, obtained from the sedimentary units, and demonstrate that the shells were gathered on MIS3 beaches [5]. The collection is composed of unperforated and mostly perforated shells. A range of use-wear traces and ochre residues observed on well preserved perforation edges whit Leica S6D electronic binocular microscope and Scanning Electron Microscopy (SEM), indicate that the shells were used as personal ornaments. The habitants of the cave chose smaller and most colourful species and *Homalopoma sanguineum* is indeed the most represented. Moreover, the analysis of spatial distribution of shells remains into the cave related to the taphonomical analyses, proves that the eastern zone of the cave entrance was probably used like a cache and like an atelier area, in which the habitants made their shells beads jewellery.

Research at Fumane is coordinated by the Ferrara University in the framework of a project supported by the Ministry of Culture e Veneto Archaeological Superintendency, public institutions (Lessinia Mountain Community and Regional Natural Park, Fumane Municipality, Veneto Region e Department for Cultural Heritage). The Microscopic observations using Leica S6D Green Ough stereo-microscope have been done at the L.A.T., laboratory of Zooarchaeology and Taphonomy of the University of Ferrara

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Podium Presentation: Session 7, Fr (15:00)

A chronological framework for Shanidar Cave (Iraq) based on luminescence dating

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Shanidar Cave located in the Zagros Mountains in Kurdish Iraq has been described as an iconic site in world prehistory and it became famous during the 1950s with the discovery of the remains of around 10 Neanderthals [1], one of whom was thought to have been buried in a flower ritual [2]. Ralph S. Solecki's excavations ended in 1961 and no research was undertaken at the site until a multidisciplinary team restarted archaeological investigations in 2015. The aim of the research is to more firmly establish the age of the Neanderthal remains and understand the temporal relationship between successive occupations of the cave and local climatic and palaeoenvironmental changes [3,4]. We have applied new luminescence dating techniques to attempt to reframe the debate about Neanderthal occupations and demise in this key region, on the possible route of early migration of modern humans from Africa into Eurasia. This paper presents new luminescence dating results obtained on 16 sediment samples collected along a 10m high section and from a block of sediment containing the *in situ* Neanderthal remains of Shanidar 5 (unburied in the 1960s). We compared different optically stimulated luminescence (OSL) signals obtained from sand-sized grains. The quartz did not exhibit any detectable OSL signal at both the single- or multi-grain scales, so K-feldspars grains were also investigated using different protocols: the post-infrared IRSL (pIRIR) and the newly developed, infrared radiofluorescence (IR-RF), used for the first time in the field. In this paper the luminescence results will be compared with previously published radiocarbon dates using the OxCal 4.3 platform [5]. The combination of these different dating techniques allows us for the first time to propose a chronometric framework for this key Middle and Upper Palaeolithic sequence, and its Neanderthal human remains. The implications of these new dates will be discussed in relation to other late Middle Palaeolithic occupations in Southwest Asia.

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Poster Presentation Number 61, Th (12:15-14:15)

High Resolution Spatiotemporal Analysis Of Archaeological Faunal Assemblages. The Case Of Le Sire (Mirefleurs, Puy-De-Dôme), An Early Gravettian Open-Air Site

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The archaeological assemblages of prehistoric sites very rarely are the result of a single event of human occupation. On the contrary, most of them are actually palimpsests containing remains related with several events, both anthropogenical and natural [1]. The scarcity of methods that allow to study the assemblages from a temporal perspective, and the investment in time that they suppose, hinders the interpretation of past human behaviour, requiring archaeologists to infer it from palimpsests, far from the most suitable time-scales (those as close as possible to "ethnographic time").

To address this issue, some researchers have recently devoted considerable effort to develop methods for palimpsests dissection, such as archaeostratigraphy, micromorphology and refits [2]. Palimpsests dissection studies, that pursues the objective of dividing palimpsests into temporally more limited units, has been especially focussed on lithic and geoarchaeological analyses. Comparatively, fewer studies have been done from the faunal record [3].

Currently, we are starting a new project with the aim of developing specific tools for palimpsests dissection from a zooarchaeological and taphonomic point of view. This perspective can contribute significantly to the understanding of both, the formation processes of the sites and the way of life of the human groups. To achieve these goals, we apply methods such as archaeostratigraphy, surface distribution of faunal remains (according to different zooarchaeological and taphonomic criteria) and faunal refits, using GIS softwares and geospatial statistics.

Our project includes the spatiotemporal analysis of the macrofaunal assemblages of the early Gravettian open-air site of le Sire (Mirefleurs, Puy-de-Dôme) [4]. This assemblage contains 2540 coordinated faunal remains, dominated by the horse. The archaeostratigraphic analysis have not allowed to identify archaeoloevels stricto sensu (archaeological layers separated by continuous sterile layers), but it has made it possible to isolate different units partially overlapped and explore its relationships. The three units containing more remains has been analyzed in detail. In order to determine and study its clustered pattern of distribution, we have applied the Ripley K and Besag L functions and the k means analysis. Next, the taphonomic and zooarchaeological features of the different units and clusters have been compared. The spatial inter-dependence of different analytical categories has also been explored. In addition, we have analysed the orientations of the elongated bones so as to detect possible preferential orientations. Simultaneously, 44 refitting groups have been identified, most of them by short distance although some few reach longer distances, up to almost 12 m.

Roughly, our results (for instance, the stratigraphic discontinuities and some refits) indicate that the site formation of the site was complex, including relevant post-depositional movements. However, some areas are better preserved and show associations of remains that seems to be of anthropogenic origin, but they should be interpreted with great caution. The features of the macrofaunal assemblage (such as the presence of complete long bones, suggesting non intensive consumption, and some distal extremities in anatomical connection o semiconnection, some of them refitted) suggest that the site was not used as a habitat, but as a place related to hunting activities, perhaps to the first processing of carcasses.

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Poster Presentation Number 24, Fr (12:15-14:15)

Damage morphology, function, and life history of percussive bone tools at the Lower Paleolithic site of Schöningen, Germany: an experimental approach

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Informal bone tools are recognized throughout the Paleolithic, often utilizing a wide variety of skeletal elements [1,2,3]. Although the use of bone material by early humans may reveal key aspects of their technological and logistical planning, little is known about the function of expedient bone tools and what drives their morphological variability. At the Lower Paleolithic site of Schöningen (Germany) a set of faunal remains from the "Spear Horizon" (layer 13 II-4) illustrates extensive percussive damage. Of this assemblage 88 bones were identified either as lithic percussors or retouchers, primarily on equid remains in addition to the present but less exploited bovid and cervid remains. A selection of specific skeletal elements is clear, in addition to the prominent exploitation of the featureless shaft fragments [3]. Of the full assemblage of lithic percussors, seven horse metacarpals have been identified, with five recovered complete. Within this equid metapodial sample, some of the tools may have been used while the bones were "dry" or weathered; distinguished from the majority of other bone tools in the assemblage which were utilized while still fresh [3]. The main goals of the present study are to test whether the damage observed on these percussive tools is consistent with a single or with a combination of basic flintknapping behaviors (hammering, retouching, abrading). Furthermore, the experiment addresses how the mechanical properties of bone and length of utilization affect the damage morphology and the overall shape of the tool. Fresh, degreased, and weathered horse metacarpals are used as hammers, retouchers, and abraders on flint by both skilled and unskilled knappers in constrained replicative experiments over segmented periods of time. Damage morphologies are analyzed with both CT and microCT scans, and processed with Avizo and ImageJ software. Results are described through the use of standardized, three dimensional ratios following methodology established in Braun et al. [4]. Parameters of these ratios are distinguished by means of a cluster analysis to test for statistically significant groupings. The results obtained are then compared to those damage morphologies documented in the archaeological record from the Schöningen "Spear Horizon" described by van Kolfschoten and colleagues . Although the results highlight associations between knapping actions and damage features, they also suggest that the duration of use, as well as differences in bone mechanical properties significantly influence the damage observed. Because they have been used for several type of actions, the bone tools from Schöningen fit better in the the typological category of percussor (*percuteur* sensu Tixier,) than retoucher (*retouchoir*). Furthermore, the results obtained suggest that the main differences between categories might also reflect variation in use intensity of the percussive tools rather than clear-cut technological differences between objects.

The authors would like to acknowledge the time and effort of both the Center for Experimental Archaeology at UC Davis (CEAD) research group and the undergraduate interns who participated in our experiments. Many thanks are also owed to the technology and support from the staff and facilities of Dr. John Boone at the UC Davis Biomedical Engineering lab, as well Dr. Douglas Rowland at the UC Davis Center for Molecular and Genomic Imaging.

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Poster Presentation Number 64, Fr (12:15-14:15)

Magdalenian bone tools from Gough's Cave (Somerset, UK)

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The site of Gough's Cave in Cheddar Gorge, south Mendip Hills in Somerset (UK), has been extensively studied since excavations began early in the 20th century. In particular, lithic artefacts, fauna, and *Homo sapiens* remains (e.g. [1,2]) have been comprehensively analysed. New ultrafiltrated radiocarbon determinations [3] demonstrate that the cave was occupied by Magdalenian hunters for possibly no more than two or three human generations, coinciding with rapid warming at the onset of Lateglacial Interstadial 1 (GI-1e, Bølling chronozone of the European record) at about 14,700 cal BP. Here, we describe an assemblage of bone tools (N=13) from Gough's Cave that had not been previously recognised, or had been misidentified in earlier analyses. The artefacts include:

- 9 bone fragments of horse (*Equus ferus*): four fragmentary metapodials and one complete metapodial, one proximal phalanx, one incisor, one molar, and a fragment of humerus;
- 1 fragmentary metapodial of red deer (*Cervus elaphus*);
- 2 fragments of ribs from a large mammal (species indeterminate); and
- 1 unidentified bone fragment (species indeterminate).

The bones were initially examined using a hand lens and binocular microscope. The modifications were further examined using a scanning electron microscope (SEM) and the topography of surface modifications was recorded using a Focus Variation Microscope (FVM), the Alicona InfiniteFocus optical surface measurement system. This system was used to produce three-dimensional (3D) micro-morphological models of the modified surfaces according to the methodology described by Bello et al. [4]. Energy-dispersive X-ray (EDX) microanalysis was carried out using an Oxford Instruments X-Max 80 Silicon Drift Detector and INCA software to identified micro-flint chips embedded in the enamel of one tooth.

Comparisons with previous publications demonstrated that some of the modifications were incorrectly interpreted as carnivore chew marks (e.g. [5]). The new micro- and macro-modifications observed on 11 bone fragments and two teeth are indicative of their preparation and use as retouchers: tools used during knapping and the manufacture of stone tools. In spite of the relatively small sample size, which may be accounted for by the recognised collection bias in early excavations of the site, this assemblage represents, to our knowledge, the first study of bone retouchers from the British Magdalenian, which provides new insight into this period.

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Poster Presentation Number 120, Fr (12:15-14:15)

Morphometric and diet changes in the Nile Valley during the Middle and Late Holocene

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Ecological factors play an important role to shape the patterns of morphological diversification among modern human populations. Agriculture was a major event in human evolution, driving important biological and cultural adaptations. Variation in dietary practices is hypothesized to affect the masticatory structures and especially the mandible. However, the impact of a reduction in functional demands and diet composition is still under discussion. Here we investigated cranial and mandibular shape patterns, as well as stable isotope pattern variation among populations from Egypt and Sudan during the Middle to Late Holocene reflecting a transition from early to intensive farming. Our study aimed to characterize and differentiate dietary patterns among all farmer groups, as well as to assess morphological changes associated with subsistence strategies and to evaluate how the skull and mandible behave differently on response to diet changes.

We analyzed 103 adult specimens from 5 archaeological sites along the Nile River belonging to 7 chrono-cultural groups: Badari (4,400-4,000 BC), Naqada (4,000-3,200 BC) from Egypt; and A-group (3,300-2,800 BC), C-group (2,300-1,800 BC), Kerma (2,000-1,550 BC), Pharaonic (1,800-1,200 BC) and Meroitic (100 BC-350 AD) from Sudanese Ancient Nubia. All individuals were surface-scanned and cranial morphology was then captured by means of geometric morphometrics methods. Diet composition was inferred from carbon (δ13C) and nitrogen (δ15N) stable values. Collagen suitable for isotopic analysis was extracted from bones on similar specimens used for morphometric analyses for A-group, C-group and Pharaonic Nubians; published data were used for the remaining samples. Patterns of shape variation and morphological affinities among groups were explored with PCA and Neighbor-Joining trees based on Procrustes distances. MANOVA were applied to test the significant influence of cultural horizon, diet and geography on cranial and mandibular shape. Finally, non-parametric Mann-Whitney pairwise comparisons were used to test significant carbon and nitrogen isotopic differences.

Both isotopic and morphometric patterns highlight differences between early and intensive farmers. Isotopic results suggest that the chrono-cultural groups had different dietary patterns, according to archaeological evidence. In turn, intensive farmers had narrower faces, higher and wider mandibles. However, only significant differences were found in mandibular shape associated with a change on subsistence practice despite the geographical and chronological proximity of the human population analysed here. The smaller differences in cranial shape patterns might support the hypothesis of a relative biological continuity or many admixtures episodes between these Nubian and Egyptian populations with no evidence of a strong adaptation to selective pressures (i.e, evolution from a mixed economy to a fully agricultural lifeway). However, the higher significant results for the mandible could support the masticatory-functional hypothesis, in which the mandible continues to evolve reflecting selective adaptation, especially related to mastication behavior and diet composition than population history. This study therefore underlines the impact of dietary practices on cranial shape and confirms that the mandible, in contrast to the skull, significantly reflects subsistence strategy rather than population history.

Poster Presentation Number 123, Th (12:15-14:15)

Comparative phylogeography of modern humans and other organisms

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Phylogeography refers to the phylogenetic analysis of organisms in the context of their geographical distribution. The analytical methods build phylogenetic trees or networks from haplotypes in order to investigate the history of the organisms. The geographical spread of modern humans into Europe over the last 50,000 years is still debated and studies of changes in the biogeography of other organisms have the potential to provide a good model for human dispersal outside of Africa. Phylogeographic studies have revealed the importance of climatic oscillations and the role of the Last Glacial Maximum (27,500 to 16,000 years ago) with the formation of refugia where distinct haplotypes originate. The population contractions into these refugial areas can also drive the evolution of different lineages. The distribution of human phylogeographic patterns in Europe may have similarities with the pattern seen in other species that came out of the ice age climate refugia.

Phylogeographic studies of temperate animals and plants have revealed distinct genetic populations, but with greater continuity between populations in different southern regions and northern areas . The concept of a refugium was originally applied to these southern areas in Europe and to temperate-adapted taxa during glacial periods but cryptic northern refugia, glacial refugia for temperate taxa situated at higher latitudes than the expected areas, have also been considered . This perspective can also be applied to modern humans when attempting to understand how climate change affected their range during the Upper Palaeolithic in Europe . Cold periods such as the Last Glaciation are likely to have had important effects on the population genetics of organisms. For example, during glacial periods species such as the western hedgehog (*Erinaceus europaeus*) and brown bear (*Ursus arctos*) retreated to southern areas in Europe representing refugia including the Iberian Peninsula, Italy and the Balkans . Modern humans may show similar patterns during the Last Glacial Maximum (LGM) and the genetic differentiation between populations from different refugia may have taken place.

This project is focused on the genetic biogeographies of humans and other species using existing data from GenBank. We have performed phylogeographic studies on a significant number of different wild organisms as well as on domestic (pigs, cattle) and commensal (house mouse, black rat) animals. We are analysing data such as the mitochondrial DNA control region to look at the various patterns seen in each species which can then be grouped by similarity according to geographical and genetic diversity indices. These include the likely divergence dates of the diversity as well as the topology of the species' phylogenetic tree and network diagrams. We will then compare the patterns seen in wild, domestic and commensal mammals with those of modern humans.

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Podium Presentation: Session 4, Th (16:40)

3D growth changes in ribs during late ontogeny in hominids and its importance for the thorax of KNM-WT 15000: a preliminary approach

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KNM-WT 15000 (Nariokotome boy) is a juvenile specimen (M2 erupted) of an African *Homo erectus* from Kenya [1] dated around 1.47 Myr. It preserves one of the most complete ribcages in the hominin fossil record, being crucial for understanding hominin thorax and body shape evolution. Originally described as the earliest evidence for a tall, narrow modern human body shape, KNM-WT 15000 was hypothesized to possess a barrel-shaped rib cage, characterized by a volumetric expansion of the upper thorax and declination (torsion) of the ribs [2]. Because previous research on thorax ontogeny demonstrated substantial changes in rib size and shape from juveniles to adults [3], we should expect a closer association of the KNM-WT 15000 ribs to juveniles than to adults, which is important for reconstructing its thorax. Here we report ongoing analyses on a preliminary data set to assess this hypothesis using 3D geometric morphometrics in a framework of late ontogeny and comparative anatomy and explore possible late ontogenetic effects on final thorax morphology. We used 52 (semi)landmarks to quantify rib shape accounting for curvatures, shaft height and thickness of ribs 1-12 of KNM-WT 15000 (n=19; CT-based 3D reconstructions). We used 95% confidence intervals of centroid size and principal components analyses to compare these fossils with ribs 1-12 and 1-13 of adults and juveniles (M2 erupted) of modern humans (Europe and Sub-Saharan Africa) and *Pan troglodytes*, respectively (N=296). In both extant species (*H. sapiens*, *P. troglodytes*) the juvenile ribs were smaller than the ribs of the adults. Also, in both extant species the difference between adult and juvenile sizes was smaller in the pulmonary ribcage (ribs 1-6) than in the diaphragmatic ribcage (ribs 7-12/13), suggesting that ribs of the pulmonary thorax attain adult morphology earlier than diaphragmatic ribs. Shape analysis confirms that *H. sapiens* differs from *P. troglodytes* by greater rib torsion and curvature. Surprisingly, pulmonary thorax ribs of Nariokotome ribs fall within the size range of adult *Homo sapiens*, whereas diaphragmatic ribs of KNM-WT 15000 are below the adult *Homo sapiens* means, and closer to modern human juveniles. This supports our hypothesis only regarding the diaphragmatic thorax.

Large-sized pulmonary ribs of KNM-WT 15000 could indicate that these had attained already adult size and shape, while the diaphragmatic ribs still needed to complete their growth. This interpretation could find some support in our comparative data, in which adult size of pulmonary ribs is attained earlier during growth than in diaphragmatic ribs. However, it would imply accelerated upper thorax growth in KNM-WT 15000 which differs from the patterns observed in both *H. sapiens* and *P. troglodytes*. Alternatively, it can be hypothesized that growth was incomplete in ribs at both pulmonary and diaphragmatic levels. In this case remaining growth might have led to greater overall rib and thorax size in Nariokotome. In both ontogenetic scenarios, the ribs of the diaphragmatic thorax would have still increased in size during late ontogenetic growth. This, along with associated allometric shape changes likely would also have modified curvatures and torsion of the KNM-WT 15000 ribs affecting middle and lower thorax shape . Greater lower thorax size would be consistent with recent reconstructions of the pelvis in this important specimen because of thoraco-pelvic integration [5]. Beyond these ontogenetic effects reconstructing thorax shape also needs to consider ontogeny and 3D shape of thoracic vertebrae [4].

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Poster Presentation Number 57, Th (12:15-14:15)

The Laminar Levallois of units A10 - A11 of Grotta di Fumane (VR)

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Grotta di Fumane (VR), with its dense cultural sequence spanning from 80 ky BP to 30 ky BP plays, a pivotal role in studies concerning the late Middle and the early Upper Palaeolithic. Here, a Late Mousterian Levallois unipolar recurrent assemblage is presented. It belongs to the units A10-A11, which underlie unit A9, dated to a minimum of 47,6 ky cal BP, and constitute the base of the Late Mousterian sequence. Paleoclimatic data inferred from micro and macromammals suggest a temperate interstadial period before the H5 event (≈ 48 ky cal BP) [1]. Late Mousterian is here intended as the Mousterian technocomplexes that are recorded during MIS 3, meaning a temporal span of 20 k years between 60-40 ky cal BP; particularly, Italian Late Mousterian is portrayed as dominated by the occurrence of recurrent unipolar Levallois assemblages with elongated blanks. The studied assemblage from units A10-A11 consists of 461 items selected due to recognition of basic Levallois technological requirements, in particular as defined for recurrent unipolar mode, and the presence of unipolar negatives on the dorsal face. Measurements have been performed only on complete items, dividing retouched and unmodified blanks. The entire operative sequence is represented. Raw material procurement is local, in fact the flint varieties of Maiolica grigia and Scaglia Rossa, available in a <5 kms radius from the site, account for the three quarters of the assemblage, with a clear predominance of Maiolica grigia. Reduction took advantage of natural convexities; it involved brief decortication and convexities shaping phases, both performed through the removal of unipolar and unipolar core-edge blanks, before the main production of predetermined and predetermining unipolar blanks. The entire assemblage shows a laminar morphometry, gathering main production around 36-51 mms in length and 1,7-2,5 in elongation. Formal tools represent 20% of the assemblage, chiefly blanks belonging to the first part of the production (i.e. the most elongated), and the retouch is mostly direct, on a single lateral edge, short, semi-abrupt and scaled or stepped in morphology: producing, then, single scrapers. Concerning retouched items, selection towards longer and more elongated blanks is showed. Fumane A10-A11 main production and retouched tools morphometric data have been compared with those published for the same technological classes of later Fumane units A5-A6 [2] as well as other Italian Late Mousterian Levallois unipolar assemblages such as Riparo l'Oscurusciuto (TA) unit 1 [3], Grotta Reali (IS) US5 [4] and Riparo del Poggio (SA) units 9-10 [5]. A stark difference is plotted between Fumane units A10-A11 and the other assemblages: the length is less constrained and the elongation is well under the 2 threshold, stopping towards 1,5, thus showing a more heterogeneous and non-laminar production. Despite being treated altogether in Italian Late Mousterian dissertations, these sites are younger in age (46-43 ky cal BP) than Fumane units A10-A11. Therefore, the study shows the application of morpho-technological constraints in one Late Mousterian recurrent unipolar Levallois assemblage in order to produce blades and blade-like blanks; the focus on blade-making is showed also by the selection towards the most elongated blanks for retouched tools. Moreover, a similar laminar production is not noticed in other Italian younger recurrent unipolar Levallois assemblages, showing that they might represent a different technological tradition. A new dating program and new comprehensive analyses of all Italian Late Mousterian recurrent unipolar Levallois assemblages are advocated to better understand the existing cultural variability.

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Poster Presentation Number 19, Th (12:15-14:15)

Beyond maps: Patterns of formation processes at the Middle Pleistocene open-air site of Marathousa 1, Megalopolis Basin, Greece

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The Middle Pleistocene open-air site of Marathousa 1, Megalopolis Basin, Greece has been systematically excavated since 2013 by a joint team from the Ephoreia of Palaeanthropology-Speleology (Greek Ministry of Culture) and the University of Tübingen. The site is located at the edge of an active lignite quarry, in lacustrine clay, silt and sand beds between two of the lignite seams of the Pleistocene Choremi formation, Marathousa member. A partial skeleton of a single individual of *Elephas (Palaeoloxodon) antiquus* and other faunal remains have been unearthed, in one of the two investigated areas (Area A), in spatial and stratigraphic association with lithic artefacts. In Area B, about 60m to the South along the exposed section, a much higher number of lithic artefacts was collected, spatially and stratigraphically associated with a faunal assemblage composed by isolated elephant bones, cervids and carnivores among others. The two areas are stratigraphically correlated, the main fossiliferous layers representing a relative high energy depositional process in a lake margin context. Evidences of butchering (cut-marks) have been identified on the elephant skeleton and other mammal bones from Area B. Due to the secondary deposition of the main find-bearing units, it is of primary importance to evaluate the degree and reliability of the spatial association of the lithic artefacts with the faunal remains. Indeed, spatial association does not necessarily imply causation, especially in secondary deposition contexts. Assessing the degree of disturbance is crucial to fully comprehend the archaeological record, and therefore to reliably interpret past human behaviours. Several methods are currently applied in order to qualify and quantify the type and degree of reworking of archaeological assemblages. Within the framework of a geoarchaeological and taphonomic approach, spatial statistics offer meaningful contributions in unravelling site formation and modification processes from spatial patterns. Distribution maps are cornerstones of the archaeological documentation and primary analytic tools. However, their visual interpretation is prone to subjectivity and is not reproducible. Moving beyond maps, statistical inference allows for interpretation of spatial patterns by adopting a more inductive and reproducible strategy. Moreover, within a frame of references, it enables us to depict the underlying processes responsible for the observed patterns, and to quantify the extent of the post-depositional reworking processes which have long been recognised to affect the integrity of archaeological assemblages. The present study uses a comprehensive set of multiscale and multivariate spatial statistics, in order to disentangle the depositional processes behind the distribution of the archaeological and paleontological record at the Marathousa 1 site. Preliminary results of our fabric, vertical distribution and point pattern analyses suggest minor reworking and substantial spatial association of the lithic and faunal assemblages. These results further support the current interpretation of Marathousa 1 as butchering site in a lake margin context.

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Poster Presentation Number 34, Fr (12:15-14:15)

Late Middle Paleolithic technological organization in the Armenian volcanic highlands: a case study from the site of Barozh 12

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Behavioral data from Middle Paleolithic (MP) open-air sites are scarce in the southern Caucasus, but are crucial for the study of settlement dynamics. Integrated analysis of artifact transport, reduction, and discard patterns at the open-air site of Barozh 12 allows us to address the questions: (1) how did MP hominins organize technology and mobility in the obsidian-rich Armenian volcanic highlands? (2) Is there evidence for diachronic variability in land use strategies and range of mobility? Barozh 12 is situated 1 - 2 km from the Mt. Arteni volcanic complex, an important obsidian source throughout prehistory. Excavation exposed stratified hominin occupations in alluvial deposits. Obsidian comprises 99% of artifacts recovered at high densities (1153-3087/m^3) from four strata, and all stages of core reduction are represented [1]. OSL age estimates indicate site occupations spanned 61 ± 6 - 32 ± 3 kya. Unidirectional-convergent Levallois core reduction strategies dominate throughout the sequence, consistent with other documented late MP sites in Armenia. We analyzed 1055 artifacts, sampling all recovered assemblages, and sourced the raw material of a sample of cores (n = 43), flakes (n = 148), and tools (n = 107) using pXRF [2]. In conjunction, we evaluated core reduction intensity using the scar density index (SDI) [3]; and tool retouch intensity using the geometric index of unifacial reduction (GIUR) [4]. Of analyzed cores, only one core on flake (2.3%) was made on non-local source material; all others were produced on local Mt. Arenti obsidians. In all strata, cores were prepared on varying frequencies of flake, primary (outcrop-derived), and split river cobble blanks. SDI estimates indicate that cobbles were always significantly less reduced than other core blanks at discard. Overall core reduction intensity differs among stratigraphic units. We found a significant positive correlation between mean SDI of cobble and primary core blanks and increased frequency of cores on flakes. Of sourced debitage, 2.7% are from non-local source material. These include blank resharpening and basal thinning flakes, and one pseudo Levallois point. All other analyzed core trimming elements, plain flakes, and Levallois blanks were made from local obsidians. Of sourced retouched tools, 22.4% were manufactured from obsidian transported linear distances of $\sim$ 40-190 km from sources in the Armenian volcanic highlands and less frequently from eastern Anatolia. The remainder were made on local Mt. Arteni obsidians. We found no significant difference in local and transported tool retouch intensity, nor in tool retouch intensity across strata. We also found no significant positive relationship between mean retouch intensity and tool transport distance. However, a significant positive relationship obtains when we only considered tools transported distances > 40 km. This study indicates variable tool-stone provisioning of individuals and place, reflecting mobility at the landscape and local scales. Over time, we detect changing emphasis on the short distance transport of outcrop-derived cores and expedient exploitation of river cobbles, on-site blank production supplemented by core on flake reduction, and the intermittent long distance transport of tools. At Barozh 12, our analysis indicates diachronic variability in technological organization and mobility, but stability in core reduction technology. Time-averaged artifact transports overlap with those observed at other late MP sites and obsidian sources in the Armenian volcanic highlands and eastern Anatolia, implying a long-term, socially embedded range of mobility. During MIS 4-3, a dynamic period of hominin dispersals in southwest Asia, hominin populations equipped with MP technology persisted in the study region despite the effects of global climate oscillations.

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Podium Presentation: Session 5, Fr (9:40)

A dental perspective on the divergence time between Neanderthals and modern humans

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The timing of the divergence between Neanderthals and modern humans is a matter of intense debate due to the conflicting data yielded by paleontological and molecular studies. Molecular data have generally indicated that both species diverged during the late or middle periods of the Middle Pleistocene [1]. On the contrary, paleontological studies have highlighted the anatomical similarities between Neanderthals and European Middle Pleistocene populations [2], which point to an early Middle or late Lower Pleistocene divergence for both groups. Recent molecular studies have demonstrated that Middle Pleistocene fossils from Sima de los Huesos (Burgos, Spain), which are dated to 0.43 Ma [3], are indeed closely related to Neanderthals [4], thus making the divergence between Neanderthals and moderns humans necessarily older than that age. It is unclear, however, how long before the geological age of Sima de los Huesos fossils that divergence occurred.

Previous studies have shown that dental shape has evolved at very similar rates across all the branches of the hominin phylogeny and have provided a comparative context for the analysis of dental evolution in the Neanderthal and modern human lineages [5]. Because the Sima de los Huesos sample is characterized by an extremely derived dentition, a mid-Middle Pleistocene divergence between Neanderthals and modern humans would have entailed an unrealistically fast evolutionary rate at the branch leading to Sima de los Huesos hominins from the last common ancestor (LCA) of Neanderthals and modern humans. Using quantitative approaches to describe anatomical variation and to measure evolutionary change across lineages, I have estimated that a minimal diverge time of 0.7 Ma is required to maintain this evolutionary rate within the same range of variation observed in other hominin species. This result strongly supports a pre-0.7 Ma last common ancestor for Neanderthals and modern humans, and excludes as plausible ancestors all hominins postdating this age. These results highlight the importance of combining molecular and paleontological data to advance in our understanding of the relationships between Neanderthals and modern humans, and their related fossil populations.

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Poster Presentation Number 7, Th (12:15-14:15)

Reconstructing Stone Age Settlement Patterns in the Elephant river valley, Mozambique

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This poster focus on the conversion of archaeological survey data to a GIS format for the identification of settlement patterns by communities that inhabited the Elephant river region, a tributary of the Limpopo River (southern Mozambique), estimated dating between *c.*300 and *c.*20 thousand years ago. Specifically, we tried to identify and characterize the settlement dynamics of each cultural phase (ESA, MSA and LSA), in order to understand the impact of a suite of physical variables on the distribution of human populations and the choices related to the selection of site location in connection to natural/landscape-related factors. The Elephant river is located in the Gaza province, stretching *c.* 50km from west to east, in southwestern Mozambique, on the border with South Africa and the Kruger National Park. Geologically, the area is marked by the Movene and Umbelúzi (Karoo) formations, respectively with basalts and rhyolites, in the extreme west of the valley, and Tertiary Mapai and Mazamba limestone and conglomeratic sandstones formations to the east. These can be found around the edges of the modern artificial lake, capped by eolian sands on the flat landscape, limited near the water lines by alluvial deposits [1]. Using data collected during archaeological field survey conducted in the Elephant river valley in 2015 and 2016 (98 archaeological sites identified) and GIS techniques, we explore a series of simple but important issues in relation to visibility and patterning of archaeological data [2]. The archaeological survey strategy was: 1) conducted by foot, in a non-systematic way, targeting areas that from a geomorphological and geological perspective greater probability of finding Stone Age sites; 2) survey areas were mapped using a Trimble GeoTX handheld GPS and archaeological sites were recorded using an Android smartphone application [3, 4]; 3) collection on surface materials was limited to both examples of the range of raw materials present in each site and diagnostic artifacts. All GIS analysis were done using ESRI's ArcGIS 10.5 software leveraging a variety of standard geoprocessing tools and custom geoprocessing models. The topographic variables were extracted and/or obtained from the elevation dataset using the Shuttle Radar Topographic Mission (SRTM) with a resolution of 1 arc-second (*i.e.*, 30m square-grid) available at https://earthexplorer.usgs.gov. Of the variables derived from physical environment, six were used in this study: slope, aspect, hillshade, plan curvature, profile curvature and convergence index. In addition, three different scales of topographic index were calculated: slope positon classification, landform classification and Beer's aspect (*i.e.* heat load index). In total, 10 variables including pre-processed elevation derived from elevation dataset were used to understand the Stone Age settlement patterns of the Elephant river valley. The preliminary results of the spatial analysis and statistical tests indicate: 1) The chi-square test results indicate no differences between ESA and MSA site location regarding Topographic Position Index (*p-value*= 0.451) and Geology (*p-value*= 0.961); 2) T-test results indicate also no statistical difference in Elevation (*p-value*= 0.344) and a moderate difference in Slope (*p-value*= 0.093); 3) The LSA site location could not be statistically analyzed due to a reduced sample size. Spatial analysis of the archaeological sites identified in the Elephant river region demonstrates that the sites were randomly distributed across landscape, a predictive fact that can be very relevant to future work in the region.

Field work was conducted by permission of the Governmental Authority for Cultural Heritage of Mozambique, Direcção Nacional do Património Cultural. Major funding was provided by the Fundação para a Ciência e Tecnologia (PTDC/EPH-ARQ/4998/2012 and PTDC/EPHARQ/4168/2014), with additional funding from the Wenner Gren Foundation.

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Poster Presentation Number 138, Fr (12:15-14:15)

Direct comparison of postcranial size dimorphism in *Australopithecus afarensis* and *A. africanus*

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Human evolutionary scenarios often invoke sexual size dimorphism (SSD), variation in size between adult males and females within a taxon, because it is linked to sexual selection and various natural selection pressures in extant primates. Previous work has focused on developing techniques to estimate postcranial SSD in the hominin fossil record while taking into account the fragmentary nature of the record and uncertainty of sex designations for fossils [1,2]. Previous work has shown that a technique referred to as the mean method is the most robust of these for both univariate and multivariate data sets. Additionally, for multivariate data sets with missing data, an implementation of this technique known as the geometric mean method is found to be more robust than other techniques that attempt to account for missing data . This technique compares fossil samples to randomly sampled comparative data sets in which the missing data structure of the fossil sample is imposed on the comparative sample. All of these techniques provide a significance test of difference in SSD between a fossil sample and a comparative sample.

The development of these and other methods have focused to date on the *Australopithecus afarensis* postcranial hypodigm due to its relatively large sample size, both in terms of actual elements and published interlandmark measurements from those elements. More recently, multivariate techniques that require complete data have also been used to compare SSD in *A. africanus* femora to extant taxa . In general, most analyses of postcranial dimorphism have found *A. afarensis* to be significantly more dimorphic than humans and chimpanzees and equally or more dimorphic than gorillas and orangutans [e.g., 2, although see 1], while *A. africanus* femoral dimorphism does not differ significantly from any of these taxa [5]. However, to date there has been no published analysis of a direct comparison of postcranial SSD in these two fossil taxa.

This study performs such a comparison using multivariate postcranial data sets drawn from *A. afarensis* (n=15), *A. africanus* (n=24), and four extant hominoid taxa spanning a wide range of SSD (*Pan troglodytes* [n=48], *Homo sapiens* [n=48], *Pongo* [n=27], and *Gorilla gorilla* [n=48]). In all species, 9 postcranial variables were measured on the femur, tibia, humerus, and radius. Extant specimens were complete for all measurements, while fossil specimens had between one and seven of the full set of measurements. The geometric mean method was used to accommodate missing data in comparisons of SSD.

Consistent with previous work, postcranial dimorphism in *A. afarensis* is found to be greater than that of all comparative taxa ($p <= 0.005$), while postcranial dimorphism in *A. africanus* is significantly greater than that of *Pan* and *Homo* ($p < 0.001$) but sits in the middle of the range of dimorphism values for *Gorilla* and *Pongo*. Because the sample sizes and specific patterns of missing data differ between the two fossil samples, an additional bias-correction resampling procedure was applied to the fossil data sets to allow for direct comparison between them.

Direct comparison of resampled distributions of postcranial SSD between the fossil samples demonstrate that *A. afarensis* is significantly more dimorphic than *A. africanus* ($p < 0.001$). However, both fossil taxa are highly dimorphic, the difference being between a *Gorilla*- or *Pongo*-like level in *A. africanus* and a *Papio*-like level in *A. afarensis*. While such high levels of sexual dimorphism are only observed in extant primates with high levels of sexual selection and presumably reflect relatively high levels of sexual selection in these fossil taxa, it remains to be determined whether the variation in the high levels of dimorphism observed among *Australopithecus* species is due to variation in sexual selection or other selective forces that can also adjust dimorphism (e.g., ecological stressors).

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Poster Presentation Number 137, Th (12:15-14:15)

A chimpanzee-sized ancestor of the earliest hominins and unusual patterns of body size evolution in the hominid clade

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Body size directly affects how an animal relates to its environment, and no trait has a wider range of biological implications. However, little is known about the body size of the last common ancestor of humans and chimpanzees, hominids (great apes and humans), or hominoids (all apes and humans). This void impacts numerous paleobiological hypotheses at and prior to the root of our lineage. Here we use phylogenetic comparative methods and body mass data from fossil hominins, a wide sample of fossil primates including Miocene apes from Africa, Europe, and Asia, and extant primates including humans to test alternative hypotheses of body size evolution, modeled in R via SURFACE according to an Ornstein-Uhlenbeck process. Our results suggest that, first, a series of selective regime shifts, possibly due to resource availability, led to a decrease and then increase in body size in early hominins from a chimpanzee-sized last common ancestor. Second, the last common ancestor of all hominoids likely lived in an environment that favored a gibbon-like size, suggesting that gibbons are not a dwarfed lineage, and supporting recent fossil findings. Further, these results support a model where antipronogrady first evolved in a gibbon-sized early ape, further adapting in the lineage that led to hylobatids, rather than the independent acquisition of suspensory behavior among the hominoid lineages. The series of morphological changes that allow for suspensory behavior evolved once and the combination of continued use and possibly phylogenetic inertia in these characters led to their persistence while body mass appears to be extremely evolvable in this clade. Finally, whereas most of primate evolution is characterized by adaptation towards only two optimal body sizes, hominids are unique among primates in having a significantly greater number of adaptive optima due to poorly understood but distinct selective regimes across evolutionary time. This result supports the hypothesis that a complex and changing adaptive landscape characterized body size evolution in the hominid and hominin clade.

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Poster Presentation Number 97, Th (12:15-14:15)

Double blind direct electron spin resonance dating of the *Homo naledi* remains

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Since the announcement of the discovery of the new human species *Homo naledi* in September 2015 [1], their age has been subject to many speculations. The archaic morphological features of the remains suggested an Early Pleistocene age [2]. However, recent dating results obtained [3] indicated a younger age, within the later part of the Middle Pleistocene. The extensive dating study utilised a wide range of techniques including U-series, electron spin resonance (ESR), luminescence and palaeomagnetism. The combined results constrained the age of H. naledi to a period between ∼230 ka and ∼330 ka.

Here, ESR dating deserves special attention, as it was actually the only method directly applied to human remains, thus providing a direct age constraint for the fossils. The ESR analyses were performed following using a double blind approach, i.e. the same teeth were independently dated by 2 different laboratories (Griffith University-CENIEH and SCU). First, each laboratory carried out independent sample preparation, ESR and U-series analyses of the fossil teeth. Then, environmental dose rate evaluation and age calculation were performed using common data and assumptions in order to produce comparable results.

The objective of the present work is to further detail the results displayed in [3], explain how those ESR chronologies were obtained, and comment on the challenges we faced, in particular for a correct assessment of the external dose rate, as access to the cave was difficult. The internal consistency of the ESR results from each laboratory will be discussed, and compared with results of the other independent dating methods.

Acknowledgements: ESR and U-series dating undertaken at Southern Cross University were supported by RJB ARC discovery DP140100919. The ESR dosimetry study carried out at CENIEH, Spain and Griffith University, Australia, has been supported by a Marie Curie International Outgoing Fellowship (under REA Grant Agreement n^{O} PIOF-GA-2013-626474) of the European Union's Seventh Framework Programme (FP7/2007-2013) and an ARC Future Fellowship (FT150100215).

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Poster Presentation Number 53, Th (12:15-14:15)

Quina Mousterian across the Pyrenees: same of different times? Making the best of single-grain OSL data using newly developed, dedicated Bayesian models

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The variability of Mousterian technologies is a long debated topic in Palaeolithic archaeology, especially for the rich record of South West France; in this context, Quina Mousterian appears to be an important milestone, all the more since it is often associated with a strong climatic proxy: reindeer remains almost always dominate the faunal spectra. While a significant part of the debate has focused on the record of SW France, occurrences of Quina Mousterian have been found elsewhere, in particular in the Cantabrian Mountains (Northern Spain). Given the very different nature of the environment of the sites – mountains in Cantabria opposed to low relief landscapes in the Aquitaine basin – the comparison of numerical chronologies for the Quina Mousterian across the Pyrenees is expected to shed light on human-climate interactions during the Middle Palaeolithic of Europe. The caves of Esquilleu and Covalejos were recently excavated and have revealed long stratigraphic sequences. In both cases, several layers have yielded Quina Mousterian industries, associated with faunal remains consisting of typical mountain-adapted taxa. Our aim is here to present numerical chronologies for both sequences, using single grain OSL. To obtain a set of accurate ages, we apply a set of Bayesian models to single-grain OSL measurements. While similar models have been developed for radiocarbon dating, until recently no model was available to handle the specificities of OSL dating; in particular the newly developed models allow a proper handling of the shared errors in the dose rate term, which contribute a significant fraction of the total uncertainty budget. As a result, for the first time in OSL dating, a numerical chronology can be obtained from measurements and stratigraphic constraints, thus fully exploiting our knowledge of the site and of our measurement characteristics. We will present the obtained chronologies and focus on the Quina Mousterian layers from Esquilleu and Covalejos; finally, we will compare these ages with those recently obtained for similar lithic industries in South West France.

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Podium Presentation: Session 4, Th (16:20)

The morphology of the *Homo erectus* pelvis

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The shape of the *Homo erectus* pelvis is best known from the Nariokotome KNM-WT 15000 skeleton. It preserves an unfused partial sacrum, ilium, ischium and a fragment of the pubis of a juvenile individual. The pelvic reconstruction by Walker & Ruff [1] suggested a mediolaterally narrow bi-iliac breadth with short superior pubic rami and vertically oriented iliac blades commensurate with modern tropical populations. This interpretation of the morphology is challenged by the recently discovered enigmatic pelvis from Gona, Ethiopia, which has also been attributed to *H. erectus* [2]. The Gona pelvis presents a significantly wider bi-iliac breadth than KNM-WT 15000, laterally flaring ilia, long superior pubic rami and a platypelloid (transversally oval) pelvic canal, while articular surface areas imply a much smaller body size. Part of this striking discrepancy might be attributable to their different sex and developmental age. While the Gona pelvis belongs to an adult female, the KNM-WT 15000 cranium suggests a juvenile male with a dental age of about 8 to 9 years. Accordingly, the triradiate suture of its acetabulum is still unfused and the apophyses of the iliac crest and ischial tuberosity are missing. Other pelvic material attributed to *H. erectus*, including KNM-ER 3228, KNM-ER 1808 and OH 28, though much less complete, seems to resemble KNM-WT 15000, which raised questions about the taxonomic attribution of the Gona pelvis [3]. Here, we reanalyse the KNM-WT 15000 pelvic girdle by performing a new virtual reconstruction. We used surface scanner-generated 3D-models of the preserved fragments. Ilium and ischium were repaired by aligning the preserved areas of the right and left sides, which are differently fractured. The remaining missing areas were integrated by morphing bony elements of modern human pelves of the same developmental age, using landmark-based techniques. The ilium and the ischium were aligned to form an acetabulum matching in size and shape the well-preserved proximal femur. The pubis, which is represented by a segment of the superior border of the obturator foramen, was reconstructed using the outline of the also preserved ischiopubic ramus and a juvenile modern human hipbone. In parallel, we realized a manual restoration using 3D-prints of the pelvic remains to control the process of our virtual reconstruction. Our outcomes were qualitatively evaluated against the other adult *H. erectus* pelvic remains. In addition, we performed a geometric morphometric analysis comparing the reconstructed pelvis of the Nariokotome boy with a modern human sample from medical CT data (9-15 years, N=20). This analysis was based on a dense configuration of landmarks and semilandmarks representing the whole pelvis. Our reconstruction suggests remarkable similarities of the KNM-WT 15000 hipbone with those of KNM-ER 3228 and OH 28. Compared to the previous reconstruction of KNM-WT 15000, our model shows a considerably wider bi-iliac breadth with more flaring and more coronally oriented ilia and a relatively long pubis. This pelvic configuration is shared with australopithecines and the Gona pelvis [4] and is well compatible with KNM-WT 15000's long femoral neck. The coronal orientation of the ilia is another characteristic distinguishing KNM-WT 15000 from modern humans. This particular feature might imply a distinct function of the gluteal musculature in H. erectus and a different mode of bipedal locomotion than in modern humans. The pelvic canal, on the other hand, is clearly sagittally elongated, which contrasts with the platypelloidally reconstructed Gona pelvis, but is similar to that of modern humans and some australopithecines [5]. The overall morphology of the KNM-WT 15000 pelvis further suggests that the size of the digestive tract was not yet reduced in early *Homo*. Finally, the commonly accepted idea of H. erectus body shape needs to be revised in the light of the new information available.

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Podium Presentation: Session 5, Fr (9:20)

Population history of late Neandertals

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The Middle to Upper Palaeolithic transition in Europe is characterized by major cultural and biological changes and coincides with the arrival of anatomically modern humans and the disappearance of Neandertals [1]. In order to investigate the population history of late Neandertals and their possible genetic interactions with early modern humans, we studied the genomes of Neandertals from the time when they, or their immediate ancestors, could have met modern humans. We screened 78 hominin bones and teeth, as well as morphologically undiagnostic bone fragments, from 21 late Neandertal sites across Eurasia for ancient DNA preservation. We identified five Neandertal specimens from the sites of the Troisième caverne of Goyet (Belgium), Spy (Belgium), Les Cottés (France), Vindija Cave (Croatia), and Mezmaiskaya Cave (Russia) (individual 'Mezmaiskaya 2') with sufficient amounts of endogenous DNA to enable the sequencing of their nuclear genomes to an average coverage of between 1- and 2.7-fold. The specimens were radiocarbon dated either directly or by dating of associated finds to between ∼39,000 and ∼47,000 years calBP. We analyzed the genomes of these five Neandertals together with previously determined genome sequences from three Neandertal individuals: one from Croatia (Vindija 33.19), directly dated to >45,000 years calBP, one from Denisova Cave in the Altai Mountains (Russia) [2], which was discovered in a layer dated by thermoluminescence to ∼90,000 years BP, and one from the Mezmaiskaya Cave (Russia), dated to ∼60-70,000 years BP (individual 'Mezmaiskaya 1'). We find that all late Neandertals were genetically more similar to each other than to the Altai Neandertal, regardless of their geographical origin. Moreover, the genetic diversity of the nearly contemporaneous late Neandertals was substantially lower than that of humans today. The reconstruction of multiple late Neandertal genomes from individuals who lived across a wide geographic range allowed us to investigate whether geographical proximity may be a predictor of genetic relatedness, as was previously shown for present-day human populations [3]. The Neandertals from Vindija Cave were more similar to each other than to any other Neandertal; as was the case for the three Neandertals from Belgium and France, supporting the presence of geographical substructure in Neandertal populations. All these individuals in turn were more closely related to each other than to the younger Neandertal individual from Mezmaiskaya Cave (Mezmaiskaya 2). Nonetheless, the latter individual is more closely related to the other late Neandertals than to the older Neandertal individual from the same site (Mezmaiskaya 1). This may point to a genetic population turnover towards the end of Neandertal history. We compared the Neandertal genomes from this and previous studies to the genomes of present-day humans to investigate which Neandertal individual was closest to the Neandertal population that contributed Neandertal genetic material to present-day humans. We find that all the late Neandertals and the older Mezmaiskaya 1 Neandertal are genetically more similar to the introgressing Neandertal than the Altai Neandertal. Thus, the majority of the gene flow into ancestors of present-day non-Africans originated from a Neandertal population that was equidistant or ancestral to the late Neandertals and Mezmaiskaya 1 but had diverged from the Altai population. The generation of additional Neandertal genomes in the future will allow the reconstruction of Neandertal population history at a finer resolution and across more of their temporal and geographical range.

Podium Presentation: Session 4, Th (17:40)

Marathousa 1: New Lower Paleolithic elephant butchering site from the Megalopolis basin, Greece

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Marathousa-1 is a Lower Paleolithic open-air site located in the lignite mines of Megalopolis, Central Peloponnese, Greece. It was discovered and subsequently excavated by a joint team from the Ephoreia of Paleoanthropology and Speleology and the Paleoanthropology section of the Senckenberg Centre for Human Evolution and Paleoenvironment, University of Tübingen, in the framework of the ERC Starting Grant Project "PaGE" awarded to K. Harvati [1]. The find-bearing layers are composed of silty and sandy clays, exposed between two lignite seams along an old section of the mine in the Marathousa Member, Choremi Formation. During our 2013 survey we located lithic artifacts as well as elephant and other fossil faunal remains eroding out of the profile for approximately 100 m along the section. A short rescue excavation was undertaken in 2013, and systematic excavation proceeded from 2014 until 2016 in two main areas: Area A to the North and Area B to the South of the section (ca. 80 m apart). In this period the excavation covered a total of 72 m^2, accounting for 55 m^3 of excavated sediments. The three-dimensional coordinates of finds (i.e. all the lithic artifacts and teeth; bones and organic materials with a-axis >20 mm), collected spits of sediment and geological features (e.g. erosional contacts and mud cracks) were recorded with the use of a total station. Systematic screen-washing of sediments was carried out on-site using 1 mm sieves.

The context of Marathousa-1 represents a low-energy depositional environment, such as a shallow-water swamp close to the shore of a lake. Fast burial in a very fine-grained matrix ensured extraordinary preservation of organic materials, including vertebrate remains (micro- and macromammals, birds, turtles, frogs, fishes), but also freshwater molluscs, paleobotanical micro- and macroremains, eggshells and even insects. More than a thousand lithics have so far been recovered in stratigraphic and spatial association with faunal remains, including those of elephants, hippopotamuses, cervids, bovids and carnivores. An elephant cranium and several postcranial elements attributed to Elephas (Palaeoloxodon) antiquus were found in close anatomical association in excavation Area A and represent a single individual. Cut-marks and percussion marks on bones indicate hominin exploitation of the elephant carcass and other animals. The lithic assemblage is composed of small-sized flakes and flake fragments, cores and retouched tools. Technological characteristics point to a simple operational sequence aiming at the production of flake blanks and the preliminary analysis suggests on site knapping episodes. In lack of bifaces or evidence for prepared-core techniques, the lithic assemblage shows some similarities with other Lower Paleolithic non-handaxe flake-based industries, especially those with small-sized blanks.

Marathousa-1 is the first Middle Pleistocene archaeological site ever to be excavated in mainland Greece and the first Greek, open-air Paleolithic site with both lithic and faunal remains to be examined by systematic excavation. A preliminary dating analysis by ESR on a cervid tooth from excavation Area B places the find-bearing layer at 484 $\pm$ 13 ka BP [2]. This date would make Marathousa-1 the oldest currently known radiometrically dated archaeological site in Greece.

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Pecha Kucha Presentation: Session 2, Th (11:50-12:15)

Diet and resource space of *Homo erectus* in Early Pleistocene of Sangiran – an update

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The Sangiran dome is one of the richest hominid localities outside of Africa. There are three successive hominid fossil bearing layers at Sangiran, which cover a large time span from Early to Middle Pleistocene. These are the upper part of the Sangiran formation, Grenzbank and the Bapang formation. This study focuses on the diet and resource space of *Homo erectus* (S7-37) from the Sangiran formation.

S7-37 is a right maxillary fragment with an incomplete P4 and complete M1 [1]. The *Homo erectus* M1 took c. 2.5 years for crown completion, which starts shortly before the birth of this individual. The P4 mineralization initiated with c. 2.5 years and ended with 5.2 years [2]. To analyze the stable carbon and oxygen isotope signal we took five serial samples from the first molar and four samples from the premolar. In this way different dietary phases during the infancy of *Homo erectus* are documented. The carbon isotope values as well as the oxygen isotope values of this individual are influenced by breastmilk consumption and environmental factors first of all seasonal changes.

Oxygen isotope values reflect the water source of an individual. In the case of an infant are these breastmilk and/or drinking water. Breastmilk incorporates body water, which is enriched in 18O in comparison to other water sources for the infant . For this reason the δ 18O values should be decrease, if the infant is weaned. But the δ 18O values of drinking water and therefore of breastmilk are changing whether it is rainy or dry season. The stable carbon isotope values reflect the proportional amount of different resources and therefore changes in the diet. In the case of a juvenile these changes are related to the amount of breastmilk in the diet and/or seasonal variations of food resources. So we have to know which resources are available for *Homo erectus* during rainy and dry seasons. To do so we take pollen and faunal data from the Sangiran formation to determine which food resources occurred at this time. For these resources we collected different data like the carbon isotope value, nutritional content and seasonal availability. These data are the basis for an isotope mixing model. So at the end we can analyze possible diet compositions in different live stages of an infant *Homo erectus* from Sangiran.

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Podium Presentation: Session 1, Th (10:00)

Homo naledi and the evolutionary context of subequatorial Africa

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Until recently, it appeared reasonable to assume that the hominin populations of the later Pleistocene in Africa were limited to modern humans and lineages very closely related to them. However, recent discoveries now show a diversity of hominin lineages, possibly extending up to the end of the Late Pleistocene. Genetic evidence from living human populations of subequatorial Africa suggests a minor contribution from diverse hominin lineages that cannot yet be associated with fossil evidence. Our work involves *Homo naledi*, which is represented in the Rising Star cave system of South Africa between 236,000 and 335,000 years ago. Other fossil remains from subequatorial Africa within the last million years, such as the Kabwe, Florisbad, and Olduvai (OH 12) remains, together with *H. naledi*, now appear to document a diversity beyond that yet evidenced in Northeastern or North Africa. Yet the biodiversity and paleoenvironment of the vast subequatorial region during the Middle Pleistocene has received less attention than the Rift Valley and northeastern Africa. We consider the evidence for biotic diversity outside of hominins within the savanna and open woodland biomes of subequatorial Africa. Many species of ungulates, primates, and carnivores demonstrate greater genetic variation in subequatorial Africa, or an origin of broader population dispersals from this region. This repeated pattern aligns with biotic diversity more generally, suggesting that the ecological space for hominins in this region may have been greater than elsewhere. We examine the anatomical evidence to consider whether *H. naledi* demonstrates niche differentiation from other hominins. *H. naledi* is substantially different from archaic and modern humans in many aspects of its skeleton, including smaller brain size, shoulders and hands with adaptations associated with climbing, and a primitive conformation of the pelvis. Yet with long, slender legs, humanlike feet, hands showing adaptations for tool manufacture, and a reduced postcanine dentition compared to *H. erectus* or *H. habilis*, *H. naledi* appears to have related to its ecological circumstances in a much more humanlike way than primitive hominins from the Early Pleistocene or Pliocene. This evidence raises additional questions about how *H. naledi* and other lineages may have fit into the early MSA archaeological context. It cannot be ruled out that *H. naledi* was a potential manufacturer of early MSA industries, and may have been present across a broad geographic region.

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Pecha Kucha Presentation: Session 2, Th (11:50-12:15)

Tubers in Winter

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It is a widely held notion in the archaeology of populations living at mid and high latitudes that wild plant foods would have been most limited and of least value during the winter. This perception has colored many reconstructions of hominin and early human lifeways, and is often used as an argument for the preeminence of animal foods during colder months. Several researchers have pointed to the problem of 'rabbit starvation' - that is, the protein ceiling which can cause death when insufficient fat or carbohydrate is available [1]. Most animals are at their leanest in the late winter and early spring, making this time period especially dangerous for hunters relying on only game meat. Furthermore, essential nutrients like vitamin C would also have been limited in a diet consisting only of animal sources [2]. Signs of scurvy appear in humans after four to eight weeks of vitamin C deprivation [3], indicating that nearly constant sources of this vitamin were needed even throughout the winter.

We propose here that plant foods, particular the underground storage organs (USOs) of biennial or perennial plants, would have been the most valuable to foragers in the late winter and early spring, not only because of the increased need to stave off protein poisoning, but also because this is precisely the time frame in which the USOs have their greatest nutritional value, the plant having stored abundant resources in the USO for the winter. Our survey of available literature on wild edible plants in mid latitude habitats indicates that USOs are available in moderate quantities year round, and peak in availability in the autumn (Sep-Nov). However, what is most striking is that considerable numbers of USOs are available in the winter months (Dec-Feb) when almost no other plant resources are available. Analysis of the starch grains preserved in the USOs of a variety of wild edible plants indicates that many species contain abundant starch, and would therefore have been a valuable source of carbohydrates during the winter. Many of these plants also contain abundant vitamin C (e.g., wild carrots). While some important tuber-bearing plants, especially those from near-water environments (e.g. *Typha* sp. [cattail / reedmace], *Phragmites* sp. [common reed]) are easily recognizable year-round, a large number of others (e.g. *Nuphar lutea* [water lily], *Ranunculus ficularia* [lesser celandine], *Conopodium majus* [pignut], and *Daucus carota* [wild carrot]) are cryptic in the winter. The need to locate carbohydrate and vitamin-rich foods implies that hominins had detailed ecological knowledge that allowed them to find USOs in the winter. If hominins were not directly familiar with the location of plants as indicated during the spring and summer flowering season, then they must have relied on other cues, such as commensal species, the behaviors of other animals, or other habitat markers. This would be particularly true in the case that early high-latitude hominins regularly migrated long distances to survive the winter [4].

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Poster Presentation Number 82, Fr (12:15-14:15)

Dental microwear pattern of a cannibalized Bronze Age population at El Mirador Cave (Sierra de Atapuerca, Burgos, Spain)

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Dietary habits of past people are fundamental to understanding their subsistence economy and their way of life. Dental microwear analysis is a useful tool which provides important information about diet and feeding behaviour in our ancestors. It allows us to identify the physical properties of food, as it provides information about the hardness and abrasiveness of the food and shows how it was processed before being consumed. The main objective of the present study is to infer the diet of the Bronze Age individuals from El Mirador Cave (Sierra de Atapuerca, Burgos, Spain) through the analysis of dental microwear patterns.

The cave of El Mirador, is located on the southern side of the Sierra de Atapuerca (Burgos, Spain), was inhabited from the Upper Paleolithic to the Bronze Age and different activities were carried out there such as habitation, animal stalling and burial [1]. The Bronze Age levels yielded the remains of six individuals with evidence of being processed in a clear case of gastronomic cannibalism [2]. In the Early Bronze Age, the cave was used in a funerary and ritual context, not for living purpose. Later, during the Middle and Late Bronze Age the cave was used for keeping animals.

The assemblage of the Bronze Age human remains recovered in El Mirador Cave is made up of 106 remains (dental, cranial and post-cranial) belonging to at least six individuals. We studied 27 molars, the upper and lower M1 and M2 of six individuals. But finally, we chose 6 molars, each of them representing one of the individuals. For microwear analysis, we worked with an environmental scanning electron microscope (ESEM) (FEI Quanta) and we observed the buccal surface of the original teeth.

The most remarkable feature of the El Mirador Cave buccal microwear is the low density of striations documented per tooth and the high striation length in comparison with others Bronze Age populations from the Iberian Peninsula. It should be pointed out that microwear of El Mirador individuals is characterized by long and scarce striations. This has been related to diets with a high component of meat and/or soft and processed foods. However, archaeological remains such as pottery and lithic tools associated with agriculture show us that Bronze Age populations had also an intake of foods of vegetable origin. The key is the abrasiveness of the diet. Food highly processed before and during the cooking process decreases the presence of abrasive particles. A low-abrasive diet would have left few microwear features on the dental surfaces. This can be explained by the use of pottery vessels for cooking because it changes the physical composition of food, making it softer and easier to eat [3].

Our results lead us to propose a scenario in El Mirador Cave during the Early Bronze Age, where the agriculture did not play an important role in the economy of these individuals, who are mainly farmers. We conclude this was a population of shepherds and farmers and it would be expected that they intake a mixed diet, with a high proportion of animal foods complemented with highly processed vegetable food.This preliminary study in Bronze Age populations is a first step of methodological testing for a more reaching study with a diachronic perspective of dietary evolution of human populations throughout the Pleistocene and early Holocene.

All works about Sierra de Atapuerca sites are funded by the Dirección General de Investigación of M.E.C, project number CGL2012-38434-C03-03 and by the Junta de Castilla y León.

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Podium Presentation: Session 12, Sa (16:00)

Finding hominin bones from the Palaeolithic using collagen peptide mass sequencing (ZooMS)

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Ancient DNA sequencing has shed significant light upon our knowledge of archaic and modern humans during the Middle and Upper Palaeolithic. Many Palaeolithic sites contain large numbers of bones, but due to the combination of post-depositional influences and carnivore processing of bone remains, many of them lack the diagnostic features required for identification of bone to specific taxon. Human remains dating to this period are, therefore, very rare. We have been applying a method of collagen fingerprinting to screen Palaeolithic bone fragments to identify the species/taxon of the bone, and importantly, to identify bone which has characteristic unique human peptides. The method utilizes mass spectrometry (MALDI-ToF-ToF) to produce a spectrum of peptide masses. Different species disclose small differences in the sequence of these peptides that enable them to be identified. Thus far we have found four new human fossil bone fragments from >4,000 undiagnostic bone remains, ranging down to as small as 23 mm in length. We have screened bones from the Palaeolithic archaeological sites of Denisova Cave (Russia) and Vindija Cave (Croatia). We then carried out DNA sequencing of the human bone fragments to identify into which human group they fall. At Denisova Cave, we previously identified a tiny bone as a hominin and showed, using DNA methods, that its mitochondrial DNA was of the Neanderthal type (Denisova 11) [1]. We have identified 2 additional bones which have been genetically analysed. At Vindija Cave we identified a new bone fragment from the G1 level and found that it had the same mtDNA sequence as another Neanderthal from the same site but a deeper level. We also found evidence for human processing on this bone in the form of cut-marks. We directly dated the bones using single amino acid dating of hydroxyproline. We will describe the significance of the new fossil finds in terms of the archaeological sequences at both sites. Collagen fingerprinting has immense potential for identifying hominin remains in highly fragmentary archaeological assemblages. Coupled with DNA analysis and direct dating, this method should be widely applied to previously excavated archaeological materials.

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Pecha Kucha Presentation: Session 10, Sa (11:00-11:25)

The influence of environmental fluctuations on ochre use at Blombos Cave and Klipdrift Shelter, southern Cape, South Africa, during the Late Pleistocene

Tammy Hodgskiss[1], **Christopher Henshilwood**[1,2], **Karen van Niekerk**[2]

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Collection and use of different varieties of ochre and manganese is common at Middle Stone Age/Middle Palaeolithic sites. These materials provide a way to explore some of the behavioural changes that took place during the Late Pleistocene - a time of significant behavioural developments, with important cognitive implications for *Homo sapiens* and Neanderthals.

Blombos Cave (100-72 ka) and Klipdrift Shelter (66-59 ka) are two important Middle Stone Age (MSA) sites on the southern Cape coast of South Africa. The sites contain large ochre assemblages, including ground, scraped, knapped and engraved ochre pieces [1-3], with most activities aimed at producing powder. A range of colours are represented in the assemblages but there is a preference to collect and use bright-red varieties. In the c. 100 ka levels at Blombos Cave, *Haliotis midae* (abalone) shells associated with ochre processing were found. These provide the earliest known evidence of the use of containers, which were used to prepare and store an ochre-rich compound 'paint'. Ochre powder and ochre paints have many uses, such as an aid for hide tanning, in adhesives for tool hafting, medicinal purposes, or as a body paint for ritual purposes or as protection against sun or insects. The preferential use of bright-red ochre and pieces bearing engraved geometric designs have afforded it a symbolic role. The possible applications of ochre imply that its use was influenced by both cultural and social systems and as well as daily subsistence requirements.

This study explores changes in the collection and manipulation of ochre at Blombos and Klipdrift in relation to changing environments, changes in subsistence and sea level variations. New faunal, speleothem and isotope data reflect significant fluctuations in the local vegetation, aridity, rainfall, and sea temperature during this time period [e.g. 4]. Within this context, we consider changes in the collection and use of ochre types, in the ways ochre pieces were processed, and the application of ochre powder. Raw material choices over time were influenced by sea level changes which restricted/allowed access to sources. Periods of resource intensification due to environmental change often correlate with increased and intensified ochre use, however intensive ochre collection and use is not always a feature of high density occupation phases. Specific types of ochre were chosen for use during periods of resource stress, sometimes coinciding with marine isotope stage transitions. Changing patterns of ochre use reflect the demographic, subsistence and social pressures which resulted from deteriorating climatic conditions.

DST-NRF Centre of Excellence in Palaeosciences NRF Chair - Human Origins Platform Palaeontological Scientific Trust (PAST)

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Podium Presentation: Session 7, Fr (14:20)

U-series age constraints for cave art in Cuevas de Puente Viesgo (Cantabria, Spain) - new minimum ages for El Castillo and La Pasiega

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Cave art is found on almost every continent and, in addition to its bearing on the origins of art itself, it constitutes an important source of archaeological information about symbolic behaviour of early humans. Accurate chronological control of the emergence and/or execution of cave art is important for its interpretation, but cave art has proven to be one of the most difficult archaeological phenomena to date. U-series dating is an important geochronological tool which has great potential to provide age constraints for archaeological sites or artefacts in cave environments. We present our methods to conduct precise U-series analyses on calcite crusts that formed on top of cave paintings. Recent developments in multi-collector (MC) inductively coupled plasma mass spectrometry (ICPMS) U-series dating greatly improved the precision of this method, and sample sizes needed to obtain reliable results were significantly reduced. Based on these developments the U-series technique can be applied for accurate dating of thin calcite crusts covering cave art at many sites, while taking care not to harm the art underneath. The method provides minimum ages for the covered art and, where possible, also maximum ages by dating the flowstone layer the art is painted on. In our presentation we will present details of our methodology and the steps we take to demonstrate the reliability of U-Th dates. This includes sampling strategy and execution in the cave as well as analytical protocols and interpretation of results. We also address potential biases for U-series dating such so-called 'open system' or detrital contamination. Our sampling strategy and dating method has been successfully applied in a number of recent projects to date calcite precipitates above and occasionally below cave paintings in Spain. We present new results for El Castillo and La Pasiega, two important caves of Puente Viesgo in Cantabria, Spain. We focused the sampling campaign in Puente Viesgo on calcite crusts that formed on top of early symbolic cave art. In total we analysed 55 samples collected from 29 crusts. All results we obtained so far are considered to be robust. 22 out of the 29 crusts are pre-holocene and provide reliable age constraints for the underlying art. In particular, we will present and discuss new dating results for calcite crusts on the 'Panel of hands' in El Castillo. Based on ten new sample positions we find that calcite on the panel of hands formed episodically between 42 and 28 ka. The new minimum ages for the art underlying the calcite crusts on the Panel of hands confirm previous initial results [1] that the earliest dated paintings in the caves of Puente Viesgo are dating at least to the Early Aurignacian period.

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Pecha Kucha Presentation: Session 10, Sa (11:50-12:15)

To the point — Understanding the chronology of 'Aurignacian' osseous point industries and their meaning for the Middle to Upper Palaeolithic biocultural shift

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Osseous spear points have been obtained from numerous Early Upper Palaeolithic (EUP) assemblages and are often seen as a leitmotif for Early Aurignacian complexes. Despite their key representation in discussions on the spread of anatomically modern humans (AMH) into central Europe and their possible interactions with Neanderthals, the osseous point chronology remains not well understood. This has several reasons, most importantly their precious nature and challenging sampling conditions for radiocarbon dating. We will present new radiocarbon evidence that will effectively double the number of direct measurements on "Aurignacian points" available, placing these artefacts in their spatio-temporal context as well as investigating their variability (including in raw material used), and role in the Middle to Upper Palaeolithic biocultural shift.

Osseous spear points have repeatedly been used to highlight the complex cultural and socio-economic changes during the Middle and Upper Palaeolithic shift in Europe. However, many osseous points were found in challenging contexts during excavations in early-to-middle 20th century. This means that direct dating is crucial to understanding the spatio-temporal complexity of their appearance and their role in the Middle to Upper Palaeolithic biocultural shift. This research applies recent improvements in radiocarbon dating methods such as ultrafiltration [1] and single amino acid dating (modified from [2] and [3]) to directly date nearly 40 osseous spear points from 11 different sites along the Danube fluvial corridor: Dzeravá Skala (Slovakia), Istállóskō, Bivak, Jankovic, Peskō, Szeleta (Hungary), Vindija, Bukovac (Croatia), Kozarnika, Tabashkata and Toplja (Bulgaria).

Additionally, all osseous points were analysed with ZooMS (e.g. [4] and [5]) , a peptide fingerprinting technique for species identification, to get a better understanding of the raw material used for their manufacture and possible variability in space and time.

In combination with results from previously published research, we explore the temporal and geographical variations of osseous spear points during the early stages of the Upper Palaeolithic and hope to shed light on the role these artefacts might have played in the spread of Early Aurignacian industries and migrations of anatomically modern humans in Europe.

The research leading to these results has received funding from the European Research Council under the European Union's Seventh Framework Programme (FP7/2007-2013) / ERC grant agreement n^{O} [324139] "PalaeoChron" awarded to Professor Tom Higham.

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Poster Presentation Number 30, Fr (12:15-14:15)

The Neanderthal Occupation in Southwestern Iberia: preliminary data from the Gruta da Companheira site

Pedro Horta[1], **João Cascalheira**[1], **Nuno Bicho**[1], **Frederico Tátá Regala**[1]

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Southwestern Iberia is often considered a privileged region for the study of what are considered the last Neanderthals. However, unlike most other European and even Iberian regions, there is a clear lack of information available on this subject, especially if we consider behaviour changes through time. For this poster we present a summary of what little is known about Neanderthals in this region, as well as provide new data from the recently discovered Gruta da Companheira site.

The current available data on Neanderthals in this region has simply provided us with means to infer answers to important questions such as resource selection and exploitation, technology and settlement patterns [1]. Recently, during construction work in its vicinity, the Gruta da Companheira site was discovered, two test pits of one squared meter each revealed several Mousterian artifacts as well as faunal remains. With the addition of Gruta da Companheira, around 18 Mousterian sites have been identified south to the Tagus, however, only 5 (Mina do Paço, Gruta da Figueira Brava, Gruta do Escoural, Gruta de Ibn Amar and Sapateiros 2) have been excavated.

Unfortunately, there is a lack of a clear chronological picture for this area, and aside from the caves of Escoural (c. 50k cal BP) and Figueira Brava (c. 30.9k cal BP), no other sites have been dated [2]. Considering this region is marked at north by late Mousterian occupations (30k cal BP) including the Foz do Enxarique site, and on the east by Southern Spain where other late Mousterian sites have been identified, published and excavated (e.g. Gorham's Cave, Cueva del Boquete de Zafarraya and Cueva del Bajondillo), it is quite likely that late Mousterian sites can be found in the region.

What we do know is that since at least 150k BP, Neanderthals showed particular behaviors that can be considered unique compared to other European regions, such as a high variability of resource exploitation, including marine resources [1]. At Gruta da Figueira Brava, high frequencies of Patella shells were found associated with lithics, as well as great auk and seal remains [3]. Likewise, in Gruta de Ibn Amar tortoise remains were found, and on smaller amounts Patella, Clam and Mussel shells were found in mixed frequencies with terrestrial fauna, such as, Rabbit, Wild Ass and Red Deer. In the Southernmost sites, these distinct behavioral patterns are quite evident. All of these sites are located exclusively near seasonal lakes , coastal areas or rivers. Gruta da Companheira is no exception, located next to the Arade River estuary.

In Central and Northern Portugal, the Mousterian between 200k and 100k is marked by low frequencies of Levallois and discoidal flake debitage, however, in Southern Portugal the Mousterian is marked by an abundance of discoidal and Levallois flake debitage, most of it done on local raw materials [4,5]. At Gruta da Companheira 85 lithics were found so far, a preliminary analysis shows us that the raw material exploitation was a bit distinct from the one identified in Ibn Amar (which is located around 600m from Gruta da Companheira). While the same raw materials are present, limestone shows the highest frequencies opposed to quartz in Ibn Amar. The artifacts are clearly Mousterian with the presence of Levallois flakes, together with a notch and a couple of hammerstones.

While for the time being we have limited information on Neanderthals in this region it is quite clear that sites like Gruta da Companheira may provide us with important data on what may have been the Last Neanderthals and what made them last longer in these areas.

Poster Presentation Number 69, Th (12:15-14:15)

A Taste For Honey: On the Co-Evolution of Pyrophilic Primates, Honeyguides and Honeybees

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It has been suggested that the mastery and use of fire was one of the pivotal drivers of human evolution [1]. However, since habitual fire use appears rather late (∼1 Ma) in the archaeological record, its role remains disputed [2]. Recently, a new line of indirect evidence of the influence of fire on human evolution – the role of fire-prone environment - has been recognized [3]. Long before hominins acquired an ability to ignite fire at will they most likely utilized products of landscape burning and manipulated wildfires, which provided them with access to cooked food as well as other benefits. Here, we suggest another possible indirect line of evidence pointing to early fire use in hominins. Similarly to present-day hunter-gatherers, one of the most desired food items for hominins could have been honey from honeybees (*Apis mellifera*). The Greater Honeyguide (*Indicator indicator*), a small African piciform bird, is likely the earliest known wild animal mutualist with humans [4], and potentially also with hominins [5]. However, evolution of any mutualism anticipates that the participants already had a particular set of pre-adaptations which enabled them to pool their individual abilities for mutual benefit. Our contribution has these aims: i) to analyse presence of mutualism with the Greater Honeyguide in contemporary African human lineages to investigate its possible ancestral state and ii) to shed more light on the evolution of behavioral and cognitive adaptations to wildfire in hominins as the likely precursors to hominin-honeyguide mutualism. Phylogenetic analysis of contemporary African tribes (N=44, maximum parsimony reconstruction of ancestral states) suggests that interspecific cooperation with the bird could have been present in the last common ancestor of contemporary humans. For a qualitative assessment, the respective behaviors involved in mutualistic honey gathering between the honeyguide bird and a potential hominin species, were coded in cognigrams and effective chains. When reduced to the crucial and simplest tools and therewith to the least required perceptions, foci, phases, and operational steps, it is possible to distinguish the degree of behavioral complexity assessed from cognigrams in a comparative way [6]. We show that the essential hominin tool that has always been a necessity to maximize honey extraction and minimize the danger emanating from honeybee stings was smoke from fire. This behavior does not require tool-production; only the acquisition of a smoldering stick is needed to pacify honeybees. For a proper execution of the task, understanding the effect of smoke on honeybees, necessary for the anticipation to transport the smoke to the hive, must have been present. We suggest that the evolution of hominin-honeyguide mutualism would not have been possible without this key hominin pre-adaptation. The least required hominin tool involvement during mutualistic honey gathering might potentially predate the cognitive capacity for modular tool behavior, archaeologically traceable in stone tools from around 2.6 (Oldowan)-3.3 (Lomekwi) Ma which might then have further facilitated the process at a later stage. Past mutualistic honey gathering cannot be assessed directly. However, the behavioral prerequisites for this behavior were very likely already present at around 3 Ma coinciding with the estimated age of the Greater Honeyguide lineage and with the Pyrophilic primate hypothesis proposed by Parker et al [3].

OPV ITMS: 26110230119; KEGA: 001PU-4/2017.

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Poster Presentation Number 89, Th (12:15-14:15)

The effect of dental wear on food processing during development in a hard-object feeding primate (*Cercocebus atys*)

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Dental form is known to alter significantly during an organism's lifetime due to wear and dental replacement, but how these changes impact on feeding performance is relatively unknown. The effect of dental wear is especially important for species which consume the same food types throughout their lifetime. Juveniles may face the same mechanical challenges of food processing as adults but, due to smaller muscle sizes, have smaller overall bite force capacities. It could be the case that an unworn state of dentition, with high sharp cusps, presents a more advantageous form for food breakdown, reducing the maximum force required to fracture an object, and resulting in a performance which is functionally equivalent to fully mature individuals. This idea has yet to be explored in detail but would offer an interesting insight into the evolution and development of dental form and function.

In order to address this, the effects of dental wear were examined in an extant primate species, the sooty mangabey (*Cercocebus atys*). This primate has an extreme stress-resistant diet, with individuals of all ages post weaning feeding intensively on the same hard seed, *Sacoglottis gabonensis*. This diet contributes to heavy and rapid tooth wear, reducing the first molar from four sharp cusps to enamel-ridged dentine pools by adulthood. It is predicted that the high, sharp, unworn molar cusps in younger *C. atys* require lower forces than the lower, blunter, worn molar cusps in older individuals to fracture these hard foods. Metal replicas of four *C. atys* M1 teeth, representing three different stages of wear (1 unworn, 2 moderately worn, and 1 heavily worn), were created. Food replicas, in the form of hard and brittle hollow hemispheres, were compressed using a universal testing machine fitted with the metal tooth replicas. The force required to initiate fracture was recorded.

The unworn tooth, which had 4 cusps in contact with the food object at the point of failure, was the poorest performer requiring the highest force at initial fracture. The moderately worn tooth, which had 2 cusps in contact with the food object at the point of failure, required the lowest force at initial fracture. The heavily worn tooth, which had a single enamel ridge in contact at the point of failure, showed a slight increase in force at initial fracture compared to the moderately worn tooth replicas but still required less force than the unworn tooth replica.

The prediction that the unworn molars of younger individuals require lower forces than the worn molars of older individuals to fracture the hard food objects is partially supported by the results. The youngest individuals with unworn teeth are not fully weaned, and so it is possible that inefficiencies in food breakdown are supplemented via maternal milk. Moderate wear in the dentition of *C. atys* occurs early in development when the individuals are fully weaned but still have a mixed dentition and are not full adult size. Individuals with moderate wear are eating the same diet as full adults but have smaller muscles and so can generate lower bite forces. The results show that the moderate tooth wear at this stage allows the hard food items to be fractured at lower forces than the more worn teeth in the adults, compensating for the lower bite forces and so could provide a means of functional maintenance of food breakdown from weaning through into adulthood. This work highlights the complexity and possible functional implications of dental wear during development.

Poster Presentation Number 2, Fr (12:15-14:15)

Is ESHE a partisan event? A quantitative assessment of differences in visualisation practices among Anglophone and French lithic scholars and the issue of pluralism in palaeo-archaeological research

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ESHE aims to be a meeting place of pan-European research on human cultural and biological evolution. Although it has been founded explicitly as *the* European counterpart to PAS, the Paleoanthroplogy Society, ESHE's annual meetings have been relatively unsuccessful in bringing together the full spectrum of research traditions that exist on the European landscape, especially when lithic analysis is concerned. This paper focuses in particular on the divide between French and Anglophone research traditions ([1], [2]). It argues that in order to satisfy its 'European ambition', ESHE has to acknowledge the multi-paradigmatic nature of the European research enterprise and to promote it *actively*. In a first step, the paper will show that the divide between French and Anglophone (U.S./U.K.) research on lithic technology is both real and robust. In a second step, it will be demonstrated that these differences translate into different and, in fact, often opposing knowledge claims. In a third step, finally, it is shown that French-type lithic analysis tends to be underrepresented on ESHE's annual meetings. As a result, ESHE practically reproduces some of the fault lines that characterise the French/Anglophone divide – a situation which threatens to undermine ESHE's pan-European ambition.

To test the reality of the French/Anglophone divide in lithic analysis, a data base of recent scientific papers (published between 2003 and 2017 mostly in peer-reviewed high-profile journals) has been created (n=100). First authors have been grouped into one of the two traditions based on their sociological and institutional background(s). Since current theory of science suggests that scientific visualisations play a key role in knowledge formation and can thus be utilised as a proxy for different styles of reasoning ([3,4,5]), types and frequencies of lithic visualisations (artefact drawings, statistical tables, diagrams, etc.) have been recorded for each individual paper ($\sim$ 100 variables). By conducting a simple discriminant analysis, it is then shown that French and Anglophone research backgrounds are coextensive with distinct and mutually exclusive practices of visualising lithic data and results. A network analytical approach confirms this finding and reveals that socio-institutional background is a strong predictor for shared types of visualisation in the field. Comparing the nature and frequency of the recorded visualisations with the general type of conclusion(s) they support (measured on an a graded scale between 'internalist' and 'externalist' explanations) indicates that the relationship between knowledge claims and visualisation practices is co-constitutive; this suggests that knowledge claims are underdetermined by the lithic evidence. The quantification of lithic research presented on ESHE meetings finally reveals that Anglophone scholars are commonly overrepresented.

Since both French and Anglophone approaches to lithic technology represent a legitimate epistemic endeavour and since both continue to be productive in their own right, this paper calls for the need to productively re-engage with French-type lithic research on the ESHE-level. Rather than remaining silent on the issue or tolerating partisanship, ESHE should actively promote pluralism and encourage its members to do the same. New efforts to invite proponents of French *"Technologie préhistoire"* would be a first step into this direction.

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Poster Presentation Number 77, Th (12:15-14:15)

The cranium of *Ouranopithecus macedoniensis*: virtual reconstruction and comparative analysis

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The genus *Ouranopithecus* has been documented since 1974 in the late Miocene deposits of Northern Greece in the form of several mandibles, a number of teeth and an almost complete face (XIR-1) of *Ouranopithecus macedoniensis*. The specimen XIR-1 belongs to an adult male and was discovered in 1989 in the locality Xirochori 1 (XIR), in association with mammal fauna [1]. The face of XIR-1 is well preserved, but slightly distorted as a result of taphonomic processes. The right side of the lower face is complete, and a big portion of the frontal bone as well as part of the left side of the face is preserved. The age of *O. macedoniensis* ranges between 9.6-8.7 Ma, based on magnetostratigraphical and biochronological data [2-3]. The aim of this study is, first, to virtually restore symmetry to the deformed face of the XIR-1 cranium and to reconstruct its facial anatomy using mirror imaging, a virtual anthropology technique. Second, to conduct a comparative analysis of the specimen's reconstructed facial morphology using 3D geometric morphometrics and a comparative sample of other fossil hominoids and extant great apes, in order to test the hypotheses proposed for its phylogenetic position. Over the years, *O. macedoniensis* has been hypothesized to represent either a sister group of the australopithecines and *Homo* or as the ancestor of *Gorilla* or *Pongo* [e.g.4-5]. High-resolution computed tomography (CT) was used to create a digital representation of the XIR-1 specimen. A virtual reconstruction of its facial area was achieved by using a mirror image of the better-preserved side, so as to restore bilateral symmetry. Additionally, a set of anatomical landmarks (51) were registered on adult crania of extant great apes and fossil hominoids from Eurasia and Africa and multivariate statistical analyses were applied. Preliminary results indicate that *Ouranopithecus* is more similar to *Gorilla* than to *Homo*, *Pan* or *Pongo*, and support the hypothesis that the overall shape of the face of *O. macedoniensis* is most similar to *Gorilla* and Eurasian dryopithecines (*Dryopithecus* and *Hispanopithecus*). This study forms the first attempt of correcting the symmetry of the XIR-1 cranium, using 3D techniques, and the results of the multivariate statistical analyses help us to better understand the phylogenetic relationships of this important early hominoid.

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Podium Presentation: Session 1, Th (9:00)

Enigmatic Neanderthal structures (Bruniquel Cave, SW, France).

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Since 1990, the Bruniquel Cave is known for its enigmatic circular structures of broken, stalagmites. At ∼330 meters from the entrance, a large circular structure is made of three to four superposed levels of broken stalagmites to form a low wall [2]. Small stalagmites or stalagmite pieces are used in the structure to give support and longer ones are used as vertical stays as to strengthen the wall. In total, between 2.1 and 2.4 tons of moved material represented by 400 stalagmite pieces (now defined as 'speleofacts') are used to build the large circular structure (A), a smaller one (B) and four accumulation structures (C-D-E-F). Several fireplaces, more than eighteen, are observed on each structure and are principally located on the stalagmites. Only one fireplace located on the floor was clearly identified. The different fireplaces were confirmed by magnetic measurements.

U-series dating performed in 2015 revealed the unexpected age of 176 500 years (±2 100) [1]. The authors of these structures are therefore most probably early Neanderthals (*Homo neanderthalensis*).

They entered caves and obviously mastered the underground area some 140 000 years before modern humans (*Homo sapiens*). The current interdisciplinary study aims to provide responses to the numerous questions concerning this site, i.e. the function of the structures, the reasons for an implementation far from daylight or the status of the authors of the constructions. The environmental study at the scale of the cave (topography, dating, internal climatological, sedimentological and hydrological functioning), of the external site (geomorphology) and of the more extended regional area (paleoclimatology) is also crucial to answer some of these questions. Since the publication of the study in Nature, the investigations continued. The thematic maps confirm the specific structuring of the constructions. Forthcoming studies concerns experimental studies about the fireplaces, the type of the material used to make fires. The location and the local environment of the former entrance need to be confirmed. Finally new traces of human presence inside the cave in particular concerning lighting were observed. These new findings clearly demonstrate that Neanderthal entered and mastered the underground area approximately 130 000 years before Anatomically Modern Humans.

French Ministry of Culture, DRAC Occitanie, Toulouse

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Pecha Kucha Presentation: Session 2, Th (11:50-12:15)

Cordial co-existence, competition, or avoidance strategies? Understanding the human ecological niche through the palaeoecology of the top-predators in northwestern Europe during the Late Pleistocene

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Despite some strong fluctuating environmental and ecological pressures between the MIS 5 and 3, human Palaeolithic groups, just like a large amount of other great predators, cohabited in northwestern Europe. They lived sympatrically; particularly in karstic regions like southern England and the Meuse valley in southern Belgium. Already considered as 'fellow travellers', it has been suggested that the main competitors humans and hyaenas probably moved in concert, following the spatial dynamics of the ungulate communities [1]. Recent isotopic studies undertaken on Belgian material suggested however that the diets of Neanderthals and hyaenas did not overlap, proposing that they occupied two different ecological niches [2]. As a part of a doctoral project, we explored differential diets, interactions and spatiotemporal strategies of those top-predators through zooarchaeological, taphonomical and cementochronological analyses. We propose to present here our results. For this study, we analysed four different assemblages from the Meuse valley and the surrounding area, anthropogenic and carnivores-accumulated, delivering data on direct and indirect competitions between the top-predators. Two of them are mixed assemblages from karstic sites (Trou Magrite and Tiène des Maulins, Belgium), another is a hyaena den (Caverne Marie-Jeanne, Belgium), and a final one is a mixed assemblage coming from an open-air site (Hénin-sur-Cojeul, northern France). Detailed faunal and taphonomic studies have been conducted (biotic agents, faunal spectra, skeletal elements on the site, skeletal element modified by each of the agents, butchery marks, etc.), informing on the nature and the intensity of the competition. In a second phase, we proceeded to cementum analyses in order to compare the seasonality of predation and the spatiotemporal strategies of humans and hyenas. These analyses were part of the ANR CemeNTAA project and were enabled by our new standardized protocol [3]. Our study shows that hominins and hyaenas hunted almost the same prey species in the Mosan basin, namely horses, bovins and megaherbivores; but some assemblages show a clear difference in their composition depending on the agent considered (faunal spectra and age profiles). The cementochronological analysis shows that human groups occupied the Mosan basin mostly during the colder season, thereby confirming a previous hypothesis [4]. However, new data from hyaena-collected assemblages reveal a more heterogeneous seasonal signal, highlighting possible differential temporal strategies on an annual basis. These new data permit to greatly increase precision of the differential diets of the two main predators, allowing us to reconsider the boundaries of their ecological niche and to thus suggest a partial overlapping, at least periodically. Gauging the competition between the predators on its dietary, spatial and temporal dimensions, these results offer the possibility to know more about the reasons and modalities of the recurrent human incursions in the southern Mosan basin, despite the lack of first-choice raw material in this area and ecological pressures due to a high density of carnivores.

We are very grateful to the FNRS, IRSNB and the ANR CemeNTAA project for their help and financial support.

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Poster Presentation Number 130, Fr (12:15-14:15)

The patterns among human hand entheses are associated with occupational manual activities

Fotios Alexandros Karakostis[1], Gerhard Hotz[2], Heike Scherf[1], Joachim Wahl[3], Katerina Harvati[1]

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Reconstructing the habitual behavior of past human populations comprises a fundamental objective of anthropological sciences. In this context, the hands are of special importance as they constitute a fundamental source of interaction between humans and their surrounding environment. A plethora of previous studies has utilized the morphology of entheses (i.e., the areas of the bones where muscles attach) as a marker of occupational stress [1]. However, until now, there is no clear and direct evidence that enteseal form reflects the nature of human individuals' lifelong occupational tasks. Previous research has developed a new and precise 3-dimensional method for quantifying hand entheseal surfaces [2]. In this study, using this quantitative method on a sample of mid-19th century skeletal remains from Basel (Switzerland) with rarely detailed documentation on the individuals' occupation over several years before death [3], we investigated the statistical association between occupation and the morphometric patterns among hand entheses. A total of 270 hand bones from 45 adult male individuals – whose biological age ranged from 18 to 48 years – were surface scanned using high-resolution structured-light technology. Their entheseal areas were then delineated directly on the 3D models and quantified using a highly repeatable technique [2]. Subsequently, the patterns of hand entheses were explored using principal component analysis on both raw and size-adjusted variables. Furthermore, a series of correlation tests were used to investigate the impact of age-at-death, body mass, and hand bone length on the resulting patterns. Both multivariate analyses (using either raw or size-adjusted variables) identified two main patterns among hand entheseal surfaces, which were not significantly correlated with biological age. Individuals sharing the same or comparable occupations presented a similar relationship among entheseal 3-dimensional areas [4]. According to the historical sources and literature, it seems that specimens involved in intense manual labor showed a distinctive entheseal pattern, which is associated with sustained high grip strength. On the contrary, individuals performing less demanding and/or mechanized occupational tasks presented a pattern with proportionally larger entheses of the thumb intrinsic muscles [4].

We are very grateful to the team of the 'Citizen Science Project Basel Spitalfriedhof' (University of Basel), and especially to the team of the genealogists: Marina Zulauf-Semmler, Diana Gysin, Marie-Louise Gama and Odette Haas, for providing us with vital information on the background of the samples analyzed. Special thanks should also be given to Albert Spycher for his valuable advice surrounding the occupational activities in Basel during the 19th century. K.H. was supported by the German Research Foundation (DFG FOR 2237: Project "Words, Bones, Genes, Tools: Tracking Linguistic, Cultural, and Biological Trajectories of the Human Past"). F.A.K. was supported by the German Academic Exchange Service (91584619) and the A. G. Leventis Foundation (12386).

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Pecha Kucha Presentation: Session 6, Fr (11:00-11:25)

The Jutland Peninsula of northern Europe: Neanderthal corridor or cul-de-sac?

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The northern range of Neanderthals (*Homo neanderthalensis*) and the factors driving and constraining these ephemeral expansions are not well-understood. Renewed archaeological focus is therefore necessary in historically overlooked regions of the northern periphery. To this end, new results of a largescale study of the Pleistocene archaeological potential of the Jutland Peninsula, containing the German state of Schleswig-Holstein and the continental portion of Denmark, are presented. This study includes a regional assessment of the climatic, environmental and geographical times of opportunity for potential hominin expansion as well as an assessment of the geological conditions for archaeological site preservation. The conclusions stress the potential of interstadial landscapes (rather than full interglacials) and identify a number of localities suitable for prospective reconnaissance. With this baseline as motivation, new investigations are initiated at the site of Schalkholz (54.24^{o} N, 9.27^{o}E) in Schleswig-Holstein, Germany, which will also be presented. This site potentially holds the most northern Neanderthal lithic artefacts from an early Weichselian stratigraphic context ($\sim$ Brørup Interstadial), and is therefore crucial for understanding hominin mobility during interstadial conditions. The site was originally detected in the late 1970s but never formally excavated [1]. The new investigations are aimed particularly at two clarifying aspects: 1) documenting and verifying the anthropogenic and technological integrity of the original 11 lithic finds through renewed typological and morphometric studies, and 2) resolving the preservation and potential for new find recovery at the original site location through preliminary field work and excavation (planned for Summer 2017 and funded by Aarhus University Research Foundation). The overarching aim of these activities is to assess to what degree the Jutland peninsula functioned as an ephemeral migration corridor or cul-de-sac for northern Neanderthals. This regional case-study has implications for understanding the drivers and constraints of Neanderthal dispersal in a wider perspective and therefore embeds significant potential for obtaining new information on Neanderthal biogeographical behaviour.

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Pecha Kucha Presentation: Session 10, Sa(11:25-11:50)

Getting a grip in the Lower Palaeolithic: an empirical analysis of grip diversity and frequencies of employment during stone-tool use

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Relative to other extant apes, modern human hands are unique in both anatomy and manipulative capabilities. For over half a century the use and production of stone-tools has been hypothesized to have created selective pressures contributing to the evolution of these attributes. Much of the research undertaken in this regard has focussed on the grips required to securely hold flake and core tools. To date, however, there has yet to be a large-scale analysis of the grips employed during stone-tool use or an empirical analysis of the frequency with which different grips are utilised. To address this gap, we conducted two experimental studies that empirically detail the diversity of grips employed during Lower Palaeolithic stone-tool use behaviours, and for the first time, their relative frequencies of use during variable cutting tasks. The first set of experiments utilized flake and bifacial core tools (n = 122 subjects; n = 1022 tools) in a series of laboratory-based cutting tasks. The second set employed a single skilled butcher who used flake and bifacial core tools to deflesh and disarticulate domestic goat and cow carcass segments (n = 1 subject; n = 28 tools).

We identify a diverse number of grips used by participants during both flake and core tool use. The majority are broadly in-line with precision grips previously described during stone-tool use (e.g. [1,2]); although marked diversity in the positioning if the 2nd-5th digits is notable. As has previously been recorded, the thumb is heavily recruited in almost all grips, and serves to secure the tool against regions of the fingers and palm. We do, however, also note a substantial and apparently forceful role for the index finger in opposing the cutting edge of tools, providing a counteraction to both the "push" and "pull" motions of cutting. We argue that although the important role of the index finger has been previously noted [2,3], and recent findings show high pressure on the index finger during flake use [4], the high frequency, and at times force, with which it is recruited here indicates that it plays a significant role in tool use. As a result, changes to index finger morphology throughout the hominin fossil record may offer better signals to changes in tool-use behaviours and manipulation than previously recognised. Three previously undescribed grips are also recorded for stone-tool use, although these are used infrequently. Frequency data indicate that a few principal grips are central to the use of Lower Palaeolithic stone-tools and should form the focus of analyses investigating the tool-related gripping capabilities of fossil hominins. Subsequently, the diversity of grips recorded here stems largely from periods of trial and error when finding appropriately comfortable grips for a given task or tool form, or when using tools that are of an inappropriate form for a given cutting task.

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Podium Presentation: Session 5, Fr (10:20)

The Last Interglacial (Eemian) lakeland of Neumark-Nord (Saxony-Anhalt, GER). Reconstructing Neanderthal occupations and subsistence opportunities based on estimations of ungulate biomass production

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Human diet in the Pleistocene was substantially based on ungulate hunting. Ungulate carrying capacity in past ecosystems must have been a key factor influencing human subsistence in terms of prey choice, mobility as well as social organization and population size. Thus, defining the past biocoenosis, from which a studied thanatocoenosis originates, is a major challenge in the study of human subsistence based on faunal analysis. For the last interglacial (Eemian) forested ecosystem on the Northern European Plain, rather unfavorable conditions for Neanderthal hunters were reconstructed compared to open mammoth steppe environments during glacial periods. Like modern-day temperate and tropical forests, the Eemian deciduous forests would have been characterized by a high primary production and high primary biomass. Most of this richness would have consisted of trees and vegetational resources relatively expensive to process and only available over short periods of time, while meat must have been a critical food source. In contrast to the open mammoth steppe environments, ungulate biomass in forested environments would have been significantly lower and more dispersed, complicating the detection, tracking, and killing of prey. Based on the faunal and palaeoenvironmental evidence from Neumark-Nord, Germany, we can qualify aspects of ungulate biomass and Neanderthal subsistence opportunities during the Eemian. Major determinants of the carrying capacity of an ecosystem are temperature and rainfall. Reconstruction of both parameters in the region of Neumark-Nord during the Eemian allows us to give estimates of ungulate carrying capacity and biomass production. At Neumark-Nord (two lake basins: NN1 and NN2) the remains of more than 500 larger mammal individuals were uncovered. The high-resolution palaeoenvironmental record of Neumark-Nord allows the definition of different thanatocoenoses attributed to the different pollen stages of the Eemian succession. For each thanatocoenosis we provide species composition, the rate of human involvement as well as calculations of overall body weight and caloric values. The combination of the calculated (theoretical) carrying capacity and the (factual) biomass of the death assemblages allows us to construct a frame of subsistence opportunities and to compare them with observed subsistence patterns at Neumark-Nord. This discussion circles around the following questions:

1. Could and did ungulate biomass at Neumark-Nord reach the Carrying Capacity?
2. What is the size of the "catchment area" of the ungulates deposited at Neumark-Nord?
3. How did ungulate biomass influence Neanderthal organization (i.e. mobility, group size) in the region of Neumark-Nord?
4. What can we say about prey choice at Neumark-Nord?
5. Can we measure an impact of Neanderthals on ungulate populations during the Eemian at Neumark-Nord?

Poster Presentation Number 20, Fr (12:15-14:15)

The *Elephas (Palaeoloxodon) antiquus* skeleton and other large mammals from the Lower Palaeolithic locality Marathousa 1 (Megalopolis Basin, Greece): preliminary results

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The Megalopolis Basin (Peloponnesus, Greece) has long been known for its Middle Pleistocene mammal fossils (see [1] and references therein). In 2013 a palaeolithic/palaeoanthropological survey, conducted by a joint team from the Ephorate of Palaeoanthropology Speleology of the Greek Ministry of Culture and the University of Tübingen, led to the discovery of a new open-air locality, Marathousa-1 (MAR-1), when stratified bones and lithic artefacts were identified in a section of the Marathousa Member, Choremi Formation [2]. The preliminary ESR analysis dates the locality at 0.5-0.4 Ma [3]. The large mammal faunal material collected so far (2013-2016) includes the castorid *Castor fiber*, the mustelids *Lutra simplicidens* and *Mustela* sp., the felid *Felis* sp., the canids *Vulpes* sp. and *Canis* sp., the elephantid *Elephas (Palaeoloxodon) antiquus*, the hippopotamid *Hippopotamus antiquus*, the bovid *Bison* sp., and the cervids *Dama* sp. and *Cervus elaphus*. This faunal association is common in the Galerian mammal communities of Europe (ca. 0.9-0.4 Ma). Furthermore, it is consistent with a temperate climate, and is indicative of a landscape with substantial woodland components and more open areas, close to permanent and large freshwater bodies. Of particular interest are an elephant cranium and numerous postcranial elements, which were found in close anatomical association and are attributed to a single individual of the straight-tusked elephant *Elephas (P.) antiquus*. The skeleton belonged to an old male in its sixties, with live skeletal height around 3.7 meters and body mass around 9.0 tones. The good state of preservation of the MAR-1 bones allows the identification of taphonomic modifications. Three-dimensional virtual reconstructions of marks with the use of a confocal microscope enabled the identification of cut marks and their micromorphological characteristics. Cut marks and percussion damage indicate hominin exploitation of the elephant carcass and other mammal bones by means of butchering activities, which is in accordance with the lithic assemblage and its spatial association with the bones. Carnivore gnawing is also evident on some specimens, suggesting a certain degree of carnivore competition with humans for early access to the animal carcasses. Marathousa-1 is among the oldest elephant butchering sites in Europe and the only one known in Southeastern Europe.

This research was supported by the ERC-STG-283503 ("PaGE") and the University of Tübingen. We are grateful to the Ministry of Culture, the Municipality of Megalopolis, the authorities of the Region of Peloponnese and the Public Power Corporation S.A. for their support.

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Pecha Kucha Presentation: Session 10, Sa (11:25-11:50)

Perfect pitch: An experimental comparison of aceramic birch bark distillation and its implications for Neandertal adhesive technology

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The Palaeolithic production and use of adhesives for hafting has featured in recent discussions about the technological and cognitive abilities of both Neandertals and modern humans [1,2]. Tar lumps found at some middle Paleolithic sites are considered to be evidence for one of the oldest transformative technologies in human evolution. It is believed that in order to produce a successful adhesive, the abilities to precisely control fire temperature and to manipulate specific material properties required advanced mental traits such as abstraction and forward planning. However, we currently know very little about Neandertal adhesives, in particular how birch bark tar was being manufactured with aceramic techniques. Because of this, we are lacking crucial information such as how precise temperature control needed to be, and ultimately how big of an innovation birch bark tar production really was. This presentation showcases experiments in which we tested and compared a novel set of aceramic techniques that could have been used to produce tar during the Palaeolithic. Each method can produce quantities of tar similar to what has been found in the archaeological record. We have compared the fuel, time, materials, temperatures, and tar yield from each method to demonstrate that Neandertals could have invented and reinvented the dry distillation of birch bark to produce glue by recombining knowledge and material they already had. The technology of aceramic tar production likely went through several stages of development including what we detailed here. This process began with a simple method containing only birch bark and fire, and may have later evolved to more complex methods with higher tar yields. A ceramic or heat-resistant container is not required, and temperature control is necessary but need not be as precise as previously thought. For Neandertals to turn this invention into a perennial innovation, however, they must have been driven by their curiosity of material transformations and properties like tack and viscosity, as well as had the necessary social structure to retain the knowledge of successful techniques.

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Podium Presentation: Session 1, Th (9:40)

Spatial taphonomy and post-mortem disarticulation patterns of the *Homo naledi* assemblage from the Dinaledi Chamber, Rising Star Cave

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The Dinaledi Chamber of the Rising Star Cave has yielded over 1550 elements of *Homo naledi*, and is the largest single collection of fossil hominin material found on the African continent to date. The extent of material recovered thus far has been limited to the collection of bone material from the surfaces of the chamber floor and the excavation of a single 1m x 1m unit in the central zone of the cave. The assemblage is commingled, and contains the remains of multiple adult and immature individuals. Although there are several clear examples of skeletal elements in anatomical articulation, none of these articulated units unequivocally extend to whole limbs, and it has not been possible to individuate single bodies within the assemblage. As such, we have had to adopt multiple lines of evidence from analyses of spatial distribution and bone clustering in an attempt to understand both the extent of fossil dispersal within the cave, as well as the processes by which fossils may have accumulated in the chamber.

For the present study, we examined the spatial locations of 792 hominin bone specimens from the Dinaledi Chamber. Of these, 283 were recovered from the surface of the chamber floor, while 509 specimens were recovered from within the extant floor sediment load. A combination of registered white-light photogrammetry and high-resolution laser scans were used to collect three-dimensional data, providing an accurate spatial location of each specimen. Subsequent analyses of spatial data comprised: (1) analysis of overall surface distribution and regions of apparent bone concentration; (2) statistical cluster analysis in both two and three-dimensions to characterize internal structure in spatial loci; (3) analysis of conjoins within the chamber to investigate up-slope or down-slope movement of fossils; and (4) the analysis of associated and articulated anatomical elements to elucidate the region of ingress into the chamber.

Three main clusters of surface material were identified which show a concentration of fossils within the central region of the chamber, and a clear drop-off in fossil density in both adjacent passages and up-slope towards the chamber entrance. In the excavated deposits, we identified clusters by body part which are best attributed to the decomposition and disarticulation of the anatomical regions of multiple individuals in a confined space, with limited winnowing of bones by size or element. A general downslope trend in the angular alignment of elements was noted, suggesting post-mortem movement of bones within their encapsulating matrix. The present distribution of bone may be most parsimoniously explained by downslope movement of floor sediment load which has carried osseous material as part of gravity-led slope processes. Further investigations of subsurface deposits in other parts of the chamber are needed in order to resolve specific issues regarding the point of ingress of bodies into the chamber and differing hypotheses are highlighted here regarding possible patterns of intentionality in the introduction of anatomical units into the Dinaledi Chamber.

Poster Presentation Number 127, Th (12:15-14:15)

Do Lifestyle Factors Affect Pelvic Shape in Eastern European Males? A Computed Tomography Comparative Study

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Objectives: The significantly accelerated development of human society in the last millennium has brought changes in human behavior, particularly in terms of diet, modes of transportation, daily activities, and occupations. Taking into account that locomotion and body weight are transmitted to the lower limbs through the pelvis, the question arises whether changes in lifestyle and body weight have resulted in variation in pelvis shape. We tested two hypotheses: 1) men from a modern population are characterized by a different pelvis shape than individuals from the Medieval Ages due to different lifestyles; 2) body weight influences the shape of the pelvic girdle in males.

Materials and Methods: We obtained 22 pelvic girdles of adult males from a medieval cemetery located in Cedynia, Poland. The control group comprised 31 contemporary male pelvises from individuals of the same region. The parameters analyzed included interspinous distance (ISD), intercristal distance (ICD), intertuberous distance (ITD), anatomic conjugate of the pelvis, height of the pelvis (HP), iliac opening angle (IOA), iliac tilt angle (ITA), and ISD/ITD/HP ratio. Geometric morphometrics was used to analyze shape differences in the pelvis. All analyzes were carried out on three-dimensional CT reconstructions of the pelvis.

Results: Mean ISD, ICD, and IOA were significantly greater in the modern than in the Cedynia pelvises, but no significant differences were seen between groups in ITD, anatomical conjugate, HP, or ITA. The ISD/ITD/HP ratio was significantly lower in the Cedynia group. Geometric morphometrics revealed significant pelvic shape differences between analyzed groups.

Discussion: The study revealed significant changes in the shape of the male pelvic girdle over the last 40–50 generations. The modern pelvis is larger, wider, and flatter than its medieval counterpart. This differentiation in pelvic shape in males cannot be explained as a consequence of differences in body size, as we found that the base of the sacrum area and overall pelvic size, computed as centroid size, was similar in the medieval and contemporary samples. After exclusion of climatic, genetic, and geographic variables, the factors that enhance changes in the shape of the pelvis appear to be shifts in levels of physical activity and increased body mass. Similar research, analyzing changes in female pelvises, is necessary.

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Poster Presentation Number 76, Fr (12:15-14:15)

Ancestral state reconstruction of dental development in Miocene fossil taxa

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Primate fossil taxa from the Miocene are fundamental to understanding the evolutionary divergence between great apes and humans and remain an important taxonomic context with which to examine hominin evolution. Teeth remain the most abundant fossils, and reconstructing dental development using dental microstructure provides information on the life history of fossil taxa. Dental microstructure preserves a temporal record of development preserved in the form of short and long period incremental lines in enamel and dentine. When quantified they show patterns of development shared between closely related taxa. While numerous studies have described dental development in Miocene fossils in relation to modern apes, none have evaluated whether the ontogenetic record preserved in dental microstructure provides insight into the evolutionary relationships of fossil and extant primate taxa. This study reconstructs the ancestral state of traits in enamel from extant primates to determine whether any of the Miocene fossil taxa with reported enamel development are potential candidates of the last common ancestor of the great apes. Dental microstructure traits include daily secretion rate, periodicity of long-period Retzius lines, extension rates, cuspal, imbricational, and cusp-specific formation times, cuspal enamel thickness, and perikymata counts collected from a sample of 42 extant primates combined with 14 Miocene fossil taxa. Traits were reconstructed on an extant phylogeny based on primate molecular data. Results suggest that the fossil taxa *Anapithecus hernyaki* and *Vicotoriapithecus macinnesi* express character states consistent with the expected basal nodes for the Cercopithecoidea, with *Victoriapithecus* sharing more ancestral states with the expected ancestral state of the papionini primates. The reconstructed ancestral states suggest that the last common ancestor of the great apes exhibited rapid enamel development relative to the living apes and none of the Miocene fossil apes with known dental development data fit the reconstructed ancestral values.

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Poster Presentation Number 55, Th (12:15-14:15)

Chronology of two Middle Palaeolithic-Châtelperonnian-Upper Palaeolithic sequences in open-air sites in Southwest France: Les Vieux Coutets and Canolle Ferme studies.

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The transition from the Middle to the Upper Palaeolithic, and mainly the status of the Châptelperronian technocomplex, is still an issue, at least from a chronological point of view. Châtelperronian layers of occupation that are simultaneously well-defined and well-dated are uncommon, and open-air Châtelperronian occupations with these characteristics are almost non-existent. Yet the potential complementarity of rockshelters and open-air sites occupations is essential. Les Vieux Coutets is an open-air site that was discovered in 2002 and excavated in 2003; it is situated in Creysse, near the city of Bergerac, in Dordogne, France. The site presents three Palaeolithic occupations: a Middle Palaeolithic occupation, attributed to the Mousterian of Acheulean tradition, underlies a Châtelperonnian level. The upper layer is attributed to the Early Aurigniacian . Canolle Ferme site also is an open-air site, situated in the same area, where a complex mosaic of occupations was unearthed in a 300m radius (Barbas I, II, II and V, Les Rigoux, Canaule II... See). It was discovered and excavated in 2012. The site presents at least three occupation phases, with a Mousterian of Acheulean tradition level upstream, sometimes in contact with a gravel layer, that can be observed all over the stratigraphic profile, and two Châtelperronian heaps. Downstream, a Gravettian layer was unearthed. A sinkhole is present in this second part of the site. The chronological study of both sites has been conducted with different goals: basically, to give a chronological framework for these two precise Châtelperronian occupations, but also to construct a chronological framework for the numerous occupations observed previously in the neighbourhood. It also gave us a good opportunity to bring new information to better understand the Châtelperronian chronology, the dated levels in open-air sites still being very rare. The two chronological sequences were obtained using Thermoluminescence (TL) studies of heated flints, multi-grain Optically Stimulated Luminescence (OSL) studies on quartz grains, and completed with single-grain OSL studies on quartz grains. The chronological frameworks were then established using a set of recently developed Bayesian models , thus taking into account both luminescence measurements results and stratigraphic constraints.

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Poster Presentation Number 148, Fr (12:15-14:15)

Rethinking foramen magnum position as a proxy for locomotion

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The relative antero-posterior position of the *foramen magnum* (PFM) along the skull base has been commonly used as a proxy for locomotion and has been used to infer locomotor behaviours of fossil hominins [1,2]. Several indices have been designed to quantify PFM, but their relationship to postural and locomotor behaviours has led to contradictory results [3,4]. In this study, we used a broad sample of living primates and fossil hominins (81 species, 304 individuals) to investigate the power of the PFM in discriminating between different locomotor categories. We compared four different measures of PFM: *opistocranion-prosthion* (OP-PR) and *opistocranion-glabella* lengths (OP-GL), *basion-biporion* (BA-BP) and *basion*-bicarotid (BA-BC) chords. We tested for multivariate correlation between PFM and locomotion, cranial base shape and size. The analysis was performed on the following hierarchical clusters, moving from most to least inclusive: Primates (Strepsirrhines, Haplorrhines), Catarrhines, Hominoidea (all the groups including modern humans and fossil hominins). We also calculated the PFM in a subsample of non-human Primates. Phylogenetic relatedness was taken into account by using a phylogenetic least squares approach. Our results show that the methodological framework is crucial when investigating locomotion from PFM. The OP-GL and OP-PR measurements seem to better discriminate locomotion in Primates, Catarrhines and Hominoidea compared to BA-BC and BA-BP methods. The BA-BC measurement does not discriminate between locomotor patterns at any hierarchical level. In addition, when hominins are excluded from the sample (non-human Primates), none of the methods results statistically significant. In addition, cranial base shape and size do not show a significant correlation with locomotion in any of the group tested. In conclusion, this study suggests that the relation between *foramen magnum* position and locomotion here observed is mainly due to the hominin subsample; in fact, in non-human Primates, *foramen magnum* position is not linked to locomotion, when phylogeny is taken into account. Also, in Primates, the cranial base region may have not evolved as a specialised structure for locomotion, as a result of the several connections with other cranial and post-cranial modules .

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Poster Presentation Number 54, Fr (12:15-14:15)

Optical dating of the Saalian glacial cycle and the onset of the Middle Paleolithic in central Germany

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The Saalian complex in the northwestern European quaternary stratigraphy is post-dating the Holsteinian interglacial and consists of several cold and warm stages. Due to the debated age of the Holsteinian of either MIS 9 or 11 [1] and a lack of resilient ages for sediments representing the Saalian complex, its onset is still unclear. However, the Saalian glacial cycle is characterized by various periods of fluvial aggradation and incision, mainly triggered by climatic shifts. The preserved fluvial sand and gravel, mostly deposited under cold-stage climate conditions form the so called Saalian Main Terrace. These deposits belong to different river systems, but they all overlay the Elsterian till and are in most cases covered by the Saalian ice advance deposits, dated to about 150 ka [2]. The basal parts of the Main Terrace are associated with stone artifacts. Some assemblages show clear Middle Paleolithic features, whereas others have a Clactonian character. Therefore, it is of high relevance to establish a chronological framework for the fluvial sedimentary sequences representing the Main Terrace system in central Germany to better understand the timing of a major technological shift in human flaking behavior, namely the Lower to Middle Paleolithic transition. Furthermore, age estimates are mandatory to understand the driving forces for periods of increased fluvial activity, aggradation and erosion.

In our study, we collected samples for luminescence- and infrared-radiofluorescence (IR-RF) dating from six different locations: Uichteritz and Schladebach in Saxony-Anhalt and Rehbach, Zwenkau, Delitzsch-Südwest and Markkleeberg in Saxony. Both sites in Saxony-Anhalt are associated with Lower Paleolithic artifacts [3, 5], whereas the assemblages from Saxony are Middle Paleolithic in character [4]. The samples were taken at the base, the center and the top part of each Main Terrace sequence.

Luminescence-dating is applied to coarse-grained potassium-feldspar. Equivalent dose estimations are mainly based on the pIRIR-approach and small aliquots are used for measurements. For selected samples, IR-RF is applied to cross-check results against those of pIRIR-dating.

Preliminary results from Uichteritz point to several periods of fluvial aggradation within the Saalian glacial cycle ranging from ~290 ka -180 ka. Preliminary IR-RF ages for the base of the Main Terrace in Delitzsch-Südwest suggest an onset for the regional Middle Paleolithic about 200 ka ago.

This work is dedicated to Matthias Krbetschek.

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Poster Presentation Number 98, Fr (12:15-14:15)

What can anterior tooth root morphometrics tell us about *Homo naledi*?

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The Dinaledi Chamber (Rising Star Cave system, South Africa [1]) has recently yielded around 190 fossilized dental elements (in situ and isolated) from a newly described hominin species, *Homo naledi*. The crowns of the *H. naledi* anterior teeth have been described as smaller than those of early *Homo*, and of comparable size as those of *Au. africanus* [1]. We investigate anterior tooth root morphology to further characterize the taxonomic status of *H. naledi* within the context of other Eurasian and African Plio-Pleistocene hominins.

Using conventional μCT, 35 *H. naledi* incisors and canines were scanned at the University of the Witwatersrand, with voxel sizes ranging from 27.6 μm to 66.6 μm. The comparative dental samples ($\sim$ 100 anterior teeth) comprise early *Homo*, *Australopithecus*, and *Paranthropus* (scanned by the MPI-EVA on conventional portable μCT scanners with voxel sizes ranging from 13.72 μm to 91.23 μm), as well as, the Neanderthals and fossil and extant modern humans studied in [2] ($\sim$ 380 teeth). In VGStudio MAX 3.0, we measure the linear root length on standardized 2D sections oriented for accounting for root growth (the volume was centered on the pulp horn tip and then rotated to capture the maximum extension of the roots). In some instances, the roots were so curved, that we measured a curved root length. When the root tips were taphonomically or developmentally incomplete and that more than the two thirds of the root were preserved, we estimated the missing portion as in [2]. We also measured the cervical diameters of each tooth as well as its maximum labio-lingual crown diameter on virtual 2D sections optimized for crown development [3]. We also scored incisal wear after [4], and the presence/absence of hypercementosis and tertiary dentine.

Our results show that in terms of root length, *H. naledi* overlaps with Neanderthals, fossil and extant modern humans for all anterior teeth, and more specifically with the *Paranthropus* and *Au. africanus* for the incisors. Some of the *H. naledi* mandibular central incisors have shorter roots than the recent modern humans, while some of their maxillary lateral incisors have longer roots than modern humans. In the *H. naledi* sample, variability in root length is larger than that in labio-lingual crown diameter (the latter being similar to that in found in recent modern humans). The maxillary incisor crowns of *H. naledi* are comparable size to those of *P. robustus*, while the lower incisors and the upper canines overlap in size with both *Paranthropus* species. The upper canines and lower incisors of *H. naledi* are of similar crown size as those of early modern humans. In summary, *H. naledi* has overall short anterior tooth roots. The *H. naledi* and *P. robustus* anterior teeth show a quasi-systematic presence of significant hypercementosis from wear stage 3. The natural root shape of the *Au. africanus* and *P. boisei* maxillary anterior teeth can be highly curved, thus not necessarily related to a compensatory hypercementosis as already observed in chimpanzees. We discuss those findings in terms of anterior tooth use.

We are grateful to the organizers of the workshop on the *H. naledi* dental remains held in June 2016 at the University of the Witwatersrand. For access to fossils and scanning assistance we thank Bernhard Zipfel, Lee R. Berger, and Kudakwashe Jakata.

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Poster Presentation Number 122, Fr (12:15-14:15)

Stable Carbon Isotope Ecology of Small Mammals from the Sterkfontein Valley: Implications for Habitat Reconstruction in Mosaic Environments

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Carbon isotope analyses of tooth enamel have been widely employed by paleoanthropologists to understand past habitats. Most of these studies use large- to medium-bodied mammals and exclude small taxa. Yet, small mammals are abundant in the fossil record and diverse in dietary/habitat preference while having limited lifespans and home range sizes. These animals therefore may provide higher resolution paleohabitat information because the carbon isotope compositions of communities and/or taxa might reflect the composition of vegetation in local environments more accurately than larger-bodied species. As such, analyses of fossil small mammals hold promise for addressing questions about past environments and may provide useful complements to other paleoenvironmental proxies. In this study, we assessed the degree to which carbon isotope compositions of modern small mammal hair and tooth enamel record changes in habitat within a southern African savanna environment. Sampling sites ranged from very open (< 5% canopy cover) to wooded (∼ 60% canopy cover) and included grassland, mixed woodland and wetland (vlei) habitats. Hair samples were obtained by live trapping and enamel samples were collected from small mammal remains identified from the pellet accumulations of barn owl (Tyto alba africanus) roosts. For hair samples, we compared δ13C values between microhabitat types, and across taxa, in order to test whether these data follow predictable patterns based on local vegetation. We also compared community δ13C enamel compositions between microhabitat types to evaluate how well isotope data reflect vegetation composition associated with the roosts. Results were further divided into terrestrial insectivores–including Soricids (shrews) and Macroscelids (sengis or elephant shrews)–and rodents, on the basis that fundamental differences in dietary ecology separate the two groups. Our analyses of modern taxa suggest that both rodents and insectivorous small mammals preferentially consume C3 resources, even in habitats where C3 resources are relatively uncommon (e.g. open grasslands). Overall, insectivorous small mammals appear to better track the C3/C4 vegetation ratio of the habitats from which they derive, while the relationship between rodent carbon isotope values and vegetation composition is more complex. However, with appropriate taxonomic control and consideration of relative abundance, rodent carbon isotopic compositions may be used to investigate past habitats at fine scales. To complement this modern study, we performed isotopic analyses on the enamel of small mammal fossils from three hominin-bearing sites in the Cradle of Humankind World Heritage Site, South Africa. Results of these fossil analyses suggest a greater contribution of C4 resources to the diets of small mammals and thus the potential for more C4 grass cover at these sites in the past than characterizes the area today.

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Backed pieces and their significance in the Later Stone Age of the Horn of Africa.

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Classic definitions for the Later Stone Age (LSA) in eastern Africa often include the presence of microlithic industries [1]. However, what can be considered "microlithic" is hotly debated [2]. If, particularly in eastern Africa, many researchers tend to use the definition of small backed pieces for microliths, there is no consensus for what "small" means (varying from 25 to 30 or even 50mm in length). Backed pieces, considered without any indication of size, is a more inclusive category and corresponds to a type of retouch that can be objectively identified. The use of this broad category thus allows for more comprehensive diachronic comparisons of implements, regardless of their size. Backing is usually associated with a change in hafting solutions and the development of composite tools, which may be for a large part linked to projectile technologies. Although sporadically present at earlier periods, backing became a widespread technical process in the Late Pleistocene and Holocene, and this is why backed pieces are generally considered as a hallmark of the LSA.

However, the association of the LSA with backed pieces appear less clear in eastern Africa than in other regions. Backed pieces are present in assemblages with otherwise distinct Middle Stone Age characteristics and many assemblages attributed to the LSA (ca 50-2 ka) include a great diversity of backed pieces, along with other, more common types of tools. The homogeneity of the "backing phenomenon" in this region can thus be questioned: does it represent an innovation that subsequently spread? a series of independent innovations? expressions of functional or stylistic variability?

Here we present a review of the context in which these backed tools occur, with a focus on the Horn of Africa. We propose a comprehensive set of attributes and statistical methods to discriminate different groups within the backed tool population. Our classification system based on objective grounds allows us to get rid of equivocal terminologies and to make inter-site comparisons more operative in order to discuss some of the hypotheses for the variability of backed pieces in the Late Pleistocene and Holocene.

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Poster Presentation Number 144, Fr (12:15-14:15)

Hominin and bipedalism definition: where do we stand?

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Bipedalism is considered to be a hallmark of the hominin lineage: therefore, paleoanthropologists use this defining feature as an interpretative criterion to determine if a fossil specimen belongs to the hominin clade. Major fossils found during last decades, such as *Ardipithecus ramidus*, *Orrorin tugenensis*, *Ardipithecus kadabba* and *Sahelanthropus tchadensis*, have provided an unprecedented opportunity to discuss the hypothesis that bipedalism is unique to the hominin lineage and marks its origin. And yet, this long overdue debate did not really take place. From an epistemological perspective, we demonstrate that the definition of the hominin clade based on bipedalism results in interpretative biases that are prejudicial to the discipline. Consequently, a paradigm shift is required to break the circular reasoning going from the definition of hominins as bipeds to the interpretation of any bipedal feature as necessarily hominin. First, we tackle the essentialist definition of the hominin clade based on bipedalism. On the basis that all and only the members of the tribe Hominini share the essential property of being bipeds, bipedalism is used as a necessary and sufficient criterion for membership of the tribe Hominini. Therefore, it is seen as a property that, when it is present, involves a hominin status and that excludes it, when it is absent. Such an essentialist use is reinforced by the fact that bipedalism has long been held to be a single event at the origin of the hominin lineage, rather than an evolving process. Yet, the current evidence of a postcranial variability and potentially locomotor diversity throughout the hominin clade has made clear that bipedalism is not only the property explanatory of the hominin evolutionary history: it covers a complex evolutionary process and consequently it cannot be used as an essential property providing a firm touchstone to sort fossil specimens. We also underscore that "bipedalism" is an ambiguous concept, which covers a wide range of locomotor and postural referentials, from occasional upright posture to obligate striding gait. Yet, the static concept of upright posture and the dynamic concept of bipedal walking are not always clearly distinguished. Besides, because "bipedalism" is equated with "hominin", the presence of characters consistent with a bipedal behaviour usually suffices to assert a commitment to bipedalism. Second, we show that these issues are the source of pervasive biases in fossil interpretations. The system of inferences going from morphology to function and to taxonomy/phylogeny results in a system of equivalencies between human-like/bipedal/hominin features. In contrast, we explain the issues pertaining to the qualification of features as intrinsically human-like, to the notion of unequivocal bipedal traits and to the inference from functional similarity to phylogenetic relationship. Third, we point crucial points out that may help the debate moving forward. Indeed, the paradigm shift that we are calling for from an epistemological perspective is already initiated by empirical and theoretical inputs. The postcranial variability and locomotor diversity evidenced by paleontology and primatology provide opportunities to challenge the uniqueness of hominin bipedalism. Developmental biology and epigenetics provide new resources in order to understand changes in hominin postcranium and their significance. We also notice that it is critical to include postcranial characters in cladistic analyses. Finally, we underscore that an epistemological approach is particularly needed in paleoanthropology and explain why the history and philosophy of this science is crucial in order to benefit plainly from future fossil finds.

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Poster Presentation Number 18, Fr (12:15-14:15)

SEM micrographs of pollen complexes as a source of pollen and palaeobotanical information on the Palaeolithic red earth layers of Atapuerca cave site (Spain)

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SEM studies of samples from different cave sites have shown that SEM micrographs of pollen complexes are the source of pollen and palaeobotanical information and the way to preserve it for the future. Pollen diagram based on traditional pollen studies of Atapuerca (Spain) cave site sediments was first published in 1999 and reprinted by E. Aguirre in 2008 [1, p.168]. SEM was not used for the studies. According to the archaeologists, pollen suitable for analysis was not obtained from Atapuerca cave site red earth samples treated by traditional methods. In 2014, red earth samples (10 and 10.3) from Atapuerca section that was demonstrated at 2014 UISPP Congress were kindly provided to G.M. Levkovskaya for treatment and SEM analysis according to the methodology suggested by the author. SEM researches of Palaeolithic pollen complexes from cave sites, especially data on Barakayevskaya cave [2, p.235], showed that in Pleistocene sediments only individual pollen grains were found because pollen were often coated with mineral colloid and disappeared from pollen complexes after centrifugation of the sediments with different heavy liquids. Samples of Atapuerca red earth were treated by four different chemical methods and results were compared using the SEM micrographs of pollen complexes. Alternated sample treatment with HF and HCl acids (triply repeated for each sample) and KI hard liquid for centrifugation enabled obtaining complexes with identifiable pollen grains, though partly colloided unidentified playnomorphs dominated. Only single identified colloided forms were found in the same samples treated by three other methods. The most important in the SEM analysis is to study both individual pollen grains and pollen complexes. The sample liquid is spotted on SEM tables and aurum-palladium admixture is dusted on the specimens after drying (methodology suggested in the BIN RAS). The identified part of the first pollen complex obtained for Atapuerca read earth sediments is dominated by *Alnus*. The single identified forms are represented by: trees (Pinaceae, *Juglans*), grasses (Cyperaceae, Poaceae) and water plants (pollen of Halorhagidaceae and spores of Osmundaceae). The numerous partly colloided unidentified palynomorphs dominate the complex. The SEM study of the samples allowed obtaining first palaeobotanial data. E. S. Chavchavadze and O. Yu. Sizonenko identified wood micro remains of angiospermous plant with burnt parenchyma. Accurate species determinition is not possible as the wood microremain is photographed in longitudinal orientation. The dense wood pore structure is the evidence of the wet climate. The obtained data shows that the studied sediments were formed in wet (presence of *Alnus* and water plants, specific morphology of wood microremain) but not cold (presence of *Juglans* and Osmundaceae) conditions. The test study of Atapuerca red earth demonstrates good prospectives for obtaining palaeobotanical and palynological information if the proposed methodology is applied.

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Poster Presentation Number 21, Th (12:15-14:15)

Preliminary taphonomical assessment of the macromammalian zooarchaeological assemblage at the late Early Pleistocene site of Cueva Negra del Estrecho del Río Quípar (Caravaca, Murcia, Spain)

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Cueva Negra, a spacious rockshelter (at 740m.a.s.l.; lat.38.03679, 38^o 02'12.5"N; long.-1.88494, 1^o 53'5.8"W), contains mainly fluviolacustrine sediment, deposited intermittently from an erstwhile swampy lake, without significant interruption [1] during a brief period between 0.78 and 0.99 Ma according to biochronology [2] and magnetostratigraphy [3]. Palaeopalynology, mammalian palaeontology and avian fauna (including 6 waterfowl species) indicate temperate, humid surroundings (plausibly MIS-21). Micro- and macromammalian remains are comparable with broadly contemporaneous faunal assemblages in the Iberian Peninsula (e.g., Atapuerca Gran Dolina TD6; Orce Basin FN-3 and BL-5 sites; Barranc de la Boella; Vallparadís; and in Murcia at Quibas and Cueva Victoria). Cueva Negra micromammals include *Pliomys episcopalis*, *Microtus (Victoriamys/Allophaiomys) chalinei*, *Microtus (Mimomys) savini*, *Microtus (Iberomys) huescarensis*, *Microtus (Stenocranius) gregaloides*, *Microtus (Terricola) arvalidens*, *Cricetulus (Allocricetus) bursae*, *Oryctolagus* cf. *giberti*, *Prolagus calpensis*, *Crocidura kornfeldi*, *Apodemus* cf. *sylvaticus*, *Sorex* sp., *Erinaceus europaeus*. Macromammals include *Megaloceros novocarthaginiensis*, *Dama vallonnetensis*, *Capreolus* sp., *Hemitragus bonali* or *Capra alba*, *Bison* cf. *voigtstedtensis*, *Equus altidens*, *Stephanorhinus* cf. *etruscus*, *Macaca* sp., *Sus scrofa*, *Lynx* sp., *Crocuta* sp., and fragments of proboscids, ursids, and mustelids.

Preliminary taphonomical assessment of macromammalian bones reveals well-preserved cortical surfaces showing sparse or nonexistent edge-rounding, and limited signs of trampling or weathering. Surfaces of bone excavated deeply in stratigraphical unit VI (below the combustion findings [4, 5]) bear signatures of root-etching, Mn precipitation, and solutional effects; the alterations imply sporadical waterlogging with negligible transport energy (responsible for accumulation of predominantly fine sediment in the cave [1]). Postdepositional processes and horizontal displacements were slight. Cutmarks and percussive marks are noteworthy on meat-rich humeral and femoral diaphyseal fragments. Green fractures occur across a broad range of macromammalian sizes. The assemblage is highly fragmented, 10-60 mm fragments predominating, especially from the deeper levels (where some carbonized or calcined bones attest to exposure to combustion). Carnivory is inferred from sporadical presence of tooth marks and columnar transversal fracture planes. Investigation of potentially competitive relationships between early humans and carnivores employed 3-D reconstruction that paid particular attention to cutmarks on bones. This technique enabled their geometric morphometrical analysis, thereby shedding light on the range of stone tools used for animal processing at the site.

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Poster Presentation Number 92, Fr (12:15-14:15)

Characterisation of Sima de los Huesos mandibular incisors dental tissue proportions using microtomography.

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The characterisation of hominin dental tissue proportions are now a common occurrence, and used in reconstructing phylogenies. The observations of the internal structure of fossil teeth have become increasingly important, especially since advancements in micro CT have allowed for accurate systematic, non-destructive methodologies to be undertaken [4]. The examination of incisors is extremely under reported for hominoids in the archaeological record for all dental measurements [5]. Despite the potential taxonomic and behavioural information they could provide. Examination of *Homo neanderthalensis* reveals that their anterior dentition was adapted to wear from frequent and/or heavy loading [2]. Systematic excavations at Sima de los Huesos (SH) (Sierra de Atapuerca, Burgos, Spain) dated to 430,000 have made significant contributions to the understanding of human evolution, renowned for its implications to the origins of Neanderthals [1,3]. Here we report the results of dental tissue proportions from a lingual-labial 2D plane of section. From this plane we obtained average enamel thickness (AET), relative enamel thickness (RET), and relative dentine area (RDA). We have also conducted 3D analysis of the incisors to allow for the inclusion of dimensional data absent from the 2D results [4]. Previous work concerning 3D analysis has revealed that enamel thickness is variable across the whole crown and might aid in the understanding of tooth function and phylogenetic signal, with the distribution of enamel indicating adaptations within different areas of the tooth. From the SH population, which is constrained geographically and temporally [3], a subset of central (6) and lateral (8) mandibular incisors were analysed using micro CT. This valuable contribution to the data of incisors will also be expanded, to allow for the comparative analysis of Neanderthals (7) and modern humans (35). Our Kruskal Wallis analysis revealed a significant difference ($p = 0.043$) between modern human and SH central incisor for AET, all other results were insignificant between the three species dental tissue proportions. Results signify that the SH population holds an intermediate position between Neanderthals and modern humans, with a notable increase in dentine surface area relative to modern humans. There is also a level of sexual dimorphism within dental tissue proportions similar to modern humans within the SH sample. We will discuss the implications of these results in relation to the phylogenetic position of the SH population. These dental tissue results are consistent with results published for Neanderthals and modern humans, but this is the first account of SH incisor material using micro CT to analysis dental tissue. This work contributes to the extremely limited data set of dental tissue proportions for Middle Pleistocene hominins, and is the first data set reporting the SH sample. We aim for this data set to aid in the clarification of the phylogenetic position of SH, and promote further investigation into incisors dental tissue proportions.

We would like to give our warmest appreciation and acknowledge the members of the Atapuerca Research Team, with special thanks to those who excavate at Sima de los Huesos. University College London staff members involved in the MSc Palaeoanthropology and Palaeoarchaeology, who supported the development of this research project. Staff members Pilar Fernández Colón and Elena Lacasa Marquina, at CENIEH Conservation and Restoration Department for their preservation of the specimen. We acknowledge the Multidisciplinary Laboratory of the International Centre for Theoretical Physics in Trieste where a portion of the sample was scanned. Additionally we would like to thank Bernardo Perea, Elena Labajo and José Antonio Sánchez from the Escuela de Medicina Legal for granting access to the modern dental collection. We take into consideration and thank the personal support Dub Crook and Gordon Gettty to one of the authors (MM-T) from the Leakey Foundation. For the curation of the Homo neanderthalensis we thank Thüringisches Landesamt für Archäologische Denkmalpflege mit Museum für Ur- und Frühgeschichte and the Croatian Natural History Museum. We gratefully acknowledge author LM-F, who is the beneficiary of a Fundación Atapuerca Post-Doctoral Research Grant, for their advice and support with data collection and methodological considerations. Finally, we thank author MM-T for their personal support and supervision of author ALL.

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Podium Presentation, Session 11, Sat (14:00)

Shellfish harvesting strategies in South Africa across the Later and Middle Stone Ages

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This paper addresses longstanding debates about the annual timing of shellfish harvesting during the Middle and Later Stone Age and whether subsistence behaviours differ significantly between these periods. The southernmost coast of Africa features an exceptionally long record of coastal hunter-gatherer habitation going back at least to Marine Isotope Stage 5. The sustained exploitation of coastal habitats is suggested to have driven the evolutionary and demographic processes key to the global success of anatomically modern humans. In particular, harvesting of marine molluscs provides an abundant, predictable source of protein and otherwise-rare nutrients, which could have provided the impetus for population growth and dispersal. Further, a subsistence strategy centred on the predictable and defendable resources along a productive coastline is thought to have had profound implications for behaviours like territoriality and, consequently, how early human societies were organised. While sustained and intensive marine resource use in southern Africa is unambiguous during parts of the Holocene Later Stone Age, the extent to which molluscs were relied upon during the Middle Stone Age is still heavily debated.

High-resolution oxygen isotope analyses within the growth increments of archaeological opercula of the gastropod *Turbo sarmaticus* capture seasonal water temperatures and reveal changes in the annual scheduling of shellfish harvesting. This paper presents a comparison of shellfishing behaviours between two Later Stone Age sites, Nelson Bay Cave and Byneskranskop 1, and two Middle Stone Age sites, Pinnacle Point 5-6 and Klasies River Main site. While *T. sarmaticus* were harvested year-round during Marine Isotope Stage 5, they were collected in greater frequencies in winter and the transitional seasons during Marine Isotope Stage 4 and the Later Stone Age, with little evidence for summer harvesting, despite better conditions for shellfishing in this season. Differences in the annual timing of harvest within the Later Stone Age Oakhurst and Wilton periods, and the Middle Stone Age levels, and between sites are also discussed. In conjunction with assessments of the seasonal availability of other resources from the Cape fynbos biome, this study facilitates greater nuance in descriptions of coastal hunter-gatherer resource usage throughout the Middle and Later Stone Ages.

This work was supported by the South African Research Chairs Initiative of the Department of Science and Technology and the National Research Foundation of South Africa; Merton College, Oxford; a Quaternary Research Association New Research Worker's Award, the Palaeontological Scientific Trust and a NERC Isotopes Geosciences Laboratory Steering Committee Award (grant number IP-1543-0515). Permissions for export and sampling were obtained from the curator of the archaeological collections at Iziko Museum, Heritage Western Cape (case number 14072110GT0730E) and the Eastern Cape Provincial Heritage Resources Agency (permit number 2/2/APM-PERMIT/14/09/003). Grateful acknowledgments to Curtis Marean and Sarah Wurz for help accessing the collections from PP5-6 and KRM.

Poster Presentation Number 131, Th (12:15-14:15)

Reconstructing hand use in fossil hominins: validating musculoskeletal and finite element models of the third digit for precision grasping and locomotion

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Musculoskeletal and finite element (FE) modelling are becoming increasingly popular methodologies in palaeoanthropology to more accurately reconstruct behaviour in the past [1,2]. However, a critical component of both of these methods is validation; the model is only useful if it can be shown to accurately reflect biological conditions in extant taxa [3]. Here we validate a musculoskeletal model and a FE model of the human third digit by measuring the force experienced by the third metacarpal, fingertip force, and bone deformation of the metacarpal in cadaveric specimens. The musculoskeletal and FE models will be adapted (and validated) to morphology of the bonobo third digit, and ultimately to the morphology of fossil hominins *Homo naledi* and *Australopithecus sediba*. Validation experiments were conducted on three human cadaveric digits, in which the flexor tendons were loaded to simulate grasping and the distal and proximal ends of the finger were stabilized. The finger was tested in four different postures, including major flexion, mild flexion, hook and hyperextension. Two tendon pathway conditions were tested: a "bowstringing condition" where the tendons ran parallel to the metacarpal shaft and a "semi-physiological condition" where the tendons were pushed closer to the bone, to simulate the soft-tissue anatomy.

Results from the three validation studies revealed that the force experienced by the third metacarpal was highest during major flexion of the digit (3.7-5.8 N) and smallest in the hook posture (3.4-5.0 N). There were important differences in the direction and magnitude of load at the third metacarpal, especially in the dorsal-volar direction, based on changes to the tendon pathway. In the bowstringing condition, the force was oriented volarly in all hand postures (apart from hyperextension) while in the semi-physiological condition the force was always oriented dorsally and was higher in magnitude. Similarly, measures of metacarpal bone strain also revealed differences between the two tendon pathways: in the bowstringing condition the dorsal surface of the metacarpal shaft experienced tension but was in compression during the semi-physiological condition. However, in both tendon conditions, the radial side of the shaft always experienced compression and the ulnar side tension, indicating bending of the metacarpal shaft during each of the different postures. Finally, fingertip force was oriented in a similar direction in the flexed and hyperextended postures, but was more distally oriented when the finger was in a hook posture. Fingertip force was highest in mild flexion (1.1-2.11 N) and smallest in the major flexion posture (0.81-1.62 N). In the semi-physiological tendon pathway condition, fingertip force was oriented more proximally and the force magnitude was higher. Together, results from the bowstringing and semi-physiological conditions should represent the range of values expected within the true physiological condition.

These results reveal the importance of representing as accurately as possible the physiological condition of extant primate morphology in musculoskeletal and FE models to reconstruct behaviour in the past. In the experimental conditions, the human metacarpal experiences the highest load in the major flexion posture while the fingertip force is the smallest, and the third metacarpal experiences bending strain during loading in all postures. This validation will permit simulation of human precision grips and ape suspensory (hook grip) and knuckle-walking (hyperextension) postures in extant and fossil taxa using the musculoskeletal model. Thus, these results have important implications for interpreting variation in fossil hominin external and internal metacarpal morphology, and ultimately reconstructing manipulative and locomotor hand use during our evolutionary history.

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Poster Presentation Number 23, Th (12:15-14:15)

Limited mobility of a Middle Pleistocene pregnant woman from Southern Italy: inferences from LA-MC-ICP-MS strontium isotopes analyses of a deciduous human tooth

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Understanding how mobility or sedentary has influenced human evolution is a major challenge in human past ecology. Mobility patterns of human groups have profound implications on their exploitation of the landscape resources, proving whether the human adaptation strategies are more or less successful in relation to climatic changes. In this sense, strontium isotope geochemistry offers a great chance to reconstruct human provenance and mobility, given the special association between the Sr isotopic fingerprint of human bones/teeth and the living location of the individual. In this work, we exploited the micro-destructivity and the high spatial resolution offered by the laser ablation MC-ICP-MS technique [1] to analyze the Sr isotopic composition of a Middle Pleistocene deciduous human incisor. Since deciduous teeth form within the uterus of pregnant women, the aim of this work is to determine the mobility pattern of the mother of the individual, and ultimately the role that (pregnant) women may have played within archaic human groups. This tooth (IS42) has been recovered within the archaeological level 3coll of Isernia La Pineta site (Molise, Italy), dated to 583-561 ka (end of the Marine Isotope Stage 15) by 40Ar/39Ar ages on sanidine crystals [2]. IS42 belonged to an individual of 5-7 years, possibly corresponding to the age-at-death considering the rather low degree of root resorption (Res $\frac{1}{2}$). To determine the isotopic baseline of the local bio-disposable Sr, we analyzed rodent teeth from the archaeological site and modern plant specimens, collected in a radius of c.a. 30 km. Moreover, the 87Sr/86Sr ratio of macro-mammal (*Bison schoetensacki* and *Stephanorhinus hundsheimensis*) remains from the site has been determined to unravel possible routes taken by the local hominin group. Our analyses revealed a limited mobility for the pregnant woman/mother from Isernia, likely limited to a radius of c.a. 15 km. Moreover, the average 87Sr/86Sr ratio of the human tooth falls within the range observed in rodent teeth, suggesting a local origin. The mobility pattern is thus comparable to that one observed in modern collectors, practicing the so-called logistical mobility. The reason of this limited mobility is hard to define, leading us to two different interpretations: 1. The whole hominin group mobility pattern was reduced because of the presence of at least one pregnant female and/or the favorable climatic condition of Southern Italy. 2. Only the mobility of the pregnant female/mother was reduced according to the division of labor observed in modern hunter-gatherer groups. If this is true, the case study here presented represents the earliest evidence of a gendered division of labor, which, to our actual knowledge, should have started later during the Upper Palaeolithic with the Anatomically Modern Human.

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Poster Presentation Number 100, Fr (12:15-14:15)

Climate and modern human nasal evolution: Reassessing the adaptive role of nasal projection

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Geographically-patterned variation in external nasal projection is commonly cited as evidence for climatic adaption in modern humans. Specifically, humans living in colder and/or drier environments are generally argued to exhibit nasal bones characterized by both greater anterior protrusion and nasal bridge elevation. However, the majority of studies investigating nasal projection have employed European samples as primary representatives of "cold-dry" environments, despite the existence of populations inhabiting even colder/drier environments in Asia and the New World. Here, we reassess nasal projection within climatic contexts employing a geographically and climatically diverse sample of modern human crania (n = 504), including sub-samples of Asian and New World populations from mid-to-high northern latitudes. The results of multivariate regression using 3D coordinates for sixteen nasofacial landmarks in conjunction with climatic variables (e.g., temperature, absolute humidity) from the CRU-TS3 database, demonstrate that nasal bone protrusion and bridge elevation are not significantly correlated with climate across modern humans ($r = -0.084$, $P = 0.119$). Instead, exceedingly projecting external noses appear primarily restricted to populations from Europe, North Africa, and Western Asia. Indeed, randomization tests (10,000 permutations) reveal that these geographically adjacent populations exhibit significantly more projecting noses than humans inhabiting cold-dry environments in Northeast Asia (all p-values < 0.001) or the Arctic Circle (all p-values < 0.003). Further, contrary to previous predicative models, these Asian and New World populations from cold-dry environments generally exhibit levels of nasal projection similar to populations from tropical areas. Our results clearly suggest that external nasal projection is not a universal adaption to cold and/or dry climates among modern humans as often implicitly or explicitly advocated. Still, such a finding does not necessarily eliminate a potential climate-mediated adaptive function for nasal projection. Rather, an exceedingly projecting nose may represent a specific adaptive approach that evolved in some, but not all, human populations inhabiting cold/dry climates. Accordingly, these results have important implications for understanding climatic adaptation during modern human evolution, and potentially, for interpreting the fossil record of Neandertals and other archaic humans inhabiting cold-dry environments during the Pleistocene.

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Poster Presentation Number 25, Th (12:15-14:15)

Alapars 1 - A New Middle/Upper Pleistocene Paleoenvironmental and Archaeological Record from Armenia

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Situated at the geographical intersection of Africa, Europe, and Asia, the Southern Caucasus is a critical area for addressing questions on local and regional Middle - Upper Pleistocene technological evolution as it relates to climatic variability and hominin population dynamics. The main sources of knowledge regarding land-use patterns, mobility and lithic technological evolution derive from long sequences of occupations at cave sites. However, few open-air sites have been studied in this region, and even fewer preserve long stratigraphic sequences. The recently excavated open-air site of Alapars 1, Armenia, revealed a ca. 5 m thick sedimentological and pedological sequence with a succession of three stratified Middle Paleolithic assemblages. The site is situated ca. 25 km north of Yerevan in the Hrazdan River catchment at the foothills of the Gutansar volcano, and immediately adjacent to a rhyolitic obsidian dome. The archeological horizons are found in three distinct depositional contexts. The lowermost assemblage is vertically dispersed within a succession of paleosols (ca. 220 cm thick). This assemblage contains a very low density of small, well preserved artefacts. The assemblage is mainly comprised of flakes, Levallois flakes and blades, with lower frequencies of retouched tools and cores. This assemblage represents brief episodes of flake production and discard. The second assemblage is found within a carbonate bonded/calcitic horizon capped by carbonate crust (ca. 40 cm thick). In comparison to the lower assemblage artefact density in this layer is higher, the artefacts are larger, and artefact surface weathering suggests the greater impact of post depositional processes. All stages of core reduction are represented in this assemblage. The uppermost archeological assemblage is in secondary context, and is found in the plow zone and on the surface (ca. 40 cm thick). There is an unconformity between the second assemblage and the plow zone, indicating a temporal gap between the deposition of the two assemblages. All three assemblages possess Middle Paleolithic characteristics such as Levallois flakes and cores. Each of the assemblages most likely reflect variations in land-use patterns and mode of occupation of this locality. Preliminary obsidian artifact sourcing using pXRF suggests that artefacts from all three assemblages were made predominantly from locally occurring Gutansar raw material. Two retouched tools were brought to the locality from 20 km linear distance from the Tsaghkunyats (Damlik) sources as well as few obsidian flakes that were transported ca. 15 km (linearly) from Hatis volcano. In the future, variability in raw material provisioning will be studied in relation to the different assemblages. The Alapars 1 excavations provide a unique opportunity to study diachronic changes in land-use patterns in the Middle Paleolithic at an open-air context. These results together with a detailed environmental reconstruction will enable examination of Middle Paleolithic variation in mobility patterns in relation to changing climate and environments. The results of the excavations at Alapars 1 will fill a major gap in the understanding of settlement systems during the Middle Paleolithic of the southern Caucasus.

Poster Presentation Number 11, Th (12:15-14:15)

Late Pleistocene Middle Stone Age Technology in the Eastern Lake Victoria Basin, Kenya

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Kenya's eastern Lake Victoria basin provides multiple examples of late-occurring (~ 100-35ka) Middle Stone Age (MSA) localities with well-established chronologies and multi-proxy environmental reconstructions. This makes the region significant for understanding technological variability and human responses to climate change in the Late Pleistocene. This paper presents a technological description of the landscape-scale MSA lithic assemblages collected from pedestrian surveys, controlled surface collections, and excavations at temporally constrained localities in the eastern Lake Victoria basin. The analysis focuses on consistently collected artifact classes, i.e. Levallois cores and debitage, radial cores, unretouched convergent flakes, and retouched points. Open-air and surface collections complement higher-resolution data-sets, as they can inform and help formulate new hypotheses about hunter-gatherer activities across past landscapes.

Technological and attribute analyses of the eastern Lake Victoria lithic artifacts reveal diverse MSA knapping behaviors on a variety of local and exotic raw materials. Differences in morphology, platform management, the exploitation of dorsal convexities, flaking directions, and retouch relate to both raw material and technology. Non-lava and non-Levallois components show the greatest variability. Convergent flakes and points cover a wide range of morphologies and technologies including unifacial and bifacial points, Levallois points, pseudo-Levallois points, convergent blades, and short broad convergent flakes. Convergent flakes and points are generally small with over a quarter of these artifacts retouched. Platform faceting is varied, but both cortical and heavily faceted platforms are rare, and there is a moderate degree of external platform preparation. Flake scar patterns are predominately bidirectional, but over a third have multidirectional flake scars. In contrast, most Levallois flakes are uni- or bidirectional. Scar patterns on cores also demonstrate a range of flaking strategies. Marked size differences exist between lava and non-lava cores, with the lava cores typically being considerably larger. Most cores have little or no cortex, although non-lava cores have a higher proportion of cortex despite their markedly smaller size. This may relate to differences in the original size of the raw material packages.

The lithic sample from the eastern Lake Victoria basin has a number of features consistent with a small, light-weight, transportable technology typically associated with mobile hunter-gatherers. It also shows a flexibility and diversity in knapping behaviors that are influenced, but not constrained, by raw material. The Late Pleistocene MSA from Lake Victoria lacks "transitional" MSA-LSA (Late Stone Age) characteristics but also documents long-distance obsidian transport and overlaps in time, by tens of thousands of years, with LSA assemblages in the Rift during a time of population dispersals within (and out of) Africa. Detailed understanding of late MSA technology is important for understanding changes in mobility and population interactions, but may also raise questions about the nature of technological 'transitions' and the effects on material culture of changing population interactions during this crucial period in early modern human origins.

Poster Presentation Number 94, Fr (12:15-14:15)

3D enamel thickness in Neandertal and Homo sapiens permanent lower molars and premolars

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Most of the studies on enamel thickness distribution in Neandertals and modern humans have focused on permanent teeth, particularly the molars, utilising recently advanced digital techniques with newly developed protocols [1]. Conversely, little attention has been dedicated to the premolars [2] and to compare the various dental classes to understand which tooth class better contributes to discriminate the two human groups. In order to address this issue, here we apply a recent protocol [3] to investigate 3D enamel thickness in a sample of Neandertal and *Homo sapiens* unworn to variously worn lower permanent molars and premolars. Micro-CT data of Neandertal and modern human molars (n=72) and premolars (n=55) at different wear stages (stages 1-4 based on Molnar, 1971 [4]) were segmented to create 3D digital models of the teeth. The sample is composed as follows: 26 lower third premolars (LP_3) from Neandertal (N; n=10), early *Homo sapiens* (EHS; n=1) and recent *Homo sapiens* (RHS; n=15); 29 lower fourth premolars (LP_4) from N (n=13), EHS (n=4) and RHS (n=12); 48 lower first permanent molars (LM_1) from N (n=26), EHS (n=4) and RHS (n=18); 24 lower second permanent molars (LM_2) from N (n=13), EHS (n=2) and RHS (n=9). For each digital model, the crown was separated from the root using the interpolated surface generated by the spline curve digitized following the cervical line of the tooth. Volumes of enamel, crown dentine and the enamel-dentine junction (EDJ) surface were measured to compute 3D relative enamel thickness (3D RET) index. To discern differences in enamel thickness between N and modern humans, 3D RET index was tested using the Mann-Whitney U test ($\pm$ = 0.05; two-tailed) with a Monte Carlo permutation. For premolars and M_2s at wear stage 1-2, Neandertals show significantly lower 3D RET index than modern humans ($p<0.01$). In particular, the premolars show more significant difference between the two groups, while no significant difference was observed for the M_1 ($p=0.507$). Regarding EHS, though the small sample size prevents statistical analysis, the 3D RET computed for all tooth classes always fall in the range of variation of RHS. This preliminary study provides additional information on the 3D enamel thickness of Neandertals and modern humans lower premolars and molars at different wear stages taking into consideration the current lack of comparative data for lower (and upper) premolars. Our results confirm that Neandertal M_2s have significantly lower RET indices than modern humans [1; 5], but the same does not hold for the M_1, opposite to our expectations and previous contributions [1; 5]. Differences between the two groups seem to persist in wear stage 3, in particular for the premolars, even though the small sample size prevents statistical tests. These results highlight how lower post-canine dentition, and particularly the premolars, are useful tooth classes to discriminate between Neandertals and modern humans, even when affected by moderate dental wear.

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Poster Presentation Number 1, Th (12:15-14:15)

Understanding artifact variability and function in the evolution of human behavior: Introducing the Laboratory for Traceology and Controlled Experiments (TraCEr), MONREPOS, RGZM.

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In pleistocene archaeology, interpreting artefact variability in the archaeological record has long been one of the most debated topics, mainly related to different types of raw materials and their possible use by past humans. Investigating how tools were produced and used in the past by humans is one of the key research areas in the study of human behavioural evolution [1,2]. The very presence of diverse types of materials in artefact assemblages shows that humans managed different resources and, therefore, technology was characterized by the production of different tools made from materials with different properties [3]. Functional studies are of major importance in order to determine and understand artefact use, and thus to address fundamental questions about the evolution of human behaviour. Functional analysis examines characteristic patterns of traces left on the tool surfaces and edges. In order to interpret these different types of use-wear traces, experiments are aimed at replicating the manipulation of different materials in laboratory conditions [4,5]. Although state-of-the-art methods in artefact functional studies show interesting results, a lot of criticism has been raised in terms of standardisation and replicability. This does not only apply to the traditional analysis method which focused on the identification and interpretation of the different types of use-wear traces, but also to experimental set ups, which are essential for interpreting the archaeological record. In this poster we present the research agenda and preliminary research topics of the Laboratory for Traceology and Controlled Experiments (TraCEr) based at the MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution (RGZM). The main scope of TraCEr is to carry ground-breaking functional studies that combine 1) methodological development and 2) fundamental research on Pleistocene and Early Holocene archaeology. In order to build on current use-wear methods and techniques, our research will follow two avenues: 1) Controlled experiments and material properties of the tested materials: by isolating and testing one by one the different variables affecting use-wear formation, controlled experiments will be designed to improve the identification, measurement, and analysis of major variables involved. One often neglected factor is the range of raw materials properties (e.g. hardness, roughness). In this poster ongoing research will be presented, showing how the lab will assess these properties and their influence on the results. 2) High-resolution imaging methods will be used to quantify and interpret use-wear traces from both experimental and archaeological contexts. 3D digital data will be quantified to minimize potential sources of error and bias, and to generate data that can be statistically tested. Following this approach, we believe that the definition of standards in data acquisition and open access to results will definitively establish traceology as an archaeological sub-discipline.

The TraCEr laboratory is part of the RGZM Traceology research project, funded by the Leibniz Association. The authors would like to thank Radu Iovita and Shannon McPherron for comments and long discussion on the topic of use-wear and experiments, regarding theoretical framework, state-of-the-art methods and possible research improvement for the discipline, which are part of the lab research agenda.

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Poster Presentation Number 96, Fr (12:15-14:15)

Homo antecessor lower molars at a glance.

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Since the recovery of about a hundred human fossil remains from the TD6 level of the Gran Dolina cave (Burgos, Spain) in 1994, the paradigm on human evolution in Europe has considerably changed. These fossils were dated to the Early Pleistocene and attributed to a new species, *Homo antecessor* [1]. Furthermore, the increasing number of human fossil remains found in Africa and Eurasia has allowed new phylogenetic interpretations for *Homo antecessor* hominins as well as alternative hypotheses about the settlement of Europe [2].

To date, the Gran Dolina-TD6 human remains are the oldest and most representative human fossils from Europe. The unique combination of primitive and derived cranial and postcranial traits provides important data to understand the first settlement of this continent [3]. The trigonid crest pattern has an extraordinary utility for taxonomic and phylogenetic studies [4,5] . The main aim of this study is to characterize the pattern of trigonid crest expression at the internal and external surfaces of the lower permanent (n = 11) and deciduous (n = 3) molars from *Homo antecessor* by means of micro-computed tomography (microCT). In order to explore the evolutionary meaning of this feature, *Homo antecessor* specimens will be compared against the outer enamel surface (OES) and enamel dentine junction (EDJ) of modern humans and other Pleistocene *Homo* in Eurasia.

The results of our analysis show that *Homo antecessor* present continuous mid-trigonid crests, although in lower frequencies than in other Middle and Upper Pleistocene hominins from Eurasia. This finding suggests that this feature cannot be considered a Neanderthal apomorphy as it is not exclusive to this species. In addition, our study also explores the evolutionary status of this species and its relationship with the Middle Pleistocene populations of Europe. Overall, evidence points to a less linear settlement of Europe and the possibility of *Homo antecessor* representing one of the successive hominin waves into Europe, possibly from Western Eurasia.

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Poster Presentation Number 90, Fr (12:15-14:15)

2D Enamel thickness in Early Pleistocene *Homo antecessor* (Atapuerca, Spain)

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Teeth possess a strong genetic expression used for taxonomic and phylogenetic inferences in hominins [1]. Despite being widely investigated, the taxonomic signal of enamel thickness in the genus *Homo* remains unclear due to the scarcity and preservation of the fossil remains.

Genus *Homo* is known to possess thicker relative enamel compared to living African Great apes. Within the genus *Homo*, different trends in enamel thickness were observed between older and younger taxa as well as among geographic groups [2]. In particular, molar tissue proportions have been useful to distinguish between Neanderthals and modern humans [3]. However, little is known about the polarity of this feature.

In this context the addition of new data will contribute to the discussion of this trait within the genus *Homo*. In this study we provide for the first time the characterization of the 2D enamel thickness in the Gran Dolina (TD6) molar sample. Early Pleistocene *Homo antecessor*, dated ca. 0.86 Ma, is defined by a unique mosaic of primitive traits of the *Homo* clade, and derived traits shared with Neanderthals and modern humans. The skeletal and dental remains have been associated to eight individuals [4]. In this study we calculate the 2D molar tissue proportions in *H. antecessor* to: i) characterize the molar enamel thickness in this population; ii) provide new insights about the polarity of the enamel thickness within the genus *Homo*; iii) assess how different is *H. antecessor* population in relation to Neanderthals and modern humans.

We applied mCT imaging to Early Pleistocene *H. antecessor* molar collection (n=17). Following Olejniczak and colleagues methodology [3] we calculated the relative enamel thickness and average enamel thickness, and compared the results with fossil hominins and modern humans.

Our results indicate that the relative enamel thickness of *H. antecessor* molars is generally greater than in Neanderthals and closer to *H. sapiens* values, except for the upper first molar. The polarity of the enamel thickness in the genus *Homo* is discussed to the light of these results. Future studies in other Early Pleistocene hominins may shed further light on the evolutionary meaning of this feature.

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Podium Presentation: Session 9, Sa (10:20)

New dental remains from Atapuerca-Gran Dolina TD6 level: *Homo antecessor* revisited.

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Homo antecessor species was named in 1997 based on the fossil hominin collection recovered at the Gran Dolina-TD6 level of Atapuerca [1]. At that time, *H. antecessor* was proposed as the best candidate to represent the last common ancestor of *H. sapiens* and *H. neanderthalensis*. However, the suggestion that the modern human-Neanderthal split occurred during the late Middle Pleistocene was an important handicap for the acceptance of this hypothesis [2]. Recently, new molecular data points to an earlier split for both lineages [3] and calls for a reconsideration of the evolutionary meaning of this hominin population under a new light [4, 5]. Here, we describe for the first time the outer enamel (OES) and dentine (EDJ) surfaces of 15 permanent teeth attributed to *H. antecessor*. We compare the new teeth against a large sample of African, European and Asian hominins from the Early to the Late Pleistocene. Some of the new dental specimens have been unearthed in the excavations held during the last decade. Other specimens have been virtually extracted by means of micro-CT from inside an immature maxilla discovered more than 20 years ago. Overall, *H. antecessor* presents a primitive dentition in common with most of the Early and Middle Pleistocene hominins from Africa such as *H. habilis*, *H. ergaster* and the Buia and Tighenif specimens. However, TD6 teeth present a suite of traits that are present in Asian *H. erectus* and absent in their African counterparts . The identification of this Eurasian dental pattern suggests an early differentiation of the Eurasian Early Pleistocene groups from the African groups. *H. antecessor* does not display any dental synapomorphy with *Homo sapiens* but presents a few traits exclusively shared with Neanderthals. Overall, the new data supports the taxonomic validity of *H. antecessor* by presenting a mosaic of dental traits that is unique to this group. Our data is also compatible with a position close to the node of divergence of *H. sapiens* and *H. neanderthalensis* but warns about the complexity of the interactions and dispersals during the Early to Middle Pleistocene transition in Europe.

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Poster Presentation Number 60, Fr (12:15-14:15)

Hunted or collected? A critical re-evaluation of the Proboscidean remains at the Aurignacian open-air site Breitenbach-Schneidemöhle (Germany)

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The open-air site Breitenbach-Schneidemühle was initially discovered during the 1920s. It represents one of the northern-most stations attributed to the Aurignacian [1]. Unlike the majority of Early Upper Palaeolithic open-air sites in Central Europe, Breitenbach has also yielded a large faunal assemblage (n= ca.4500) that consists to a large part of Reindeer (*R. tarandus*) and Proboscidean remains, thus permitting an investigation into Early Upper Palaeolithic subsistence-and settlement dynamics [2,3]. The abundance of Proboscidean remains in particular was — according to the original investigators — a clear indication for the presence of a 'mammoth hunter settlement' akin to those of the Gravettian sites of the Middle Danube region [1].

On photographs taken in 1925, a dense accumulation of large mammal bones ('mammoth layer'), which the excavators interpreted as an anthropogenic accumulation, can be seen 20–30 cm beneath the main archaeological horizon and material from this 'mammoth layer' presumably accounts for a large portion of the Proboscidean material of the faunal collection.

This research presents the first results of zooarchaeological, taphonomic and stratigraphic analyses with a focus on the interpretation on the origins of Proboscidean remains. Using material recovered during the 1920's excavations and from recent MONREPOS field campaigns (2009 – 2015), we question the original assessment of a mammoth hunter camp and argue that the Proboscidean remains at Breitenbach represent a mixture of naturally and anthropogenically accumulated material. On the basis of recent stratigraphic observations , we show that a major part of the Proboscidean finds is Middle Pleistocene in age and the result of a natural deposition. However, macroscopic identifications of finds [3] and 14C dates from the Aurignacian levels show that *M. primigenius* was present during the Early Upper Palaeolithic occupation of the site, some 34,000 years ago. Further questioning the original assessment, we show that incomplete recovery (e.g. no sieving or wet-screening) of organic finds and selective retention of faunal remains in favour of large, and preferentially diagnostic specimens has led to an overestimation of the role of Proboscideans in Breitenbach. While some *M. primigenius* remains bear signatures of human activity, it is not possible to substantiate claims of mammoth hunting at the present time. Drawing on these observations and find frequencies from recent campaigns, we show that in addition to reindeer, smaller taxa such as arctic fox (*V. lagopus*) and hare (*L. timidus*) probably occupied a more prominent role in subsistence strategies at Breitenbach, thereby highlighting not only the value of our on-going excavations at the site, but also the specific subsistence -and raw material acquisition strategies at the northern boundary of the Aurignacian oikumene.

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Poster Presentation Number 119, Th (12:15-14:15)

First biological insights on new early Holocene human remains from the site of Hara Idé 3, Republic of Djibouti.

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Hara Idé 3 is an early Holocene open air site located in the Gobaad Basin (Republic of Djibouti), 30 kilometers south-east from the Lake Abbe. The site was excavated by Henri Duday between 2003 and 2005 (UMR 5199 PACEA). Hundreds of human bones and tooth fragments were embedded in a lacustrine limestone matrix with varied faunal remains and lithic artifacts. Seven individuals have been identified representing three adults, one adolescent, two infants and one neonate. Four human bone fragments have been directly dated between 9,100 and 10,200 cal BP, placing the Hara Idé 3 site at the very beginning of the Holocene. The dearth of human remains in Africa at the end of the Late Pleistocene and the beginning of the Holocene period limits our understanding of past modern human phenotypic diversity. Consequently, the question of population processes and adaptation is mainly approached through archaeological proxies or extant genetic data. Genetic studies showed that the Pleistocene/Holocene transition was a period of major gene flow in Africa. One major peak of migration from Central to eastern Africa has been identified through mtDNA at 10,000 ka BP [1]. In the Horn of Africa, recent studies on lithic and faunal assemblages tend to show that the great diversity of knapping traditions as well as the remobilization of the faunal spectrum may be the consequences of the abrupt climatic changes of the Younger Dryas (13,000 - 11,600 ka BP) [2 ; 3], resulting in significant population movements and probable replacements of local groups. Phenotypic differences observed between Holocene and actual populations in Africa question the ancestry of this morphological complexity at the inter- and intra-regional levels [4]. In a basin that has delivered many sites with human remains from Mid- to Late Holocene, Hara Idé 3 is the only site representing the very beginning of the Holocene. It is therefore of great interest to describe the morphological evolution of past inhabitants of the Gobaad Basin and discuss population processes in the Horn of Africa. Traditional morphometric data of the mandibles and dental remains are compared, among others, to a unique comparative sample of Late Pleistocene and Holocene sites from the Horn of Africa. The specimens (N=3) are first compared with another sample of individuals originating from the Gobaad basin (dated from Middle to Late Holocene), as well as with a larger African sample, dated from present time up to the Middle Pleistocene period. The specimens of Hara Idé 3 and to a greater extent the Djibouti specimens, exhibit both modern and archaic features. The mandibles are robust and show some affinities with earlier specimens from the Late Pleistocene. Our results highlight a high phenotypic diversity until at least the beginning of the Holocene and a much higher morphological variability in past African populations than in present ones.

The study is supported by the ANR's project «Big Dry : Rupture and continuity in the Late Pleistocene settlement of Africa : Paleoanthropology, archeology and palaeoenvironment compared between the Rift and Nile Valleys within their continental context» (Dir. F. Bon ANR-14-CE31), the LabEx LaScArBx « Diversité morpho-métrique de l'Homme moderne à la fin du Pléistocène dans la Corne de l'Afrique, l'Étude du site d'Hara Idé 3 (République de Djibouti)» a research program supported by the ANR (ANR-10-LABX-52), and the Mission archéologique franco-djiboutienne « Premières Sociétés de Production dans la Corne de l'Afrique» (Dir. J. Cauliez - UMR 5608 TRACES). The authors are deeply greatful to Drs. Zelalem Assefa, Steven A. Brandt, Xavier Gutherz, Osbjorn Pearson, and David Pleurdeau for permission to study several east-african human remains, as well as to the ARCCH (Addis Ababa) for accepting us in their premises

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Poster Presentation Number 112, Fr (12:15-14:15)

Neanderthal Infant Kiik-Koba 2 and a Possible Pathology in the Context of Bioarchaeology

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The Neanderthal skeletons from shelter Kiik-Koba in the Crimea (45^o 03' N, 34^o 18' E) were excavated by G.A. Bonch-Osmolovski in 1925, when he revealed three Middle Paleolithic levels numbered III, IV, and VI [1]. Since that time human remains from two burials became a part of collection of Kunstkamera of Russian Academy of Sciences in Sankt-Petersburg. A Kiik-Koba 2 infant was buried in 30 cm near the adult individual in a separate pit. Both skeletons should have been associated with the upper level IV. The latter contained both temperate and cold climate faunal remains (e.g., Sus, Cervus, Saiga, and Marmota in Levels IV and VI, plus Rangifer in Level IV). Consequently, humans were buried during one of the colder phases of MIS 4 or earlier MIS 3.

The infant Kiik-Koba 2 died in the age of breastfeeding (5-7 months at death after Vlçek [2], 12 months after Tillier, 3-5 months after Mednikova, or 4-6 months after Trinkaus et al. [3]). Using modern standards of long bones growth KK2 child was about 3 months. Some features join KK2 with Neanderthals (dorsal sulcus of the scapula [4] and the opponens pollicis crest of its metacarpal 1, as well curvature of forearm bones, retroversion of the upper epiphysis of tibia and robusticity (after Vlçek)). In the absence of cranium KK2 postcranial remains seem to be representative: right humerus, scapula and acromion of the left one, left forearm bones, right ulna and radius in soil, femoral bones, left fibula and tibia, left iliac and right ischium, vertebral bodies and arches, right patella, fragmented ribs and clavicle, manubrium and even manual and pedal phalanges.

The current paper presents results of the new radiological research carried out on KK2 skeleton. Particular attention was paid to the description of pathological condition. Method of volumetric X-ray microscopy was used in addition to visual observation. Control samples with estimated diagnosis were included in comparative study.

Pathological manifestations of KK2 include periostitis and ossified hemorrhages on surfaces of the humerus, both femurs, forearm and foreleg bones. Altogether they could indicate generalized condition. There are no lesions on scapula. The iliac wing bears a number of nutrient foramina, reflected individual variability or started pathological process. The scanning of manual middle phalanx indicated a picture with regular structure. The size of osteons vary in range 82,5-232 μm. The scanning of left femoral diaphysis showed reduced medullary space and irregular structure of walls. Moreover, diaphyseal walls are for two third built by the cancellous bone tissue, and not by the compact bone, indicating activity of blood cell production.

The differential diagnostics included normal morphological variability, infection or vitamin deficiency. Even in absence of skull, which could bring important diagnostic features, the last hypothesis should especially be considered. E.g. D.Ortner and his numerous followers carried out investigations of pathological features related to abnormal porosity of the cortex [5]. The pathological lesions identified are a response to chronic bleeding at the site of the porosity or hyperplasia related to infantile scurvy or so called Moller-Barlow disease. A vitamin C was needed by Neanderthals as by all humans and its deficiency should cause severe disturbance in collagen synthesis, especially in case of small children, as well defective osteoid formation, fragile blood vessels and ossified hemorrhages. The age of KK2 is just the same, when the features of infantile scurvy could manifest in modern humans. Our suggestion, possibly, reveals new risks for European Neanderthals during the Glacial Age.

Author is deeply grateful to Dr. V.Khartanovich for permission to study Kiik-Koba 2 skeleton.

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Poster Presentation Number 91, Th (12:15-14:15)

The Nefuraytu mandible and temporal trends in *Australopithecus afarensis*

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Australopithecus afarensis is one of the best-known early hominin species, represented by numerous fossils sampling a timespan of roughly half a million years. Researchers have been interested in the magnitude of morphological variation in this hypodigm for decades. While sexual dimorphism accounts for much of the variation in size, studies have demonstrated significant temporal trends in some skeletal elements [1]. Within the Hadar Formation, mandibular size tends to increase through time, with the smallest specimens dated to 3.5 – 3.3 Ma and the largest specimens dated to about 3.0 Ma.

A recently discovered mandible from the Nefuraytu region of Woranso-Mille (NFR-VP-1/29) exhibits typical *A. afarensis* morphology. NFR-VP-1/29 lacks the broad corpus that distinguishes *Australopithecus deyiremeda* mandibles [2] and it also lacks the notably large P4 described for the Lomekwi mandible (KNM-WT 8556), which may belong to *Kenyanthropus platyops* [3].

The Nefuraytu mandible is large and therefore likely represents a male individual. It is dated to 3.33 - 3.21 Ma. Although this age places NFR-VP-1/29 in the middle of the Hadar chronology, it falls among the largest Hadar specimens in mandibular and dental size. This observation led us to further investigate whether support for the temporal trend hypothesis remains robust given an expanded sample that includes NFR-VP-1/29 and additional mandibles described since 2000 [4, 5].

Lockwood and colleagues found that a trend of increasing mandibular size was significant regardless of whether size was quantified by corpus breadth, corpus height, or the geometric mean of height and breadth (corpus size). Using similar methodology, we found that the addition of the more recently-discovered mandibles weakens the correlations between size and time. The temporal trends in corpus size and corpus height remain significant ($p<0.05$), whereas the trend in corpus breadth drops below the level of significance.

The Nefuraytu mandible is a large and well-preserved specimen that confirms aspects of morphology and evolution already known for *A. afarensis*. The close spatial and temporal proximity of this discovery to sites that produced *A. deyiremeda* and the Burtele foot has important implications for our understanding of middle Pliocene hominin diversity.

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Poster Presentation Number 110, Fr (12:15-14:15)

Differential degree of association between diet diversity, facial and mandible variation: a case study on South American populations

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The face and mandible constitute the last two anatomical structures to acquire adult form during ontogeny, thus they have been described as strongly influenced by ecological factors. According to worldwide and regional studies, the face presents a strong association with diet hardness and composition, while the variation of the human mandible shape has been interpreted either as the result of neutral evolutionary processes as well as phenotypic plasticity [1-2]. However, there are no previous studies that focus on studying comparatively the degree of association between diet diversity, facial and mandible variation on the same sample. Therefore, the aim of the present study is to analyze the relation between diet diversity and craniofacial morphology in order to address the differential influence that diet may have had on the crania of late Holocene South American populations. South America offers a unique scenario for studying the impact of diet diversity on the crania due to the high degree of morphological variation among late Holocene populations that has been mostly attributed to ecological factors [3-4]. For this, a total of 111 3D landmarks were registered in a sample of 250 individuals coming from 8 populations. One of the samples represents an agriculturalist group (PO), other a hunter-gatherer group (RN), and the other six have been characterized by mixed subsistence practices, what contributes to discuss differential patterns and a continuum of diet variation in the data. Morphology was studied through shape and size, while diet by diet composition, using $\delta^{13}C$ isotopic data (^{13}C); and diet hardness, estimated through the calculation of bite force (BF). The pattern of variation of morphological data was studied through principal components analysis, while the degree of association between morphological data and diet hardness/composition was addressed through spatial regressions. The distribution of the samples along the first two PCA from the crania, face and mandible showed that the sample most enriched in ^{13}C, is situated in one extreme of the PC1, the sample most depleted in ^{13}C is found on the other PC1 extreme, while the samples characterized by mixed diets are distributed between those two. The main shape changes are located on the mandibular ramus; nasal and zygomatic bone, although variation is present in the whole crania. According to the spatial regressions performed, BF does not contribute to explain craniofacial variation, while ^{13}C presents a differential role depending on the anatomical region considered: crania (R^2=0.80**), mandible (R^2=0.39*), face (R^2=0.15). These results confirm previous studies on the stronger impact of diet composition than diet hardness for explaining craniofacial variation in South American populations, as well worldwide studies showing that diet might have played a more important role on the mandible shape than on the face. However, the fact that the entire cranial shape is associated with diet composition shows that the influence of systemic factors as the effect of nutrient intake during bone formation [5], rather than local ones, such as masticatory loading, might have leaded the morphological diversification of South American human populations.

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Podium Presentation: Session 4, Th (17:20)

Early Acheulean Harvesting of USOs at Olduvai Gorge, Tanzania

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The long-standing hypothesis that plant underground storage organs (USOs) drove an essential transformation towards dietary complexity has traditionally encountered an empirical void. This was partly filled through indirect data from bone chemistry, tooth wear, masticatory features on predicted dietary trends among primitive and archaic hominins. However, the fossil record contains no direct evidence of USO exploitation that could speak to the selective ecological processes underscoring the emergence of mixed plant and prey diet.

A technological development during the later Oldowan was the appearance of the biface, or handaxe, that drove the transition to the Acheulean recorded in East Africa 1.7 million years ago and speaks to a fundamental change in human cognition and dexterity. Understanding the link between food extraction techniques and the diets that fueled larger bodies and brains requires knowing which tools were used for dietary and environmental exploitation. However, for the initial Acheulean, the absence of direct evidence has made this connection impossible to elucidate.

We present exceptionally preserved plant matter from one of the oldest Acheulean handaxes in the world recovered at the newly discovered site of Frida Leakey Korongo West (FLK-W: layer 6, Olduvai Gorge, Tanzania). Stereomicroscopic plotting of residue indicates 46 clusters of waxy, yellowish masses. There are micro-fractures in the medial zone smeared with residue associated with hundreds of palisade-cell clusters and lignified bundles from thickened bark or nutshell, phytoliths from woody tissue, resinaceous material, and vascular tissue. Ultrasonic residue extractions were analyzed by 1H Nuclear Magnetic Resonance. We retrieved 609 starch granule casts that could enable a direct assessment of carbohydrate-rich foodstuff consumption and early handaxe utilization. Electron and light microscopy revealed biological microstructures. Surficial elemental mapping by Energy-Dispersive X-ray (EDX) spectroscopy identified carbon, oxygen, and silica, implying that these granules were permineralized carbonaceous compounds. Raman spectro-microscopy explored the carbon chemistry of individual grains. Transmission Electron Microscopy, EDX, and Raman ascertained subsequently the granule's interior chemistry and composition.

Researchers no longer need to speculate whether handaxes were reserved for butchery, providing direct evidence that a 1.7-million-year-old biface was used to process tubers and other plant organs.We established a link between the exploitation of USOs from a riverine forest, biface edge design, wear traces caused by digging, diverse plant remains, and the taphomomic pathways for starch grain fossilization. The evidence from biological architecture, a complex cast permineralization, kerogenous cores, and molecular fragments from starch degradation falsify the hypothesis that these could be amorphous silica particles, mineral precipitates, or geofacts, and instead show casts of former starch granules that underwent silicification-induced fossilization.

Overall, lithic and bone remains from FLK-W convey exploitation of animal proteins and plant carbohydrates, which could be consumed without fire or cooking, signaling early plant manipulation and omnivory. The FLK-W data advance knowledge of a poorly known but influential transition in Old World prehistory. To date, this is the only direct indication of early hominin reliance on USOs. The analytical methods deployed represent an advance over previous research, and provide a broader perspective on diets where carbohydrate extraction from calorie-rich, predictable food sources now complement a meat-based view of dietary ecology during the early Pleistocene.

Social Sciences Humanities Research Council (SSHRC), The Olduvai Paleoanthropology and Paleoecology Project (TOPPP), Stone Tools. Diet and Sociality project (https://www.facebook.com/OGSDS/)

Poster Presentation Number 86, Fr (12:15-14:15)

Morphometric and topographic variability of molar crowns of hominoid primates: implications for dietary adaptations of *Paranthropus robustus* and *Paranthropus boisei*

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Dental topography and morphology analyses allow comparison of molar morphologies among species. Understanding the variability of dental crown topography and morphology is crucial in order to make accurate dietary inferences of fossil specimens. The main objective of this work was to characterize molar complexity and shape variability in hominoid primates, as a way of interpreting the robust molar morphology of *Paranthropus boisei* and *Paranthropus robustus*. Landmark-based Geometric Morphometrics (GM) and topographic complexity analyses were conducted on 3D scans of a large collection of M1 and M2 molars of four hominoid genera (*Gorilla*, *Pan*, *Pongo* and *Hylobates*), as well as of *P. boisei* and *P. robustus specimens*. Molar crown morphology was analyzed from a configuration of 4,800 homologous pseudo-landmarks representing the occlusal surface on the studied molars, derived from 16 fixed landmarks in the Geomorph package in R [1]. In addition, molar topographic data was obtained by applying the MorphoTester package [2] to 10,000 polygon meshes of the 3D scans to characterize curvature, crown relief, and surface complexity of molar crowns. The first three principal components derived from the GM analysis explained over 30% of total molar shape variability. A significant allometric association was found between overall crown shape and dental size, which suggests that molar shape varies between large and small sized species. For the unworn teeth, the first principal component derived showed a strong correlation with the complexity values, clearly differentiating the two *Paranthropus* species from the rest of the hominoids studied. The paranthropines showed high complexity (OPCR) values, similar to those found in *Gorilla*, and relatively low curvature (DNE) values, similar to those exhibited by *Pan*. Furthermore, the crown relief index (RFI) values of *Paranthropus* molars were among the lowest found in the hominoid primate sample studied, similar to *Hylobates* and *Pongo*. No significant differences in the topographic variables were found between the two *Paranthropus* species, which overlapped in complexity, curvature, and crown relief values. The results obtained suggest that both *Paranthropus* species show an oclusal molar relief characterized by lower DNE and RFI values than those expected for highly vegetarian hominoids. All the *Paranthropus* specimens showed, nevertheless, high complexity values that clearly distinguished them from the more frugivorous hominoids. These significant among-species differences in tooth crown morphology observed might be indicative of a shared pattern of dietary adaptation in the robust hominin lineage.

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Poster Presentation Number 39, Th (12:15-14:15)

Peopling Doggerland: submerged Stone Age finds from the Dutch North Sea.

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It is well known that the current area of the North Sea holds important buried landscapes for both the Pleistocene and Early Holocene occupation of this area. It is in fact the heartland of Western Europe and crucial for our understanding of colonisation and occupation behaviour at this latitude. While there have been several projects that map the geology and geomorphology, the prehistoric artefacts that derive from this vast area were always treated with scant attention. They were proof of human presence at various times [1,2], but their importance was considered limited, owing to the lack of context as they were fished or dredged from the North Sea bed. While this may indeed be the case, it is also a fact that over the past years the number of archaeological finds originating from the North Sea has increased dramatically. This is mainly due to large scale infrastructural works such as "Maasvlakte 2", an extension of the port of Rotterdam, and the "Zandmotor" ("Sand Engine") on the coast near The Hague. In the process of sand replenishment, hundreds of flint artefacts, animal bones with cutmarks, worked bone and antler, bone points, and even human remains [3] are being deposited on beaches. The quantity and quality of these finds now enable us to expand our horizon [4]. Through documentation, dating and additional isotopic research, human bone is providing valuable insights into past hunter-gatherer diets. There are also indications that aDNA may be well preserved. At the same time, the numbers of artefacts increasingly allow typological and functional reconstructions and open up the debate regarding raw-material procurement and mobility. Our poster will present a number of case studies that highlight the importance of documenting these finds because, despite their problems of context, they provide a wealth of information of a hitherto little-known prehistoric landscape. Analyses on these finds are ongoing as part of a larger project by the newly established *Doggerland Research Group* (DRG).

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Podium Presentation: Session 3, Th (15:00)

A virtual reconstruction and volumetric mass estimate of AL288-1, *Australopithecus afarensis*.

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Fossil body mass estimation is a well-established practice within the field of physical anthropology. Previous studies have relied upon traditional allometric approaches, where the relationship between skeletal dimensions and body mass in a range of modern taxa is used predictively. The lack of relatively complete skeletons has limited the potential application of alternative mass estimation techniques, such as volumetric reconstruction, to fossil hominins. Yet across vertebrate palaeontology, volumetric approaches are increasingly predicting values for fossil body mass very different to those estimated by traditional allometry [1]. Here we present the results of a virtual reconstruction exercise for the iconic hominin AL288-1 and the calculation of its body mass, with a focus upon the reconstruction of the shoulder, thorax and pelvic regions. These reconstructions represent working hypotheses of the morphology of AL288-1, based upon what is currently known about *Australopithecus* anatomy.

The long bones of AL288-1 were reconstructed by scanning traditionally sculpted cast reconstructions (ATC) and its foot was scaled from ATC's reconstruction of the OH8 foot. The cranium was scaled from the Hadar composite skull. The clavicle was reconstructed by scaling the MH1 *A. sediba* clavicle to the size of the AL288-1 clavicle fragment. This gives an estimated length of 103.0mm, in line with previous estimates.

The rib cage of AL288-1 preserves around 50% of the right-hand side of the costal skeleton with large fragments of the main rib body for all ribs apart from 2, 11 and 12. The scapula is more fragmentary. The scapula and ribs were reconstructed using thin plate spline warping of modern human and chimpanzee landmark and semilandmark data for each respective element to fill in the missing data from the fragmentary originals. The resulting scapula perfectly articulates with the humerus reconstructed by Kappelman et al. [2]. The coracoid process is situated lower than in previous estimates and is more humanlike in form, similar to the Woranso Mille specimen KSD-VP1/1. The resulting thorax is much closer to that of the hypothesised shape of KSD-VP1/1, i.e. bell shaped.

The pelvis was reconstructed by virtually re-articulating scans of casts of the left os coxa. This was articulated to a mirrored reconstruction of the right-hand side of the sacrum, (mirrored to remove much of the distortion present in the sacrum). We then mirrored the os coxa using the midline of the new sacrum as a guide. This new reconstruction is more heart shaped then even Häusler and Schmid's reconstruction [3] and is the largest current reconstruction of this pelvis, which has significant implications for discussions of obstetrics in *Australopithecus* [4], as new reconstructions of *A. africanus* are also less platymeric than previous ones [5]. We estimated dry vertebral column length using vertebral proportions from small bodied modern humans, as the cervical vertebrae from KSD-VP1/1 do not differ significantly from the modern average. 'Wet' height (i.e. including intervertebral discs) was then estimated as 422.3mm. We scaled a modern human vertebral column CT scan to this height and to match the width of the surviving L3 from AL288-1.

The convex hull technique relies upon identifying a predictable relationship between the 'shrink-wrapped' volume of the skeleton and known body mass in a range of modern taxa, and subsequent application to an articulated model of the fossil taxa of interest. Our calibration dataset comprises whole body CT scans of 15 species of modern primate. Application of the convex hull technique to A. afarensis results in a relatively low body mass estimate of 20.1kg (95% prediction interval 13.3-30.6kg). A sensitivity analysis on the thorax, performed by 10 and 20% expansion of this area, suggests that the heaviest of previous body mass estimates would require the thorax to be expanded to an unlikely extent.

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Poster Presentation Number 70, Fr (12:15-14:15)

The Social Brain Hypothesis and the Hippocampus

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We examined the role of CA2, a socially-relevant hippocampal subdivision, in relation to the social brain hypothesis. The social brain hypothesis provides a framework for understanding how social complexity may be related to enhancements in brain form, size and function. Past reports indicate that in primates social complexity is a good predictor for brain size, and more specifically, relative neocortex size has shown to be related to group size [1]. This is thought to occur due to the high cognitive demands in more complex social groups, which require higher cognitive capacities and more developed brains to carry out these demands. Recent research in rodents has demonstrated a role for the hippocampus region CA2 pyramidal cells in social memory, specifically recognizing conspecifics, while no such role for other hippocampal regions - CA1 and CA3 [2]. Here we examine the social brain hypothesis in a new context, by investigating whether social group size can predict CA2 volume, as a bigger social group is likely to have greater demands on social memory, will be a valuable contribution towards understanding the drivers behind brain evolution. Given that there are many ideas about how to scale brain components [3] we conducted our analysis on CA2 on absolute volume, a ratio fraction of the hippocampus and as residual of hippocampus volume and whole brain volume in a diverse sample of primate species (n=41). The results show that social group size can indeed predict absolute CA2 size in New World monkeys, however, no significant relationship was found is prosimians, Old World monkeys or hominoids. It was also found that next to log corrected absolute volumes, ratio fractions CA2/hippocampus and phylogenetic corrected residuals can be used. Although group size data are easily obtainable from the literature for a wide range of species, they are not always appropriate due to variability within species [4], and further such measure is only a crude proxy of social complexity. It could prove interesting for further research to use more refined measurements for social complexity and memory like network measurements and experimental data. Also, it would be interesting to combine these measurements with ecological data to create a more wholesome model of the evolution of the hippocampus and its subcomponents in an attempt to reconcile ecological and social intelligence theories.

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Pecha Kucha Presentation: Session 2, Th (11:25-11:50)

Homo or *Pongo*? Trigon morphology of maxillary molars may solve taxonomic controversies over isolated hominoid teeth from the Asian Pleistocene

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The taxonomic status of isolated hominoid teeth from Asian Pleistocene deposits has long been controversial due to the morphometrical similarities between *Homo* and *Pongo* molars. Here we report a variant observed on the internal surface of the mesial marginal ridge of the upper molars that appears to be taxonomically informative. The presence of mesial marginal accessory tubercles has been previously reported in humans and other primates. However, until now, it has never been systematically studied across a taxonomically diverse sample of hominoids. Micro-computed tomography was used to examine the enamel-dentine junction of 442 hominoid upper molars, including *Australopithecus* (n=55), *Paranthropus* (n=42), *Homo habilis s.l.* (n=7), *H. erectus s.l.* (n=7), *H. neanderthalensis* (n=52), *H. sapiens* (n=93), *Pan* (n=67), *Gorilla* (n=19), recent *Pongo* (n=30) from both Borneo and Sumatra, and Pleistocene *Pongo* from Vietnam (n=45) and China (n=25). Only specimens of definite taxonomic attribution were included in this study. We used 3D geometric morphometric techniques to evaluate shape and size differences of the mesial marginal ridge between the paracone and protocone. We also examined the manifestation of the protoconule, a mesial marginal accessory tubercle located on the mesial portion of the protocone. The results of the multivariate analyses performed for M1, M2 and M3 separately and combined show that Pleistocene and recent *Pongo* cluster together and are clearly differentiated from all species of *Homo*, *Australopithecus*, *Paranthropus*, *Pan* and *Gorilla*. The mesial marginal ridge of *Pongo* is semi-circular shaped with a wide anteroposterior central diameter and encompasses a low-cusped configuration with internally placed mesial cusps, whereas that of *Homo* has a crescent-like shape, with tall and more externally located cusps. While shape changes of the mesial marginal ridge for each molar type along the morphospace in both Principal Component Analysis and Canonical Variate Analysis reveal important taxonomic differences, changes in M3 suggest greater diversity among hominoid species compared to M1 and M2. For all molars combined, our results also indicate that the protoconule is present in 80% and 87% of the Pleistocene and recent *Pongo* individuals, respectively. In contrast, the protoconule is absent or occurs in low frequencies in hominins and African great apes (0%-25%, with the greatest frequency seen in *A. afarensis*). The Fisher's exact tests indicate that frequencies of protoconule expression in Pleistocene and recent *Pongo* are significantly different to all other hominoids examined. Differences within the Homininae, on the other hand, are in most cases non-significant. Our combined approach incorporating dental non-metric and geometric morphometric data demonstrates the discriminatory power of the internal surface of the mesial marginal ridge for distinguishing between isolated upper molar teeth of Ponginae and Homininae. By identifying this new feature on the protocone, whose presence in *Pongo* is independent of tooth size and serial position, our results can provide some resolution to the taxonomic ambiguities of several Asian hominoid dental remains and contribute to the better understanding of hominoid biogeography during the Pleistocene.

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Podium Presentation: Session 12, Sa (17:00)

The dawn of dentistry in the Late Upper Paleolithic: A deeper antiquity of biomedical care and surgical intervention

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Evidence for prehistoric treatment of dental pathology is observed primarily among food-producing societies with highly cariogenic diets [1, 2]. Despite the growing evidence of a decline in oral health during the Late Upper Paleolithic [3], current data would suggest that modern humans did not practice therapeutic dentistry prior to the Neolithic. Here we analyze two upper central incisors of a modern human specimen, unearthed from the Late Upper Paleolithic deposit of Riparo Fredian (Molazzana, Lucca, Italy), showing an evidence of dental modification in the form of drilling and use of a composite filling of bitumen and organic fibers. Both upper central incisors of Fredian 5 are heavily worn with occlusal exposure of each pulp chamber. The pulp chambers show a rounded perforation (hereafter called "cavity") that extends into the root with a sudden transition with the preserved portion of the pulp canal, which is partially filled with residue. Histochemical analysis of the material embedded at the bottom of the cavities revealed a conglomerate of vegetal fibers and probably hairs. Moreover, Fourier transform infrared spectroscopy (FTIR), energy dispersion X-ray spectroscopy (EDS), and Raman microscopy analysis of black residue adhering to the walls of both cavities is consistent with organic substances, specifically bitumen. A direct chronometric date for Fredian 5 confirms a Late Upper Paleolithic context (between 13,000-12,735 calendar years ago). Overall, our results are consistent with in vivo dental drilling to remove necrotic or infected pulp tissue (pulpitis) and the subsequent use of a composite, organic dental filling in the cavity. Therefore, Fredian 5 represents the earliest known evidence of dentistry, predating by more than 6,000 years the origin of therapeutic-palliative dental filling [2]. The lack of demineralized tissue and presence of an exposed and drilled pulp chamber is suggestive of an intervention aimed at removing infected/necrotic tissue and/or draining an associated lesion. The use of bitumen provided an anti-microbial barrier between the body and the environment [4], and the presence of vegetable fibers suggests a composite filling material was involved. It was not possible to identify plant fibers to a specific taxon, but the use of medicinal plants as analgesics to alleviate oral pain and as astringents is known from ethnographic accounts and while it is speculative in the present study, the probable use medicinal plants is not without precedence in the Pleistocene. Given clear evidence for dentistry in Freidan 5 it is now possible to suggest that the caries manipulation found in Villabruna [5] is also part of a broader trend, or tradition, related to the treatment of dental pathology among Italian Late Upper Paleolithic foragers. Both Fredian and Villabruna represent cases where lithic implements were used to manipulate dental pathologies, further confirming that the Final Epigravettian was a period of important cultural changes. The major difference being that the distal position of the lesion in Villabruna (RM3) prevented a complete surgical intervention as seen for the anteriorly located pathologies of Fredian 5, which was treated following procedures similar to modern dental practices. The terminal Pleistocene is a period of increasingly diverse and broad spectrum socioeconomic organization, but a concomitant increase in dentognathic pathology called for novel strategies to cope with changing morbidity profiles. Thus, this discovery marks not only the dawn of dentistry, but a much deeper antiquity for, and considerable knowledge of, biomedical care and surgical intervention.

We dedicate this paper to Mario Dini, a young researcher of the University of Pisa who died prematurely. Mario devoted most of his research to the study of the Paleolithic and Mesolithic sites in the Serchio river valley. He recovered the human remains from the deposits at Riparo Fredian and entrusted two of the authors (J. M.-C. and A. R.) to carry out a new and detailed study of them. AMS date was funded by the Exilarch's Foundation, the DANGOOR Research Accelerator Mass Spectrometry Laboratory (D-REAMS), and the Max Planck-Weizmann Center for Integrative Archaeology and Anthropology. JCW was funded by the Leakey Foundation. The authors declare no potential conflicts of interest with respect to the authorship and/or publication of this article.

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Poster Presentation Number 145, Th (12:15-14:15)

Foot remains of the Neandertal Regourdou 1 (Montignac-sur-Vézère, Dordogne, France)

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The Neandertal site of Regourdou (Montignac-sur-Vézère, Dordogne, France) is a well-known classical site with a nearly complete Neandertal skeleton (Regourdou 1). All the elements of this skeleton were excavated during the 1950-1960's campaigns (1957 and 1963-1966). Recent research, especially the review of the faunal remains from this site have allowed us to identify new human fossils associated to the skeleton of Regourdou 1 [1,2]. Among the newly identified human fossils, some of them belong to the foot [1,2]. Two tali, two calcanei, a navicular, three metatarsals and 12 phalanges (proximal, intermediate and distal) are currently associated to Regourdou 1 skeleton. In the present work, all of these fossils are presented and studied in comparison to recent humans, Late Pleistocene *Homo sapiens*, Neandertals and the Middle Pleistocene Sima de los Huesos hominins. The foot of Neandertals is similar to that of recent humans in overall size and proportions, and comparable in the implied locomotor capabilities [5]. However, some metric and morphological traits, mainly related to robusticity, allow distinguishing the foot of Neandertals from anatomically modern humans. The Neandertal tali show large articular surfaces with large lateral malleolar facets and broad heads, the calcanei are broad with a projecting sustentaculum tali, the naviculars are broad and massive and the lateral metatarsals and the phalanges are wide and robust [3,5]. All of these traits have traditionally been associated with a high degree of biomechanical stress and with greater general robustness of the postcranial skeleton. The foot remains of the Neandertal skeleton of Regourdou 1 display the typical features observed in other Neandertals around the world, and they are different metrically and morphologycally to the Late Pleistocene *Homo sapiens*. This confirms the association of these foot remains to the Neandertal skeleton of Regourdou 1. Among the Neandertal traits observed in the foot fossils are a rectangular trochlea with a large lateral malleolar facet, and a broad head in the talus; a broad calcaneus with a projected sustentaculum tali; a broad and wedged navicular with a projected medial tubercle; large and broad bases of the lateral metatarsals and broad and robust pedal phalanges. The body mass and stature estimated based on the foot remains are similar to the Neandertal average. Finally, we can conclude that the foot remains associated to the Regourdou 1 skeleton display the typical Neandertal traits, which are different to recent and fossil *Homo sapiens*. This study is consistent with the taxonomic assessment of this individual based on the other bones such as the mandible and other postcranial bones.

We acknowledge to the Musée d'Art et d'Archeologie du Périgord (MAAP) and its personal for allowing access to the fossil under its care, especially V. Merlin-Anglade. It is very much appreciated the effort and work carried out by the excavation team in Regourdou cave. The availability of the huge comparative collection, both modern and fossil, would have not be possible without the help and collaboration of multiple institutions and people that allowed access to important collections under their care and kindly provided assistance. Part of this research was funded by the MINECO/FEDER project CGL2015-65387-C3-2-P.

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Podium Presentation: Session 11, Sa (14:20)

Exploring C4 plant foods: the nutritional and mechanical properties of African savanna vegetation

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Stable carbon isotope analyses of hominin fossil material have demonstrated that after ~4 Ma, hominins began to incorporate significant amounts of C4 resources into their diets. These resources most likely took the form of C4 vegetation (tropical grasses and some sedges), though the contribution to this isotopic signal from CAM plants and faunivory cannot be entirely dismissed. Additionally, the proportion of C4 foods consumed by australopith species is positively correlated with molar size, a trend that reaches its zenith with the "hyper-robust" species, *Paranthropus boisei*. We must now consider the notion that an increasing reliance on these resources may have selected for the robust craniodental features traditionally viewed as adaptations for hard object feeding. Grasses and sedges are often portrayed as low-nutrient foods with significant mechanical defenses against herbivory and thus, are generally regarded as poor dietary resources for most primates. As such, there have been few systematic efforts to determine which C4 plants (grasses and/or sedges) and plant parts (e.g., leaves, seeds, underground storage organs) were potential food resources for early hominins. To begin addressing this gap our project explores the interplay between C4 food availability/abundance, mechanical/nutritional properties, and consumption by savanna primates. Here we report the results from our analyses of the mechanical properties (toughness), macronutrients (protein, fat, non-structural carbohydrates), structural carbohydrates (NDF, ADF), and lignin of C4 and C3 plants from within the Cradle Nature Reserve, South Africa, and Amboseli National Park, Kenya. Our transects spanned wetland, woodland, and open grassland microhabitats with collections made during wet and dry field seasons in order to capture temporal and spatial variation. Within each transect the dominant grass, sedge, tree, and forb species were collected, and their relevant parts were isolated for analyses. Our results indicate that within these environments, variation in the mechanical and nutritional properties of wild plants exists within and across sites, species, plant organs, and seasons, illuminating a complex mechanical and nutritional landscape. In particular, C4 grasses, which dominate many African savanna ecosystems, show a level of variation that is often overlooked in reconstructions of hominin dietary behavior.

The Leakey Foundation, The Wenner-Gren Foundation, National Science Foundation

Podium Presentation: Session 11, Sa (15:00)

Uluzzian vs Uluzzian: implications of a new site discovered in the north of Italy

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In the intricated context of the Middle - Upper Palaeolithic transition in western Eurasia, the Uluzzian technocomplex is crucial for investigating the cultural and economic changes occurred in the Neanderthal and Modern Human populations. In recent years, several studies have only partially increased our understanding of the chronology, taxonomy, material culture and subsistence of the Uluzzian in Italy [1, 2] and generated an evergreen debate mostly revolved around its anthropological attribution [3, 4]. Yet, more data are required especially from stone technology, which reveals an ensemble of innovations. Persistence in flake production, use of splintering technique and of blade-bladelet making, and appearance of new types of implements characterise the Uluzzian whereas new formal tools define bone technology. The social significance of such improvements should be assessed on a wider, supraregional scale, through a comparison with previous, contemporaneous and later technocomplexes.

In the North of Italy, a recent assessment on the Uluzzian technology in relation to the cultural complex that immediately precedes it has been proposed on the base of the lithic and bone tool assemblages at the key site of Grotta di Fumane [5]. This cultural record, sandwiched between the final Levallois Mousterian and the Proto-Aurignacian shares elements of continuity and discontinuity with the Mousterian and the Proto-Aurignacian complexes and roots in the Levallois context [5]. Despite the Uluzzian at Fumane reveals it is a flake-dominated technology that brings together a set of innovations, according to works in progress, it seems that its features only partially match those expressed from Castelcivita, Grotta del Cavallo and other sites of the core-area in the south of the Peninsula [3].

Shedding light on the significance of changes recorded across the Fumane sequence is hence of key relevance for disentangling the intricate cultural dynamics occured before the Aurignacian. A new contribution comes from the Uluzzian sequence of a recently discovered site, Riparo del Broion positioned 60 km East of Fumane. Besides Fumane, which does not represent anymore an isolated case in a so geographically limited district, Riparo Broion firmly confirms the more typical Uluzzian cultural marks in the use of splintering technique, flake making, design of backed pieces and lunates, worked bones and molluscan marine shells. At the same time, Riparo Broion shares only partially this set of features with layers A4 and A3 from Fumane. Although the chronological frame of Riparo Broion stands still in construction and the relation between the Uluzzian and the Mousterian underlied is far from being assessed, we discuss the implications of this scenario.

Research at Riparo del Broion has been coordinated by the Ferrara University in the framework of a project supported by the Italian Ministry of Culture - Veneto Archaeological Superintendence, public institutions (Veneto Region - Department for Cultural Heritage, Vicenza Province, Longare Municipality), the Leakey Foundation (spring 2015 Grants) and private associations and companies. New fieldwork will be also supported from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme in the frame of SUCCESS Consolidator Grant (grant agreement N^{O} 724046) headed by S. Benazzi, University of Bologna.

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Poster Presentation Number 5, Th (12:15-14:15)

The avian fossil record of BK site (*Bell Korongo*) at Olduvai Gorge (Tanzania)

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Birds are one of the major groups of vertebrates, reaching a great variability in species and habitats, documented in all known ecosystems. Africa has a unique and diverse avifauna, currently representing the largest avifaunal diversity in the world with more than 2000 species. The use of avifauna as a paleoclimatic indicator has been applied to different archaeological and paleontological sites. Despite their great diversity and their potential paleoecological information, there is a paucity of research focused on the study of fossil birds in relation with archaeological and paleontological assemblages.

Pleistocene avifaunal communities are used to reconstruct the BK (*Bell Korongo*, Uppermost Bed II, Olduvai Gorge, Tanzania) paleolandscape. The sample was obtained from the levels 3 and 4 of the BK Site at Olduvai Gorge (Tanzania), and recovered within the work of the Olduvai Paleoanthropology and Paleoecology Project (TOPPP).

Through the identification of different fossil birds at BK site, the presence of characteristic water flows from Bed II can be documented in contrast to lacustrine environment from Bed I. These avifaunal communities point to an extensive fluviatile system across the eastern margin of the Olduvai's lake basin. The presence of *Struthionidae*, *Charadriiforms*, *Rallidae*, and *Passeriforms* as well as *Galliforms* is related to an open habitat in a fluviatile basin with periodic wetlands.

The taphonomic study of the macrofaunal bone remains supports an anthropogenic interpretation for their transport and accumulation at the BK site, with limited presence of birds and a limited carnivore impact in an assemblage that was overall exposed to very fast sedimentation processes. BK is also characterized by the high amount of ostrich eggshell remains across its sequence. This contrasts sharply with the surrounding landscape, where these are virtually non-existent.

It is argued that this repeated abundance of ostrich eggshell remains across the archaeostratigraphic sequence of BK contrasted against their rather sporadic presence anywhere else in the Gorge supports an anthropogenic exploitation of this resource at the site.

Poster Presentation Number 126, Fr (12:15-14:15)

Unravelling early human migration in southern South America using Darwin's Fuegian lice

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Some 15,000 years ago, tribes entered America from Siberia to people the Americas. These tribes continued along the west coast of America until they reached the small islands of Tierra del Fuego in the far South.

During his voyage on the Beagle, Charles Darwin obtained lice from two human groups, Fuegians and Chonos, inhabiting the southern archipelagos. Their lice are different from modern lice and they still contain the blood of the Indians. These tribes went extinct soon after Darwin's visit.

Lice collected by Darwin, Wallace and other contemporary entomologists from extinct human tribes, extinct animals like the Tasmanian wolf and many more animals, total some 3000 specimens in ~600 lots. They are currently in the Denny lice collection of the Natural History Museum, University of Oxford. Most of these specimens contain the last blood meal of their host. The collection remains untouched since its arrival in the Museum (1871), and only unpublished archival catalogues exist on its contents and value; and most specimens have never been identified. Using advanced ancient DNA methods that have been successful on a 400,000 year-old human bone, we proposed to carry out genetic analyses on the 180 year-old Darwin lice and the human mitochondria of the blood meal inside these lice.

We have identified a modern, but remote and isolated Central American tribe currently carrying the head louse species *Pediculus pseudohumanus* and a South American tribe carrying a new species of lice with a different karyotype (number of chromosomes). *P. pseudohumanus* has also been described from Polynesian Indians and monkeys. By sequencing these two modern lice species and comparing them with the louse of chimpanzees and bonobos, *P. schäffi*, as well as with the results of the Fuegian and Chonos lice, we aim to trace human migration in South America and unravel whether lice jumped from primates to humans or vice-versa. Our pubic lice, for example, have likely been acquired by our ancestors from gorillas, hunted about 3-4 million years ago. The lice that modern humans carry at present on their heads can be divided into three clades (genetic groups). Clade A is found in Africa and rest of the World, B in Europe, America and Australia, and C in Ethiopia, Senegal and Nepal. Using a single mitochondrial gene fragment, it has been estimated that the clade A and B lineages separated between 700,000 and 1.2 million years ago and that clade C split around 2 millions ago. These large range estimations are not helpful because they do not tell us from whom these lice came. Clade A and B lice, did they come from Neanderthals, from Denisovans, from *Homo erectus*, or from *H. antecessor*? The age estimation of clade C lice is so vague that we cannot even make a useful guess. The genome of clade A lice have already been sequenced. We proposed to determine the genetic sequence of clade B and C lice to obtain a time estimate as precise as possible for the split of the lice lineages. While it would be interesting enough to unravel the phylogenomics of human lice, the importance lies in the fact that we carry all these lice, which proves that the modern human lineage had physical contact with these archaic humans, e.g. *H. erectus*.

Lice cannot survive for more than a few hours off their host, so archaic and modern human lineages or species had to overlap in time and space to physically exchange their lice. This physical contact to exchange living head lice is a unique feature. Evidence about contact with no interbreeding, and the time of contact cannot be retrieved from any human sequencing, ancient or modern, only from lice. This project aims to identify with which archaic human lineage or species we had physical contact in the past and when. Since at the moment we carry three different clades of lice on our heads, we must have had two separate encounters with other human lineages, separated by roughly one million years.

Poster Presentation Number 141, Th (12:15-14:15)

Holocene evolutionary trends in South Asian body size: implications for contemporary health

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Evolutionary trends in body size (stature, body mass) offer important insights into past selective pressures and adaptation. Within our species, key shifts in body size accompanied major changes in diet and lifestyle. These include height reductions with the transition to food production in many parts of the world, through to 20th century secular increases in stature and obesity. The interaction between past and present environmental influences on body size may have significant implications not only for understanding past adaptation, but also for contemporary health. Present day populations of South Asian ancestry (broadly Indians, Sri Lankans, Pakistanis and Bangladeshis) have an elevated susceptibility to chronic diseases (e.g. type 2 diabetes, cardiovascular disease) compared with Europeans [1]. The burgeoning worldwide 'epidemic' of chronic disease therefore affects South Asian populations particularly strongly. While changes in lifestyle and diet play a central role in the aetiology of chronic diseases, South Asians have low lean mass (organ and muscle mass) relative to stature and total body mass, which is implicated in their elevated chronic disease susceptibility. Low lean mass is present at birth and persists across generations following migration, but when and why low lean mass evolved among South Asians is unknown. Proposed explanations include the impacts of climatic adaptation, the agricultural transition, vegetarianism, or colonial policies exacerbating the impacts of 19th century famines [2].

The osteo-archaeological record offers a means of investigating temporal changes in body size, and so to investigate the origins of South Asian low lean mass. However, the South Asian skeletal record presents multiple challenges, not least since preservation conditions mean remains are commonly fragmentary. To investigate when low lean mass evolved and to maximise sample size from a fragmentary skeletal record, we used data on worldwide skeletal variation across the Holocene (the Goldman dataset (http://web.utk.edu/ auerbach/GOLD.htm), and hunter-gatherer data collected by JTS) to calculate sex-specific z scores for adult long bone lengths (proxy for stature, e.g. [3]) and joint and shaft breadths (proxy for body mass, e.g. [4]) for individual skeletons from South Asia, dating from 11,000 years ago to the present. For each individual, the mean was taken for all available bone length and bone breadth z scores. Temporal, geographic and subsistence-related trends in mean length z scores, mean breadth z scores, and their relationship, were examined using linear regression. As stature increases significantly with latitude in our South Asian dataset, latitude was included in subsequent regression models. While methods for directly estimating lean mass need developing, we can expect that reductions in low lean mass will manifest in reduced total body mass relative to stature.

Our results show that all South Asians, but particularly Mesolithic hunter-gatherers, have low bone breadth z scores relative to length z scores compared with the worldwide dataset. We found a marked decrease in bone length z scores (stature) with the transition to food production, as documented elsewhere [5], but no corresponding trend in bone breadth z scores (body mass). There is no temporal trend in breadth z scores relative to length z scores, indicating that the transition to food production led to decreased stature while body mass was maintained. The results imply low lean mass was present among South Asians since at least the start of the Holocene, and therefore may represent a long term adaptation to climatic conditions, or the influence of neutral processes.

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Poster Presentation Number 46, Fr (12:15-14:15)

The lithics of the Eemian and Early Weichselian find levels of Neumark-Nord 2 (Germany) - techno-/typological developments against a background of environmental change

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The Last Interglacial (Eemian) and Early Weichselian, characterised in west and central Europe by environments ranging from temperate forest to boreal forest and steppe-tundra, are situated in time between two fully glacial phases (OIS 6 and OI4), and can therefore provide important insights in hominin adaptations to changing environmental conditions. Although a relatively high number of sites are known from the Eemian, many are butchering localities that provide, through their small size and little or no time-depth, a very limited view of Neanderthal behaviour and lithic technology in particular. For the Early Weichselian the situation is not much better with just four sites in western-central Europe for a period of almost 50,000 year [1]. The well-stratified lake basin site Neumark-Nord 2 is an ideal candidate to fill in some of the blanks, as it contains various archaeological levels in fine-grained deposits dating to the early to middle part of the Eemian Interglacial (~125 ka) [2], together yielding more than 20,000 stone artefacts [3], and an Early Weichselian archaeological level (~ 80 ka) with more than 8,000 lithic artefacts. The lithic finds are associated with even bigger faunal assemblages as well as a broad spectrum of environmental proxies which inform on local conditions during periods of occupation (e.g. [4,5] As raw material sources are the same locally available (Saalian) till deposits, these find levels provide a good comparative case study of technological development against a background of environmental change.

The assemblages from the Eemian find levels show a very persistent technology consisting of a discoidal reduction of cores, often until very small size and complete exhaustion. Large cores, as well as larger flakes, show characteristics that overlap with those of the Levallois method, but a structural use of this method cannot be inferred without refitting analysis. The modification of flakes was limited to simple notches and denticulates.

The Early Weichselian material also includes discoidal cores, but not with the same degree of (extreme) reduction as observed in the Eemian assemblages. Rather, blanks have been more heavily retouched into scrapers with occasionally very steeply angled working edges. More intensive use of blanks (and exhausted cores) is also evidenced by backed bifacial pieces (contra [1]), which can be considered *Keilmesser*, albeit with a lower degree of standardization than the ones from OIS 3.

The Eemian and Weichselian assemblages show diametrically opposed strategies of raw material use, within the boundaries dictated by raw material constraints. Whereas in the Eemian the focus was on maximizing "primary" cutting edge up to the point of microlithization, during the Weichselian hominins opted for maximizing the use life of flake blanks and waste cores, ranging from scrapers to Keilmesser. The reasons behind this change can be manifold: changes in mobility, differences in site function, *access to* (rather than the *type of*) raw material, demand for particular tools dictated by environmental conditions and/or different Neandertal populations occupying this territory after a period of absence. Ongoing research on the technology of these finds and their broader archaeological context may shed further light on this matter.

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Podium Presentation: Session 5, Fr (9:00)

Deeply divergent archaic mitochondrial genome provides lower time boundary for African gene flow into Neanderthals

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Ancient DNA retrieved from archaic human remains has provided new insights into genetic relationships between Pleistocene hominins and modern humans. Nuclear DNA attested Denisovans as a sister group of Neanderthals after diverging from the modern human lineage. However, mitochondrial DNA (mtDNA) of extinct hominins suggests alternative evolutionary scenarios. The closer affinity and more recent divergence time of Neanderthal and modern human mtDNAs with respect to Denisovans has recently been suggested as the result of African gene flow into Neanderthals before 100,000 years ago. In 1937 a right hominin femur (HST) shaft with archaic morphology was excavated from the cave of Hohlenstein-Stadel in the Swabian Jura of southwestern Germany. The specimen was discovered in a layer corresponding to the Middle Paleolithic. Attempts to directly date the femur were inconsistent and indicated that the bone may be out of range for radiocarbon dating. Here we present genetic analyses of the femur shaft in order to assess the age and phylogenetic position of this ancient hominin bone. Hybridization capture in combination with next generation sequencing were used to reconstruct the complete mitochondrial genome. HST carries the deepest divergent mtDNA lineage on the Neanderthal branch showing substantial branch shortening and indicating an age for the hominin femur notably older than previously suggested. Using a Bayesian statistic framework we molecularly dated its temporal range to ~124,000 years ago (95% HPD 183,000-62,000) and the split of HST and other Neanderthal mtDNAs to ~270,000 years ago (95% HPD 316,000-219,000), which provides a lower boundary for the time of the putative Neanderthal mtDNA introgression from Africa. In addition, we demonstrate that a complete mtDNA replacement is feasible over such a time interval even with a few percent of introgressing mtDNA. Finally, the highly divergent HST branch is indicative of greater Neanderthal mtDNA diversity during the Middle Pleistocene than previously assumed.

Poster Presentation Number 44, Fr (12:15-14:15)

Reviewing evidence of Neandertal and Upper Paleolithic diet

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Neanderthals and Upper Palaeolithic peoples have been previously reconstructed as consuming a diet heavily predicated on returns from large game hunting. These inferences are gleaned from indirect evidence, namely from the presence of processed animal bones and stone tools found in the same depositional context as dentoskeletal remains. Several direct methods have been more recently marshalled to investigate Neandertal and Upper Palaeolithic dietary proclivities including food processing material culture, dental microwear, carbon and nitrogen isotopes, dental calculus and dental paleopathology. These have been used to suggest that Upper Palaeolithic diets were broader than Neanderthal diets but more recently, significant levels of Neanderthal plant use and possible broad Neanderthal diets have been proposed. The purpose of this study is to review how these methods have been applied to Western European Neanderthals and their immediate successors in the Upper Palaeolithic to the younger Dryas period. Eastern Eurasia is utilized as a counterpoint to compare the changes in dietary signature that occurred in Western Europe from the Middle to Upper Palaeolithic. Western European Neanderthals appear to have had a diet governed by local resource availability that varied widely between open versus closed habitats and between relatively warmer regions and those more subjected to the effects of glacial advances and melt water inundations. Western European Upper Palaeolithic peoples followed these same patterns with the exception that increased trade and mobility mitigated a strict reliance on local food resources. While hunted animal meat protein and some amount of plant foods appeared to have been important to both Neanderthals and Upper Palaeolithic peoples of Western Europe, the technology used to procure and process animal meat protein may have developed more substantially over time. The latter may have consumed a diet which included riverine resources. In contrast, the proportion of plant use in Upper Palaeolithic diets varied from greater to the same with respect to that of the Middle Palaeolithic. In addition, signs are emerging of intensive ways to use plant foods. Multiple trends indicating specialization rather than dietary broadness is a major distinguishing characteristic of Upper Palaeolithic diets.

Poster Presentation Number 84, Fr (12:15-14:15)

Random genetic drift and cranial form evolution in Anthropoids

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Primate cranial form is widely variable among primate groups, while being constrained by their close phylogenetic relationships. Fossils show that extinct primates were also extremely variable in cranial form. Evolutionary, cranial form is driven by the action of microevolutionary processes, such as genetic drift and natural selection, but how each of them contribute to cranial diversification is still an open question. Here I apply "Cheverud's conjecture" to a sample of cranial linear measurements to test what the relative contribution of genetic drift is that has acted on the anthropoid cranium to produce its current diversity of forms. Data used are 6 linear measurements of the cranium taken from 1,246 adult individuals, both male and female, belonging to 38 anthropoid genera. To study whether or not the observed diversity could be explained by random genetic drift alone, the within- (**W**) and among-group (**B**) variance-covariance matrices were compared. Following the claim [1] that, in contemporary populations, the **W** matrix is often proportional to the genetic (**G**) variance-covariance matrix, one can substitute the latter by the former. Comparing **B** and **W** (as a surrogate of the average **G**) was accomplished by using the method of Ackermann and Cheverud [2]. The null hypothesis of random genetic drift is rejected if the slope of the regression (β) deviates significantly from 1. When using a significance level of $\alpha = 0.05$, it is expected that a true null hypothesis has a 5% chance of being rejected (a type I error). This test was proved to be robust in falsifying the underlying assumptions [3]. A phylogenetic tree is used here as a basis for the analyses and for the interpretation of results. In total, 36 analyses were performed. All the analyses were run in the R environment. Results show that the null hypothesis of diversification by random genetic drift alone is rejected in 6 higher-group analyses: Atelidae, Cebinae and Papionini, as well as Cercopithecinae, Catarrhini and Anthropoidea. In the lower groups, only the sister genera *Cacajao/Chiropotes* and *Lophocebus/Papio* reject the hypothesis, while papionin sister genera *Cercocebus/Mandrillus* fail to reject it (possibly due to small sample size). For the remaining groups, the relative role of neutral processes is less clear, but the hypothesis that random genetic drift was the sole microevolutionary process responsible for the observed diversity cannot be completely ruled out by this method. This work expands previously presented analyses [4] by including lower-level comparisons, allowing for a more robust interpretation. A considerably large contribution of non-random processes like natural selection seems to have occurred in Atelidae, Cebinae, and particularly in the Papionini branch. Preliminary results with 3D landmarks on Papionini [5] are in agreement with results shown here and indicate that genetic drift alone would not have been able to produce the current diversity in form of the cranium in those primates. Nevertheless, while the whole of Anthropoidea could not have diversified by genetic drift alone, drift's relative role is less clear in lower taxonomic groups, but might have been more important than it is often presumed. Of course, divergent groups of anthropoids have suffered distinct selective pressures which are not easy to discern, including stabilising selection, the effects of which can be statistically confounded with random genetic drift. 2D and 3D landmarks that better describe cranial form should provide further and highly informative data to analyse. The extension of the sample size to include prosimians and fossil primates, as well as humans and fossil hominins would also be a welcomed addition to further the understanding of primate cranial form evolution.

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Poster Presentation Number 74, Fr (12:15-14:15)

The hominin inside: an automatic tool to reproduce the internal and external anatomy of bony structures

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In recent years, the use of CT-scans in physical anthropology yielded huge improvements of the analysis of skeletal remains. Such process made the "virtual anthropology" one of the most important approaches in the study of human evolution and bioarchaeology. The virtual reproduction of inner volumes has become a frequent procedure for studying the internal anatomy of fossil hominins. Such procedure has usually been carried out by filling manually (segmentation) the regions of interest (ROI), which is a time consuming task. At the same time, isolating the outer shell of a skeletal element is very useful in Geometrics Morphometric applications, for example when using semilandmarks. During "projection" and "sliding", the semilandmarks can intercept the inner surface failing the superimposition of the reference model on the target sample. Here we describe the application of two methods aiming to automatically generate inner and outer surfaces of the 3D model of a skeletal element. The methods have been implemented in the statistical environment R. A development version of the R-package "Morpho" [2] contains the function virtualMeshScan, that allows to select all vertices of a given triangular mesh that are visible from at least one of several specified points of view (POVs). Visibility is determined by evaluating whether a straight line between vertices and the POV intersects the mesh. To obtain the part of the visible mesh from the POVs, all vertices not tagged as "visible" are removed from the mesh itself. There are no constraints to where the POVs are placed. The R-package "Arothron" [3] provides functions useful for the extraction, from a point of view (POV), of the visible vertices belonging to the point cloud of a mesh. This method, developed by Katz [1], is based on the definition of a given number of POVs placed on a sphere that surrounds the object. In this way, the procedure simulates a scan of a 3D mesh, in which the vertices forming the external surface are marked as visible points. The vertices of the mesh that define the internal structure (not marked as visible points) are subtracted from the whole vertices matrix. Here we present the application of these two methods on three examples: a modern human skull (VA023) from Germany repository, the d1 tooth (*Homo neanderthalensis*) from Krapina and a *malleus* from a Middle Ages individual (Portico D'Ottavia, Roma). In conclusion, we introduce two procedures capable of isolating the inner volume of a skeletal element and useful to separate both inner (no visible) and outer (visible) components of a 3D model. In this communication, we tested and showed the performance applying these methods on anatomical area of different complex morphology and size. Potentially the massive application on huge samples could lead to an increased production of ROIs and thus of their availability to the researchers via online sharing.

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Poster Presentation Number 38, Fr (12:15-14:15)

Searching for evidence and missing the camps: Amsterade-Allée, a new Middle Palaeolithic open air site in the Netherlands with indications for the use of red ochre.

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Middle Palaeolithic research traditionally focuses on well preserved and well stratified sites in fluvial deposits, caves and rock shelters. The well-known surface artefact collections on the edges of the loess plateaus are considered palimpsests of multiple occupation phases, emphasising their importance in Neanderthals land use. Considering that the presence of Hominins in the area is attested as early as 250.000 years ago [2], there must be many open air sited in the loess region. Research into these sites is generally neglected based on a number of premises, including 1) perceived rarity, although the time span of Neanderthal existence in Europe will have produced a staggering number of sites and 2) the belief that low density lithic sites do not yield enough informational return to warrant the effort. This is understandable for practical reasons (i.e. preferring large sites with high quality data and allowing for long term research projects), but it creates a bias towards certain localities in the landscape, while ignoring the vast areas in between. While river banks, plateau edges and shelters may well have been important in Neanderthal land use patters, they used the entire landscape. Based on a pilot study at Sint-Geertruid [3], these surface sites represent the fringes of a wide network of sites buried in the stratified loess deposits. The surfacing loess on most of the plateaus dates to the Weichselian Late Glacial Maximum, postdating the Neanderthal demise. It does, however, cover the landscape used and the sites creates by these hunter-gatherers. Since they will represent short-term use of any given location, they will be small in size, have a low artefact density with few or no preserved organic artefacts and poor, or no stratification.

In 2014 a Middle Palaeolithic site was discovered and excavated in the trajectory of a planned road at a depth of circa five metres below the present day surface. The site was discovered using a multidisciplinary approach involving prospective modelling, mechanical augering and machine dug test trenches. This produced a small, low density, Middle Palaeolithic artefact scatter. The results of a limited wet screening campaign of samples collected in grid squares across the site showed no evidence for faunal remains and microdebitage. The artefacts were found in an early Weichselian soil complex provisionally dated at 75.000 BP. Based on low density and mean size of the artefacts from the test trenches, combined with the lack of microdebitage from the screening samples, the site was subsequently excavated using a mechanical digger. Additional grid squares were excavated by hand and the soil wet-screened in this phase too. This resulted in a small open air site where Neanderthals possibly processed flint nodules from river gravels close by. Several raw material units can be discerned in the small (N=100) artefact collection in two spatially discrete artefact concentrations. From the screening samples a small fragment of haematite was recovered, which for Middle Palaeolithic sites is still a rare occurrence [1].

The research has proven of great value on three fronts. Firstly the project has been the testing ground for devising new research methods to locate and excavate the type of sites involved, boosting Middle Palaeolithic research in the European loess area after a period of relative stagnation. Secondly, the main value of the site of Amstenrade-Allée itself lies on the inter-site scale, evidencing Neanderthal land use outside of the "traditional" foci. The more sites like this are discovered, the more their value increases as part of the Neanderthals' "lithic footprint" on the landscape. Thirdly, the intra-site value of locations like this may be higher than assumed, as evidenced by the rare find of the piece of haematite.

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

Interpretation of Footprints from Site S Confirms Human-like Bipedal Biomechanics in Laetoli Hominins

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Debates over the evolution of hominin bipedalism, a defining human characteristic, revolve around whether early bipeds walked more like humans, with energetically efficient extended hind limbs, or more like apes with flexed hind limbs. The 3.6 million year old hominin footprints at Laetoli, Tanzania represent the earliest direct evidence of hominin bipedalism and researchers have extensively examined print morphology to try to find clues regarding early walking mechanics. In 2016, Masao and colleagues [1] described a new set of trackways from Laetoli which represent an exciting opportunity to re-explore the early evolution of bipedalism. Masao et al. [1] made 3D scans of these prints freely available, providing an avenue for extensive study of this important find.

Here, we compare footprints from the original Lateoli Site G (n=8) and the newly described Site S (n=8) with experimentally generated footprints from modern humans (n=8 subjects) made using both extended and flexed limb, or Bent-Knee, Bent-Hip (BKBH) biomechanics. In our modern human sample, walking with footprints generated during BKBH walking leaves deeper toe relative to heel impressions compared with normal, extended limb walking (linear mixed effects model: $p<0.001$; [2]). The difference in proportional toe depth is linked to the mechanical consequences of BKBH walking [2]. During walking, the center of pressure (COP; the point of ground force application) moves from the heel at touchdown to the forefoot during toe-off, and the forces applied to the ground determine, to some degree, the depth of the impression under the COP. As the COP travels past the mid-foot the human heel rises due to the presence of a stiff longitudinal arch, and forces following heel rise deform the substrate under the toes. The COP passes the mid-foot earlier in the step in BKBH walking, leading to larger forces under the toes and relatively deeper impressions [2].

Using linear mixed effects models, we show that prints from Site G and the newly described prints from Site S at Laetoli are most consistent with weight transfer patterns from extended limb biomechanics. Proportional toe depths (calculated as log10[maximum fore-foot depth/maximum heel depth]) do not differ significantly between the Laetoli sites (G vs. S: $p=0.998$), and do not differ between Laetoli and modern humans walking with an extended limb gait ($p=0.195$). However, the print morphology at Laetoli does differ significantly from those made by humans walking with a flexed limb ($p<0.001$) due to the uniquely deep toe depressions that occur in humans walking with this more ape-like gait.

Thus, the newly described footprints from Laetoli Site S, along with the original Laetoli prints from Site G, are indicative of an extended limb bipedal posture by 3.6 Ma. These results represent the earliest direct evidence of kinematically human-like bipedalism currently known. Our results suggest that selection acted to increase the energy economy of bipedalism early in human evolution and that efficient extended limb bipedalism evolved long before the appearance of the genus *Homo*.

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Poster Presentation Number 103, Th (12:15-14:15)

Can dental morphology be used as a proxy for neutral genomic data in studies of human population relatedness?

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In archaeological and paleontological studies, dental phenotypic data are commonly used to estimate biological distances between groups in order to reconstruct human population histories and hominin phylogenies. Teeth are an important data source because they are generally well preserved in the archaeological and fossil record, even when the overall skeletal and DNA preservation is poor. Furthermore, tooth form is considered to be highly heritable, selectively neutral, and evolutionarily conservative, thus providing an excellent proxy for neutral genomic data when none are available. However, to date only few works have attempted to directly test the level of congruence between biological distances between populations based on dental phenotypic and neutral genomic data.

Here, for the first time, we address this issue by specifically testing for correlations of biological distances between globally distributed modern human populations, derived independently from dental phenotypic data (using metrics and non-metric traits) and neutral genetic markers (using SNPs and STRs). In order to do this we, first, matched genomic and dental phenotypic population samples from all over the globe drawn from existing large databases. Matched SNP and dental phenotypic data were available for 19 populations, and matched STR and dental phenotypic data were available for a subset of 13 populations. We then used the R-matrix method to calculate pairwise population kinship coefficients ($r$ij) utilizing the genomic and dental phenotypic datasets independently. R-matrix analyses are most useful for comparing patterns of biological similarity from different types of data and, in addition, allowed us to correct for the confounding effects of genetic drift by including estimates of effective population sizes (Ne). Finally, we statistically assessed the associations between genomic and dental phenotypic kinship estimates using Mantel correlation tests. In addition, Dow-Cheverud tests were used to determine whether dental metrics or dental non-metric traits are better suited to track neutral genomic relationships as calculated from SNP and STR data.

Our results show that kinship estimates between globally distributed human populations based on dental phenotypes are significantly correlated with those based on neutral genomic data. The strength of the correlation coefficients indicated a moderate positive fit between dental and genomic data types. Moreover, we observed that dental metrics and dental non-metric traits are equally well-suited in tracking neutral genomic relationships as calculated from SNPs and STRs.

In conclusion, our results confirm that dental phenotypic data can be used as a proxy for neutral genomic markers in studies of human population relatedness. However, the moderate fit between both data types indicate that only part of the dental variation among populations can be explained in terms of neutral genomic differences. Further research is therefore necessary to identify those dental characters that most faithfully reflect neutral genomic differences among populations.

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Poster Presentation Number 68, Fr (12:15-14:15)

Diagenesis dissected: A laboratory-based experimental study into the influence of pH exposure on heated bone.

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Gaining insight in the deep prehistory of fire use may have important implications for the understanding of key aspects of early human lifeways. While the benefits fire conferred on early humans are clear, the timing and nature of the various stages of its mastery remain contentious, with hypotheses for the origins of fire use ranging between roughly two million and forty thousand years ago [e.g. 1, 2]. At the heart of the debate lies the problem of correctly interpreting the patterns of fire evidence in the archaeological record, which rely heavily on either the presence or absence of fire proxies. Preservation is a major factor in the availability and visibility of fire remains in the archaeological record, with the preservation potential of fire residues rapidly declining over time [3]. Understanding the taphonomy of fire remains is therefore an important prerequisite for valid interpretations of hominin fire-related behaviour. In the study presented here, the effect of pH exposure on the preservation potential and temperature signal of heated bone was explored through a series of controlled laboratory-based experiments. Bone samples were heated to a range of temperatures (20-900^{o} C), and exposed to pH solutions representing acidic (pH 3), neutral (pH 7) and alkaline (pH 12) conditions. The samples were incubated for a period of approximately six months, and subsequently submitted to a variety of analytical techniques, including TGA, XRF, XRD, FTIR and py-GCMS, to determine changes in physical and chemical properties. Results were compared to reference data derived from unexposed heated bone samples [4]. The study indicates that heated bone is not chemically inert and is affected differently by different pH values, causing mass loss, fragmentation, and colour and consistence changes. As a result, the material becomes more susceptible to other post-depositional processes to the point where it may be lost from the archaeological record altogether. A temperature bias can be seen towards a more severe effect of pH on low temperature heated bone. All of the observed alterations will have an effect on the reliability of interpretations about various aspects of fire use by ancient hominins. Based on these results, it is suggested that more attention should be paid to the influence of pH on fire proxies, and that pH should be recognised as a legitimate cause for absence of evidence of fire use.

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Poster Presentation Number 45, Th (12:15-14:15)

Hunting seasonality and mobility patterns among late Neanderthals in Southwestern France. A cementochronological approach.

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The late Middle Paleolithic in southwestern Europe is characterized by major climatic fluctuations that had a direct impact on the eco-systems exploited by Neanderthals. Sedentary and migratory ungulate populations alternated in the environment. Neanderthal hunter-gatherers were forced to adapt their mobility systems to the migration pattern of their prey, conducting to a reorganization of the activities within their territories in function of the seasonal cycle. In this context, seasonality is a key topic for the reconstruction and understanding of the subsistence systems and settlement patterns developed by these hominid communities. We propose here a regional study of Neanderthal hunting seasonality based on published and unpublished archaeozoological and cementochronological analyses of late Middle Paleolithic sites from southwestern France. Cementochronology relies on the study under microscopic cross-polarized light of the dynamic patterns and rhythmicity in the deposition rate of a mineralized tissue, the cementum, around the tooth roots. The cementum growth follows predictable seasonal cycles with an alternation of fast and slow rate deposits during respectively the good and poor seasons. The outermost increment, forming at the time of death, is expected to give precise estimation of the season at death. Ungulate teeth from sites attributed to the MIS 4 and 3 with available zooarchaeological data were selected. Samplings were based on the MNI and thin sections were produced following the petrographic thin section protocol generally used for zooarchaeological applications. Post-mortem modifications were systematically looked for and computer-imaging analyses were used to identify the stage of growth of the last seasonal increment. The observations were then compared to comparative collections prior being interpreted in term of season of death. Our study suggests that different hunting economies were adopted at the end of the Middle Paleolithic including specialized ones: while Quina Mousterian diet seems to have been notably focused on Reindeer, the following Neanderthal populations would have exploited a larger range of resources. The seasonal results show that these different Neanderthal populations developed specific strategies to cope with the seasonal fluctuation of their prey. Innovative hunting strategies were established as a response to the ethological specificity of their game conducting to the reorganization of human settlement dynamics.

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Poster Presentation Number 43, Th (12:15-14:15)

Genomic signature among Neanderthals unravel adaptation for high protein diet metabolism

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Neanderthals and humans were diverged from their common ancestor around 400,000 years ago. While Neanderthals spread and habitat cold regions in Europe and Asia, modern human population evolved in warmer central Africa. It is common to believe that such differences in environmental conditions may result in niche adaptation to specific nutrition. Although Neanderthals and humans share similar anatomy, some morphological differences can be observed. One of the most remarkable difference between humans and Neanderthals is their larger, bell shaped, thorax. While some speculate that this morphology may be due to respiratory demands [1], others argue that the bell-shaped thorax may accommodate larger liver and renal system in Neanderthals, due to high protein-fat diet based on large mammals in opposed to high carbohydrate nutrition in modern humans [2]. The liver is the organ which is responsible to convert proteins into energy and it is already known that high protein nutrition results in expanded liver in lab animal. If such anatomical changes between modern humans and Neanderthals are due to different nutrition, it may be possible to postulate that evolutionary forces such as natural selection should promote metabolic pathways involved in the regulation and transformation of proteins and lipids into energy and those hallmarks could be traced back into genomic polymorphisms. We have used the publicly available exomes of three Neanderthals (Altai, Sindron and Vindija) and Homo sapiens genome to explore high polymorphic area among set of 90 metabolic pathways. We have used a custom made, unbiased, statistical analysis based on hypergeometrical test to explore for high SNPs (Single Nucleotide Polymorphisms) density regions and found that out of the 90 investigated metabolic pathways only "Pentose and glucoronate interconversions" pathway was significantly enriched. We find that polymorphic genes that share this pathway are involved in two main biological processes: 1) energy regulation and interconversion under excess dietary intake which presumably induces enlarged liver, and 2) elimination and detoxification of dietary substances that are excreted in the urine. In conclusion, we show for the first time that metabolic pathways involved in excess dietary protein and fat nutrition shows a clear signature of genomic divergence between Neanderthals and humans, thus may benchmark previous discrepancies in anatomical assumptions.

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Poster Presentation Number 10, Fr (12:15-14:15)

Comparing fauna from the Still Bay of Blombos Cave with the Howiesons Poort of Klipdrift Shelter: Possible subsistence intensification during the Late Pleistocene in the southern Cape of South Africa

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The Middle Stone Age/Middle Palaeolithic encompassed significant developments in both the biological and behavioural evolution of *Homo sapiens*. The Still Bay and Howiesons Poort (dated to between 80 and 50 000 years ago) were two significant techno-complexes in the African Middle Stone Age and key periods in the expression of behavioural complexity. In this paper, we compare fauna from the Howiesons Poort levels at Klipdrift Shelter (KDS) with that from the recently excavated fauna from the Still Bay layers at Blombos Cave (BBC) in the southern Cape of South Africa. We consider our findings within the framework of resource intensification to examine whether foraging strategies in the Howiesons Poort were more or less intensive than those in the Still Bay. Resource or subsistence intensification has been defined as the extraction of increased amounts of energy from a given area at the expense of foraging efficiency and is often linked to periods of socio-ecological stress [1,2]. In the context of our study, we measure subsistence intensification based on specific zooarchaeological criteria, namely: the exploitation of low-ranked prey, specifically small mammals; the processing of low-utility elements such as phalanges, calcanei and mandibles; transport decisions (using skeletal-element profiles as proxies); and occupational intensity based on fragmentation, surface modification, breakage patterns and other taphonomic data. Our results suggest that low-ranked elements were processed more heavily in the Howiesons Poort of KDS. Diet breath was also broader at KDS than at BBC. Foraging ranges, however, may have been more extensive during the Still Bay at BBC than at KDS but the fragmented nature of the larger mammals from KDS makes this difficult to demonstrate. Taphonomic data suggests that the Still Bay at BBC was a low-intensity, sporadically occupied period in contrast to the high-intensity occupations during the Howiesons Poort at KDS. In general, the results suggest that intensive subsistence strategies are more evident at KDS than BBC. We argue that this may be related to differences in residential patterns and occupational intensity between the Howiesons Poort and Still Bay techno-complexes. Although both BBC and KDS occur in the same environmental biome (the fynbos region of the south-western Cape), changing environmental conditions during the Late Pleistocene may have also affected settlement patterns at these two sites.

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Poster Presentation Number 49, Th (12:15-14:15)

The taphonomy of small mammals at Geißenklösterle Cave in the Ach Valley of southwestern Germany during the Middle and Upper Paleolithic

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A long tradition of Paleolithic research in Germany has resulted in a detailed prehistoric record of the Ach and Lone valleys. Our current picture of the Late Pleistocene environment in the Ach Valley is of severe climatic oscillations of moist/warm periods of intermixed steppe and woodland landscapes with cold/dry periods of extended tundra [1, 2]. The agreement found between sedimentary, botanical, and faunal records indicates a robust paleoecological signal, however, nuances in the different records make a full understanding of each line of evidence critical. Taphonomic analysis of the small mammal assemblage can help us understand site formation processes, both anthropogenic and natural. The precise habitat requirements, rapid turn-over rates, and small home ranges of microfauna species make them ideal paleoenvironmental proxies. However, the mode of accummulation by predators can introduce various taxonomic biases due to the predators' dietary preference, hunting range, and behavioural patterns. This can lead to the complete exclusion of small mammal species, selection based on prey size/weight, or even dominance of one species in the small mammal assemblage. Only by determining the source of the assemblage can predation biases be identified and considered during paleoenvironmental interpretation. This paper presents the results of a taphonomic analysis of the small mammal assemblage from the Middle Paleolithic and Aurignacian at Geßenklösterle, dating to ca 48,000–36,000 BP [3]. This is the first such analysis in the German Paleolithic record, to our knowledge. Previous studies of microfauna have focused primarily on paleoenvironmental reconstructions. We use three forms of modifications to determine the accumulators active at the site: skeletal element representation, element breakage, and dental element digestive corrosion . We identified strong positive correlations (r>0,779) between post-cranial assemblages and modern European eagle owl (*Bubo bubo*), red fox (*Vulpes vulpes*), and kestrel (*Falco tinnunculus*) accumulations. Corresponding proportions of arvicolidae molars exhibiting digestive corrosion are also consistent with Category 3–4 predators (e.g. European eagle owl and kestrel). Thus it is likely these two predators contributed most to the Geißenklösterle small mammal assemblage during both cultural periods. These results imply the high proportion of voles and shrews in the Geißenklösterle assemblage may be due to selective predation. Furthermore, Soricidae species (*Sorex* and *Neomys*) and *Arvicola terrestris* may be over-represented, as both predators hunt primarily in open environments, the European eagle owl with a preference for the water vole. Evidence of a regional shift from woodland to tundra landscapes, noted in past studies [1,5], may be inflated in the Geißenklösterle small mammal material. However, since both avian predators are primarily opportunistic hunters and produce prey assemblages with high species diversity , the relative proportions of species should accurately reflect their abundance on the surrounding landscape facilitating a reliable reconstruction of the landscape surrounding Geißenklösterle.

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Poster Presentation Number 147, Th (12:15-14:15)

Human deciduous teeth from the Middle Stone Age layers of Sibudu Cave (South Africa).

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Sibudu Cave is located in the KwaZulu-Natal province (South Africa), about 40 km north of Durban and 15 km from the Indian Ocean coast. The deposits document a discontinuous occupation of the site during the Middle Stone Age (MSA). Anatomically Modern Humans (AMH) in Africa emerged during the MSA which spans from about 300 ka to 25 ka. In the South African MSA, "pre-Still Bay", Still Bay and Howieson's Poort industries correspond to a period of great behavioural and technological innovation at $\sim$ 80-60 ka [1], which has been proposed as one of the driving forces of AMH large expansion within and out of Africa [2]. Recently, at Sibudu cave, two human deciduous teeth have been recovered. Here we describe their morphology and metrics, using three-dimensional models of the teeth obtained from high-resolution micro-CT images. One is a lower left dm1 recovered in the BS5 layer; BS (Brown Sands) member has been dated at the top level at 77.2 $\pm$ 2.1 ka and the tools from this member are assigned to the "pre-Still Bay" assemblage. The specimen comprises the intact crown and the remnants of the roots that have been resorbed. Preservation is very good, with minor post mortem cracks across the surface not affecting the overall morphology. The occlusal wear is marked, with large confluent areas of dentine exposed, however the outline of all five cusps is still evident. A large carious lesion occupies most of the distal face and part of the occlusal surface. A chip of enamel is missing from the disto-buccal corner; flaking must have occurred *in vitam*, since the edges of the enamel are smooth. The roots have been naturally resorbed, causing the tooth to be shed, an event that in modern humans occurs around 10.5-11.5 years of age [3]. The other tooth is a lower right di1 coming from the Pinkish Grey Sands (PGS) member, dated at 64.7 $\pm$ 1.9 ka, and associated with the Howieson's Poort industry. The specimen has the intact crown and remnants of the resorbed root. Preservation is very good, with only minor post mortem cracks across the surface. Incisal wear is marked, with the flat wear plane tilted slightly mesially and dentine exposed. The roots were naturally resorbed; in modern humans, shedding of lower di1 occurs at 5.5-6.5 years of age [3]. In this specimen, average enamel thickness and relative enamel thickness values have been measured. For both teeth, we compared Mesio-Distal (MD) and Bucco-Lingual (BL) diameters with those of other Pleistocene deciduous teeth (Skhul, Qafzeh, Early Upper Paleolithic, Late UP, South African MSA, Iberomaurusians) and extant *Homo sapiens*. Both teeth cluster together with the other penecontemporaneous MSA specimens from South Africa; moreover MANOVA indicate that MD and BL diameters of dm1 and MD diameter of di1 discriminate well between the different groups analysed. This suggests common characteristics that make South African MSA populations at $\sim$ 80-60 ka distinguishable from the other Pleistocene and extant human populations.

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Poster Presentation Number 140, Fr (12:15-14:15)

Growth in height and somatic maturation of Neandertals compared to modern humans

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The acceleration or slowing of the rate of growth and maturation of Neandertals in comparison with modern humans is a controversial issue in human evolutionary studies, with different observations supporting either faster or slower rates [1,2]. With regard to height, it has been proposed that growth in Neandertals is slower than that seen in modern humans [2]. Height-for-age (HFA) is generally used as an anthropometric measure for assessment of growth status in living children. The height of a child at a given chronological age (CA) is classified by means of Z-scores or centiles in comparison with reference data from a healthy sample of children. Additionally, one of the methods of assessment of biological maturity in living children is the estimation of the percentage of adult height attained at a given age (PAH). Among children of the same CA, the one closer to its adult height is more mature that the other who is further from adult height. In living children, adult height can be estimated from non-invasive methods, although the most accurate ones include an assessment of skeletal age [3,4]. We present here a study of HFA and PAH in Neandertal and modern human samples.

The following three samples were studied. An ontogenetic Neandertal sample comprised by 17 subadult specimens (0-13 years), with available femoral length or stature estimations and CA estimated from diverse methods. A modern human sample comprised by 173 documented skeletons (Lisboa and Coimbra collections), ranging in age from 0 to 20 years. A mixed cross-sectional and longitudinal sample of living Guatemalan children from 0 to 16 years. Comparisons were undertaken between bone dimensions and between height estimations. Height was estimated by diverse methods from femoral diaphyseal length. The PAH was estimated considering as adult height the mean value of samples of adult skeletons (for the Neandertal sample, measurements from casts and 3D reconstructions; for the modern human skeletons, measurements from a sample of 40 adult skeletons from the same collections; for the Guatemalan sample mean adult females and males heights).

Two comparisons were carried out. First, non-structural growth models were fitted to the osteological data for the 0-10 years, and comparisons between Neandertal and modern humans were carried out through ANCOVA and the analysis of residuals. Second, we followed previous authors [2] and individually tested the association of each Neandertal specimen to the distribution of modern human samples of the same estimated ages.

Besides inevitable low sample sizes, two are the main factors that influence the comparison in growth and somatic maturation between Neandertals and modern humans. First, lack of accurate estimations of CA, with several estimations based on extrapolations from dental maturation or from bone size, in the latter case adding a circular reasoning in the growth comparison. Second, the choice of the comparative sample and the meaning of what is the modern human range of variation in height. When compared to a sample of children born at the end of the XXth century in northern Spain, statural growth of Neandertals can be considered slower than modern humans [2], but when compared with a XXth century Portuguese sample of urban children with general unfavorable living conditions, or with samples of Guatemalan children with chronic malnutrition, statural growth is very similar to modern humans.

Modern humans display a broad diversity in growth and somatic maturation in height, related to the plasticity of the human body in response to the diverse ecological environments in which modern humans live (physical, social, economic and political). Although such a broad diversity was maybe not expressed during the Paleolithic, the plasticity in growth of modern humans, also possibly present in Neandertals, complicates the detection and interpretation of significant differences in linear growth between modern humans and Neandertals.

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Poster Presentation Number 115, Th (12:15-14:15)

Investigations of activity, diet and health on the prehistoric Baltic coast

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Biological adaptation to changing subsistence patterns has been of interest to many scholars in anthropology and archaeology. However, the study of prehistoric coastal populations is underrepresented in the archaeological literature when compared to the research on populations who lived further inland. Coastlines have been dynamic zones of social and cultural change, and attractive locations for human settlement all across the globe and ever since the Palaeolithic [1]. Typically, coastal groups are also only studied in the context of one single cultural horizon, without examining sociocultural and biological change over deep time. This paper explores the lives of prehistoric hunter-fisher-gatherers and early agricultural and metal-working groups who lived by lowland river valleys, streams and lakes and the sea. The Baltic region (present-day Estonia, Latvia and Lithuania) was largely inhabited by hunter-gatherer communities between the Middle Mesolithic and Early Neolithic (9th - 6th millennium BC). During the rest of the Neolithic (6th-3rd millennium BC), communities began to live in denser population numbers, create pottery, and rely on a more mixed subsistence economy that combined fishing with early farming as modes of attaining food. Early bronze and iron metallurgy then became fashionable across these lowland and riverbank populations from the 2nd millennium BC onwards. In total, 159 individuals deriving from all these time periods were studied in terms of their activity, diet and health patterns. To interpret habitual activity, analyses of upper and lower limb cross-sectional geometry were conducted using laser scanning techniques [2]. Craniofacial robusticity, mandibular size/shape, tooth dimensions and dental pathologies were observed in order to further understandings of dietary change [3,4]. Recordings of non-specific indicators of health were taken to evaluate general health levels [5]. Our results demonstrate the unique role of prehistoric Baltic populations in the European and global narratives of cultural transitions. This paper showcases diachronic changes in lived experience of prehistoric hunter-fisher-gatherers during and after their agricultural transition.

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Poster Presentation Number 114, Fr (12:15-14:15)

New hominin material from Pešturina cave in Serbia

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Pešturina cave is located in Southern Serbia on a tributary of the Nišava River, in the vicinity of Sićevo Gorge (43^{o}10' N 21^{o}54' E) [1]. Together with Mala and Velika Balanica, the deposits cover the last 500 ka of likely continuous human occupation in the region. We obtained a series of dates by combined ESR and 14C methods that constrain the three distinct archaeological layers between 108 ka and 29 ka [2,3]. From the top to bottom of the sequence layers 2, 3 and 4 represent Pleistocene accumulations with Gravettian, Denticulate Mousterian, and Charentian Mousterian, respectively [1]. Radiocarbon dates on faunal bones show that materials have been mixed between lithostratigraphic layers.14C dates of faunal bones with cut marks provide two secure ranges during which human occupation occurred: between 33-29 ka cal BP, associated with the Gravettian, and 45-43 ka cal BP, associated with Mousterian [2]; layer 4 was dated to between app. 83 and 108 ka by ESR [3].

Hominin remains are distributed unevenly through the layers: A maxillary P3 crown of a juvenile individual was excavated from the layer 2 ;however, its attribution to the Pleistocene is not confirmed as the layer had some Holocene intrusions. In addition, the layer 2 also produced a fragment of a human cervical vertebra. All other hominin fossil material comes from layer 4: a shaft fragment of a juvenile human radius, an adult femoral head, and a maxillary M1 of an adult individual4. We compare the morphology of these specimens to the published data on Neanderthals and modern humans of comparable geological age. The maxillary premolar is consistent with modern human morphology while the maxillary molar is consistent with Neanderthals. In addition, we note the robusticity of all postcranial remains.

The addition of this material to our understanding of Neanderthal presence in the region is important. Further excavations as well as aDNA analyses (currently underway) will shed more light on the relationship of this material to adjoining regions which are increasingly recognized as key to our understanding of migrations in Europe.

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Poster Presentation Number 40, Fr (12:15-14:15)

Introducing time in the study of Neanderthals socio-economic behaviour: GIS multi-scalar spatial and temporal approach to dissect occupational patterns at the end of MIS 3.

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Humans are social agents that carry out activities in their living spaces. The activity areas, that reflect socio-economic phenomena of past human groups, are traditionally identified looking at the intra-site spatial patterns of stone tools and their density on the archaeological living floor. Variability in stone tool intensity and intra-site spatial distribution reflects variability within each activity area in number of individuals, duration of occupation, and number of superimposed events. That is why an understanding of the reasons, modalities, and variability of the type of human aggregations or repulsion in past lived space permits to understand long-term cultural and demographic processes. To understand past human behaviour there are four aspects that must be taken into consideration and that are discussed below: (i) the scale of analysis, (ii) the type of spatial patterns, (iii) the site formation processes, and (iv) the temporal resolution of the archaeological record. They are not systematically evaluated in intra-site archaeology. Phenomena that affected spatial patterns may have different trends at the large or small scale independently of the extension of the study area. The variation of point density over space is related to different intensity in acting phenomena and is also possible that in some area of the living floor the phenomena were completely different. Furthermore, humans were not the only agents acting into the site and natural processes could have disturbed the spatial distribution of the archaeological records. To further complicate the scenario, it must to be provided for palimpsest characteristic of every archaeological contexts [1], including living floor and layers with concentration of remains in few centimetres of thickness. In this paper we investigated taphonomic processes and cluster distribution of lithic remains using quantitative point-patterns modelling and statistical measure of density at Abric Romaní Middle Palaeolithic site, on a living floor dated at approximately 55 kyr. This quantitative approach has been applied to high-resolution lithic assemblage, previously analysed for Raw Material Units and refits to identify single technical events [2]. Multi-scalar horizontal analysis and vertical dispersion of artefacts within the activity areas exhibited different occupational patterns between the inner area of the rock-shelter closely located to the wall and the external area. The introduction of time into the analysis, with the identification of diachrony between the activity areas, has shown that the internal areas were firstly and repeatedly occupied by Neanderthal groups that had strongly interconnections between the areas [3], maintained similar technological [4] and occupational patterns during time and generated a horizontal palimpsest [5]. The exterior part of the rock-shelter was occupied for short events, spatially and temporally well-delimited and, most likely, during the last phase of human occupation of the site as also suggested by differences in the use of fire and in the degree of transformation of fuel.

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Poster Presentation Number 136, Fr (12:15-14:15)

Talar trabecular structure strongly correlates with locomotor mode and terrestrial mobility level in modern humans, nonhuman apes, and a Neandertal.

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Numerous studies have shown the plasticity of trabecular bone structure in response to mechanical loading throughout life [1,2,3]. In this study we examine trabecular structure in the tali of great apes, four modern human populations, and a Neandertal, to assess how internal trabecular structure correlates with locomotor behaviour. The tali from samples of four human populations (2 mobile, 2 sedentary, n=4x20), Neandertal (Shanidar 5), *Pan* (n=2), *Gorilla* (n=7), and *Pongo* (n=6) were μCT scanned. Standard trabecular properties were quantified in six volumes of interest (VOIs, lateral/central/medial trochlea, anterior/posterior talar facet, talar head). One-way ANOVA and principal components analysis (PCA) were used to assess significant differences between samples (α=.05).

A similar pattern of variation in BV/TV (bone volume/total volume) was found throughout the six VOIs in the modern human populations, but BV/TV was significantly higher in the mobile populations. The patterns of variation in BV/TV between VOIs differ between modern humans and nonhuman apes. Similar patterns of variation in BV/TV were found throughout the talus of knuckle-walking *Gorilla* and *Pan*. All nonhuman ape species have more isotropic trabecular structures overall compared to humans, with the most isotropic trabecular structures found in *Pongo*. The Neandertal has greater BV/TV than most of the mobile modern humans and nonhuman apes, particularly in the three VOIs under the trochlea. The Neandertal has significantly fewer and thicker trabecular struts compared to all modern humans, but falls centrally within human variation in trabecular degree of anisotropy (DA). A PCA of DA and BV/TV from all talar VOIs results in four clusters based on locomotor behaviour; mobile *Homo* (including Shanidar 5), sedentary *Homo*, knuckle walkers (*Pan, Gorilla*), and arboreal *Pongo*.

Both univariate and multivariate analyses show different patterns of trabecular variation throughout the talus based on locomotor behaviour. Human samples have both the highest and lowest BV/TV depending on terrestrial mobility levels, but the patterns of variation throughout the foot are identical in all human populations. Humans have higher DA throughout the talus, consistent with their more rigid pedal structure and uniform loading compared to apes who experience more variable talar loading. Shanidar 5 displays a similar degree of anisotropy to the modern humans indicating similar variation in joint loading directions. BV/TV falls within the mobile human range in the talar head but is higher in the trochlea, corresponding to the relatively large trochlear surface in Neandertals [5]. The Neandertal has exceptionally few but thick trabeculae compared to even the most robust humans in the sample. Taken together this suggests Shanidar 5 was a highly mobile individual, conforming to results from previous studies comparing lower limb bone rigidity between modern humans and Neandertals [4]. Univariate patterns of trabecular properties throughout the talus, as well as multivariate suites of trabecular properties, are informative on both locomotor mode as well as levels of terrestrial mobility in humans and great apes. Thus, trabecular bone structure may be a useful proxy for inferring terrestrial mobility levels as well as locomotor mode in fossil hominins.

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Poster Presentation Number 121, Th (12:15-14:15)

Spatial and Demographic Patterns of ^{15}N and ^{13}C Variation in Late Holocene Human Samples from Central-West Argentina

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Central-West Argentina (CWA) was inhabited by hunter-gatherer groups from ~10 000 years BP until ~2500 years BP when domesticated plants were incorporated into the diet, representing the southernmost limit of pre-Hispanic agriculture. In order to study chronological changes and the differential resource use of diverse ecological regions, a large number of isotopic data has been extracted from human remains during the last decade [1-2]. However, there are no studies analyzing intrapopulation variation according to the assigned sex and age of the individuals. Therefore, the main aim of this study is to explore the spatial pattern of ^{15}N and ^{13}C in late Holocene CWA populations by evaluating the contribution of different geographical, demographical, and chronological factors. Particularly, we will focus on analyses of the demographic variation (age, sex) in North Mendoza (NM), located at the center of the region. The sample is composed of ^{15}N and ^{13}C data extracted from 97 late Holocene individuals from 44 archaeological sites. The sample is divided into three age groups: children (<11), adolescents (11-20), and adults (>21). Moran's I correlograms, 2D map plots, and multiple spatial regressions were conducted for exploring the spatial patterns, and the best model explaining isotopic variation for CWA and NM was selected. Finally, T-test and M/ANOVA were used for determining sex and age differences in the isotopic data of NM. For both CWA and NM, ^{13}C shows a geographic cline, meaning that the samples rich in ^{13}C decrease with latitude whereas ^{15}N varies more randomly, even when samples are depleted in ^{15}N with decreasing latitude and longitude. The decreasing levels of ^{13}C and increasing levels of ^{15}N in the south could be interpreted mainly as the result of indirect consumption of C_4 plants resulting from feeding on camelids that base their diet on C_4; while the increasing levels of ^{13}C and decreasing levels of ^{15}N in the north could be explained as direct consumption of C_4 plants. This dietary pattern of animal protein increasing southwards and C_4 plants increasing northwards is in agreement with previous studies in the region [1-3]. The multiple spatial regressions for CWA show that the best model for both ^{15}N and ^{13}C variation results from the interaction between latitude, longitude, and chronology; while for NM, age, ^{15}N, and ^{13}C might also play an important role, which is expected for large and small geographical scales, respectively [3]. There are no differences between males and females nor adolescents and adults, meaning that they might have had similar diets. However, children have significantly higher ^{15}N values than adolescents and adults, and they have higher ^{13}C values though difference is not significant. Such enrichment in ^{15}N suggests that children were at a higher trophic level confirming the presence of long lasting breastfeeding. Additionally, the higher ^{13}C values for children may suggest the early incorporation of supplementary foods resulting from the hunter-gatherer's weaning patterns, although the type of supplementary foods (C_4) would be characteristic of agriculturalists [4]. Such mixed dietary patterns agree with the archaeological expectations for CWA, which was described as a buffer area characterized by the presence of heterogeneous resources and the interaction of different populations [1-3].

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Poster Presentation Number 28, Fr (12:15-14:15)

The tempo of the accumulation of hominins from Sima de los Huesos

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The hominin fossils recovered at the Sima de los Huesos (SH) Middle Pleistocene site (Atapuerca, Burgos) represent an European population that evolved into the Neandertals [1]. Recent geological, taphonomic and forensic studies allow us to rule out geological transport [2], carnivore activity [3]) or accidental falls [4,5] as explaining the presence of human bones in the SH site. So, the only hypothesis that cannot be rejected is the intentional accumulation of at least 28 bodies at the site by other hominins. Although we were able to rule out non-anthropic scenarios for the bones accumulation, the significant implications of funerary behavior 430,000 years ago make it necessary to understand the tempo and modo of this ancient behavior. At the SH site, the hominin bodies are not found in their original position, and the bones are generally found mixed together in the sedimentary matrix of the main chamber, making it difficult to associate different skeletal parts. Given this manner of deposition, many of the usual criteria for identifying burials are not applicable here. Nevertheless, the study of the spatial distribution of the remains can provide us with valuable information about whether the accumulation of bodies was synchronous (i.e. a single event) or whether they arrived at different times. This is very important because if the arrival of corpses to the site was asynchronous in time, this would indicate a recurrent behavior in this Middle Pleistocene population.

Systematic excavations at Sima de los Huesos site started in 1984. Each bone fragment in the collection was spatially located in the site relying on the X, Y and Z excavation coordinates (using local references during the first excavation campaigns and Total Station techniques in the more recent years). Every single fossil has been drawn in the excavation maps to a scale 1:1. This study is focused on the cranial collection, composed of more than 1,850 bone fragments. Of these, 565 cranial fragments have been fitted together to form 17 individual crania [5].

The analysis of the spatial distribution of SH crania revealed different patterns of spatial distribution: crania with dry bone fractures and scattered from the foot of the vertical shaft, slope to the bottom of the site, mixed with fractured crania in situ without any movement of the fragments. This indicates that when the fossil-bearing sediments carried the human remains "down slope" gravitationally, from the base of the vertical shaft to the main chamber, there were varying degrees of soft tissue decomposition in the different individuals. These data suggest that the accumulation of cadavers at the SH site was asynchronous, at least with regard to the timescale of cadaver decomposition, and thus, would indicate a recurrent funerary behavior in this Middle Pleistocene population.

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Neandertal remains from Cova del Gegant (Sitges, Barcelona)

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Cova del Gegant (Sitges, Barcelona) is the only known site in the NE of the Iberian Peninsula, where diagnostic Neandertal human remains have been recovered from a secure and well-dated stratigraphic context. At least eight site formation episodes from the Late Pleistocene (Episodes 0-3) to the Holocene (Episodes 4-7) have been recognized in the stratigraphic sequence, alternating between continental sediment deposition and periods of marine erosion followed by the accumulation of beach deposits. The layers that yielded the Neandertal remains have been dated to between 49.4 $\pm$ 1.8 ka and 60.0 $\pm$ 3.9 ka [1]. Five Neandertal specimens (MNI = 4) have been recovered in different galleries from the Cova del Gegant site; Gegant-1 & 2 from GL1 (layer XVa), Gegant-3 from GL2 (layer V) and Gegant-4 & 5 from GP2 (layer V). Neandertal fossils were associated with Middle Paleolithic stone tools and Pleistocene faunal remains.

The mandible Gegant-1 comprises most of the mandibular corpus from the right M1 tooth socket to the mesial margin of the left M3 alveolus. No teeth are preserved with the specimen, but the distal root of the left M2 is present in its root socket. The presence and development of the preserved root and root sockets indicate a minimum age at death of around 15 years [2]. The mandible has been directly dated by U-series to 52.3 $\pm$ 2.3 ka and a short fragment (52 bp) of mtDNA obtained from the mandibular bone itself groups the specimen with Neandertals. Gegant-2 is a lower left lateral permanent incisor (I2) that preserves the entire crown, but is missing approximately the apical third of the root. The degree of tooth wear suggests the tooth belongs to a second individual from the site, perhaps around 10 years old [3]. Gegant-3 is a central incisor assigned to a Neandertal specimen which has been reported previously, but remains unpublished. Gegant-4 is the distal portion of a left humerus from a juvenile estimated to be between 5-7 years old at death. The specimen shows thick cortical bone. Although fragmentary, the constellation of morphological and metric features indicates Neandertal affinities. Based on spatial proximity at the site and similar ages at death, this may represent the same individual as the Gegant-5 mandible [4]. Gegant-5 preserves a fragmentary mandible that preserves a portion of the right corpus with the dm2 and M1 fully erupted. In addition, the germs of the permanent canine and premolars are present within the mandibular corpus. Based on the degree of dental development, the age at death is estimated as 4.5-5.0 years. The M1 shows a continuous midtrigonid crest and the canine and premolars also show crown features which occur in high frequencies among Neandertals. The mandible shows a single mental foramen located under the dm1/dm2 interdental septum, a relatively posterior placement compared with recent humans of a similar developmental age. The mental foramen in Gegant-5 is also placed within the lower half of the mandibular corpus, as in the previously described late adolescent/adult mandible (Gegant-1).

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Poster Presentation Number 56, Fr (12:15-14:15)

Multiple-method luminescence dating of Palaeolithic sequences in Badalinh and Gu Myaung Caves, Myanmar

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Reliable chronologies are essential for understanding the timing and routes of human dispersal through Southeast Asia, which remain open questions. Luminescence dating of archaeological sites has proven challenging in Southeast Asia, and especially in island Southeast Asia, due to problems with the optically stimulated luminescence (OSL) signal from quartz. Consequently, alternative luminescence signals have been tested, including infra-red stimulated luminescence (IRSL) and post-IR IRSL (pIRIR) from potassium-rich feldspar (K-feldspar). To the best of our knowledge, no luminescence ages have been yet published for archaeological sites in Myanmar. The aim of this study is to provide luminescence chronologies for two Palaeolithic sites in Myanmar, Badalinh Cave and Gu Myaung Cave, where stone artefacts and ceramic fragments have been discovered, to improve our knowledge of the chronology of human dispersal through South-east Asia. Three different luminescence signals have been investigated: OSL, pIRIR and infrared-radiofluorescence (IR-RF). Single-grain OSL dating of quartz was unsuccessful due to saturation effects and generally dim emissions. By contrast, pIRIR measurements on individual, sand-sized (180-212 μ m diameter) grains of K-feldspar yielded pIRIR signals far from saturation, so reliable equivalent dose (De) values could be estimated. Issues such as insufficient bleaching and post-depositional disturbance (e.g. bioturbation) were investigated by analysing the single-grain De dis-tribution patterns. For comparison with the pIRIR De values, IR-RF measurements made on single aliquots composed of K-feldspar grains yielded IR-RF signals sufficiently bright for De estimation. The luminescence data and initial dating results will be presented at the conference, and com-pared with independent U-series ages for interstratified speleothems. Preliminary results suggest ages of up to $\sim$ 42 ka at Badalinh Cave. We will discuss the archaeological implications of the new chronologies for Badalinh Cave and Gu Myaung Cave, as well as the luminescence results for K-feldspar grains deposited at open-air sites located next to the Irrawaddy River (near Chauk) in cen-tral Myanmar, which were studied originally by Hellmut de Terra and Hallam Movius in the late 1930s.

Poster Presentation Number 66, Fr (12:15-14:15)

Assessing tool complexity: Combining approaches from Cognitive Archaeology and Information Theory

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Assessing tool complexity in archaeology remains a controversial issue, as past hominins' cognitive capacities to engage with objects and materials from their environment cannot be measured directly from the artefacts. In the past it was widely assumed that a preservative stasis prevailed in the application of simple direct percussion methods during most of the Oldowan period, and that only members of the genus *Homo* were capable of knapping stone tools. Recently, however, evidence of stone tool production including passive and bipolar percussion techniques emerged, predating the Oldowan [1]. Moreover, various extant primates were observed making use of stone tools, some even unintentionally producing flakes with various percussion techniques [2]. Thus, it remains ambiguous what constitutes early complex behaviors, what vindicates the assumption of superior 'technical intelligence' in the genus *Homo*, and how this is reflected in the earliest lithic artefacts, commonly regarded as the first indication of a developing human culture. We propose a novel method to evaluate complexity in tool-behavior. Established examples of production and/or use of stone tools by hominins and other primates are compared. The reconstructed production processes are coded into so-called cognigrams and effective chains. These reflect cognitive performance during the production and use of tools by reconstructing the different attention foci (raw materials, tools), required action steps, and resulting effects that in turn demand behavioral readjustments in order to successfully overcome a given problem-solution-distance [3]. While complexity can be assessed qualitatively from the visual comparison of cognigrams, a quantitative level of assessment is added here. The compositional elements of cognigrams are translated into code-strings with a specifically developed syntax. Comparative evaluation is carried out by an information-theoretic account based on Shannon entropy [4], i.e. the average information content of elements in cognigrams. Hence, complexity is understood here as the difficulty of describing the production and use of tools. It is challenging to detect differences in the cognitive efforts required during the production processes of artefacts that are – despite created by different species – identical in their physical appearance. However, contrarily to extant primates, hominins produced tools with the intention to use these later on for independent tasks or to produce further tools. To this end, they had to anticipate the recombination of several modules of behavior in an adequate order (e.g. acquisition of hammer; production of stone tool; cutting meat), to eventually satisfy a need [5]. The most elaborate straightforward process of chimpanzee nut cracking has a mean entropy (bits/element) of 5.72 (SD=0.38), which is not only more complex than capuchin stone crushing (M=4.86-5.08; SD=0.43-0.54), but also more complex than simple versions of hominin free-hand, direct percussion (M=5.63; SD=0.27) and passive hammer techniques (M=5.36; SD=0.27) and use of flakes. The conceptual hominin innovativeness is reflected by modularization of tasks. While this increased complexity in rather simple tasks such as flake tool production and use (M=5.48-5.83; SD=0.24-0.25), it rendered more sophisticated technologies such as e.g. a simple wooden spear actually thinkable. Complexity in simple stone tool techniques must be discerned by evaluating the anticipation of an objective instead of an intermediary stopover event in planning. Our method provides a tool for the detection of subtle distinctions in behavioral complexity on a comparative basis. Moreover, it allows for the incorporation and comparison of large datasets, currently becoming available from the growing body of cognigrams, and for their simple conjunction.

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Poster Presentation Number 47, Th (12:15-14:15)

Lithic assemblages from the Middle Paleolithic of Geißenklösterle Cave, Germany: New insights on Neanderthal technology and behaviour from the Swabian Jura

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Since the late 19th century, generations of scholars have conducted Paleolithic research in the cave sites of the Swabian Jura. One of the best known sites in the region, Geißenklösterle Cave (GK) in the Ach Valley, was excavated by J. Hahn and others between 1973-1991 and subsequently by N. Conard in 2001 and 2002. Most importantly, the locality has yielded a depositional sequence that includes Middle and Upper Paleolithic occupations. While most previous work has focused on the Upper Paleolithic sequence, here we present the first detailed lithic analyses of the Middle Paleolithic. These assemblages include 747 stone artifacts from 5 archaeological horizons (AH IV-VIII). The Middle Paleolithic deposits lie below a nearly sterile horizon that separates the Neanderthal occupations from the Aurignacian. We analyzed all artifacts >20 mm by a combination of attribute analyses and a *chaîne opératoire* approach. Smaller lithic products were classified according to raw material and retouch debitage. Our main goals were to study operational sequences, methods of core reduction, knapping techniques, and tool production. These analyses aimed at identifying diachronic and synchronic variability and characterizing Neanderthal technology at GK.

Our results show that throughout all layers, the inhabitants predominantly knapped the local Jurassic cherts (>90%) with only small amounts of other raw materials. All assemblages are characterized by artifacts of small size, with few pieces exceeding 50 mm. The assemblages demonstrate complete reduction sequences for Jurassic chert with a notable underrepresentation of end products, while other raw materials are characterized by isolated finished products. Abundant small artifacts from Jurassic chert and an almost complete absence of small debitage for other raw materials support these results. Various modalities of Levallois constitute the most frequent core reduction method in all assemblages, but with a conspicuous lack of end products. Knappers primarily aimed to produce small flakes (20-30 mm) via the Levallois reduction sequence. This being said, Neanderthals applied a variety of reduction strategies that also include Kostienki, bipolar and platform methods. We did not observe discoid or laminar technologies. Percussion by hard hammer is attested by abundant hammerstones from local river cobbles. Various types of scrapers are the most frequent tool types, followed by splintered pieces. The assemblages do not feature notches, denticulates or bifacial implements. Low frequencies (2-10%) of small retouch debitage from Jurassic chert attest to some on-site tool production. Although diachronic observations indicate variation between the layers, assemblages IV-VIII can be attributed to the same general techno-typological system.

The lithic analyses from GK suggest that Neanderthals used locally available raw materials to manufacture small blanks and tools by various core reduction methods with a focus on Levallois methods. The rarity of end products suggests the export of selected blanks and tools from the site. Low densities of lithic artifacts and other find categories, as well as the lack of features, indicate repeated short-term occupations of the site. Preliminary regional comparisons indicate that the Middle Paleolithic assemblages from GK correspond to the Swabian Mousterian, which is defined by the use of local Jurassic cherts, small lithic assemblages, frequent Levallois reduction, multiple scraper forms, and an absence of bifacial technology including *Keilmesser* and *Blattspitzen*. Previous radiometric dating by ESR have provided an age of about 50-40 ka for layer IV, suggesting that this assemblage could contribute new insights into the behaviour of late Neanderthals living in southwestern Germany. Stratigraphic observations and recent work by M. Richard and colleagues point to a much greater time depth for the deeper Middle Paleolithic find horizons.

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Ontogeny of the midface in *Homo sapiens*: building an integrative growth model for paleoanthropological studies using bone modelling and geometric morphometrics

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Ontogenetic changes in craniofacial morphology are the result of the interaction between bone modelling and bone displacement. Bone modelling is the cellular process that creates and removes bone tissue, whilst displacement describes how the bones of the skull move to achieve and maintain proper alignment. It is generally assumed that bone modelling patterns at a microstructural level are species specific [1,2]. However, it is still unknown how variable these patterns are within a species, making interpretations of fossils difficult. Further investigations are therefore needed in order to understand to what extent the patterns are linked to variations in morphology. According to Freidline SE *et al* [3], the nasomaxillary region is the most variable during growth of the face. In this study, we focus on the maxilla bone and build an integrative growth model (showing growth trajectories and activities) by quantifying the patterns throughout ontogeny using both microscopy and geometric morphometric methods. We specifically assess the hypothesis that there is a direct correspondence between bone modelling patterns and maxillary form. We used an ontogenetic series of 57 skulls of known sex and calendar ages ranging from birth to 12 years. High-resolution replicas of the maxillary bone surface were created using Epoxy resin and then investigated with a digital stereo microscope. In addition, a subset of 48 skulls was CT-scanned and ontogenetic shape changes in the maxillae were analyzed using a semilandmark approach [4]. We subdivided our sample into 4 groups, corresponding to the dental eruption patterns (Group 1: no teeth; Group 2: from first deciduous tooth erupted to all deciduous teeth erupted; Group 3: from the total completion of the deciduous dentition (roots closed) to the emergence of the M1; Group 4: M1 in occlusion). Our preliminary results suggest a good correspondence between the analysis of the bone modelling patterns and the geometric morphometric analysis. Both approaches show that between 1 month and 12 years, there are no clear shape changes in the maxilla bone. The bone modelling patterns are very similar, indicating a need for the bone to keep the same shape but increase its size. This result is also shown by our principal component analysis: the main variable that accounts for shape changes is size (ontogenetic allometry). Variability in maxillary shape between specimens in Group 1 is higher than in Group 2 and 3, a result also obtained with the quantification of the patterns at the surface of the bone. In conclusion, we found correspondence between microscopic and macroscopic levels during growth. In a future study we will apply this integrative model to different populations to gain a better understanding of the intraspecific modern human variability, as well as fossil species such as Neanderthals that are well represented by different age groups.

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Poster Presentation Number 50, Fr (12:15-14:15)

New Evidence for Handedness and Social Learning in European Neanderthals - A comparative study of the Late Middle Palaeolithic assemblages from Balver Höhle and Buhlen, Germany.

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Extreme species-level right-handedness has been a defining characteristic of hominins since the Mid-Pleistocene, and is shared by Neanderthals and modern humans. However, nearly all the data come from skeletal asymmetries. This severely limits our knowledge in several ways: firstly, due to the paucity of fossil skeletal remains, especially paired limb bones, the known sample sizes are very low; secondly, due to the restricted spatial distribution of available fossils, we know very little about geographical trends in handedness distributions for prehistoric individuals; thirdly, the skeletal asymmetries rely on repeated activity throughout the individual's lifetime, and might not appear in very young individuals or are confounded by pathological cases. As shown in several recent experimental archaeology publications, lithics have great potential to reveal handedness information [1]. The challenge, however, remains to apply handedness features to the archaeological record in a systematic way.

Bifacial backed knifes and certain asymmetric types of scrapers ('Prądnick scrapers') are tool forms characterized by their single cutting edge. They are typical for some Central and Eastern European Middle Palaeolithic assemblages attributed to the *Keilmessergruppen* [2]. Due to their lateralization they can serve as an excellent proxy for human handedness and thus, contribute to an improved understanding of the evolution of this characteristic.

Data compiled by a comparative study of Late Middle Palaeolithic assemblages from Balver Höhle and Buhlen, both Germany, provide information beyond this, since the frequencies of lateralized tool forms show strong divergence from expected distributions between left- and right-lateral artefacts [3]. Arguments are put forward to distinguish tools made and / or used by less experienced knappers or children from those (such as the bifacial backed knifes) made by experience knappers with the much higher levels of skill and experience needed to create the desired tool morphology and to guarantee long use-lives. Significant shifts in the frequencies of left- and right-lateralized items between both tool classes, i.e. bifacial backed knifes and 'Prądnick scrapers', are interpreted against the background of social learning strategies.

Our results shed new light on the origins of the regionally defined technocomplexes of the European Late Middle Palaeolithic. These can best be explained as originating from tool making traditions embedded in strategies of social learning which enabled novel forms of knowledge transfer across the generations.

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Poster Presentation Number 139, Th (12:15-14:15)

Pelvic morphology and South African australopith taxic diversity: evidence from Sterkfontein, Swartkrans, and Malapa

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The adult pelvic remains from Sterkfontein and Swartkrans, although ascribed to different taxa (*Australopithecus africanus* and *Paranthropus robustus*, respectively), have long been accepted as morphologically similar, reflecting a generally similar mode of bipedalism [1,2]. However, while there are 4 reasonably preserved os coxae - Sterkfontein Sts14 and Sts65 and Swartkrans SK50 and SK3155b – only Sts14 and SK50 have received attention, with emphasis being on their "*Homo*-like" iliac proportions and greater sciatic notch and ape-like anterior iliac distension. Overlooked are details of auricular surface shape/orientation, presence/absence of retro- vs infra-auricular areas, anterior inferior iliac spine shape/projection and configuration of the notch above, all iliac curvature, sciatic notch shape/depth, and acetabular orientation. In most features, these specimens differ markedly from one another. For example, in addition to differences in shape (e.g. elliptical vs ovoid), the orientation of the auricular surface is postero-oblique in SK50, antero-oblique in SK3155b, ~ vertical in Sts14, and ~ horizontal in Sts65. The preserved posterior iliac profile is minimally distended beyond the sciatic notch with a straight posterior margin in Sts65; moderately expanded posteriorly with broadly rounded margin in Sts14; and markedly expanded posteriorly and swollen inferiorly beyond the sciatic notch, but with a truncated margin, in SK3155b. And, the preserved iliac blade is flexed superoinferiorly in SK3155b, but anteroposteriorly strongly outward in Sts14, and minimally in SK50. Although specimens from nearby Malapa have been assigned to two individuals (MH1 subadult and MH2 adult) of the same species, *A. sediba* [3], the pelvic remains tell a different story. Cranium UW88-50 with patent sutures, partial mandible -08 with unerupted M3, and proximal femur UW88-04 and partial ischium/acetabulum -102 with unfused epiphyses are subadult, but UW88-14 (left ilium+part acetabulum), -06 and -07 (right part acetabulum+ilium, and right part ilium), also assigned to MH1, are adult and likely the same individual. UW88-14 and -07 present a narrow sciatic notch, posterior truncation, and straight, strongly outwardly-deflected posterior margin, and UW88-14 and -06 bear a deep fossa immediately above the acetabulum. MH2 adult right ilium UW88-133 differs in its blunt, projecting anterior inferior iliac spine with deep notch above, some posterior expansion, narrowly rounded posterior margin, anteroposteriorly obliquely oriented, ~ elliptical ilium, and broad sciatic notch bound posteriorly by an inferiorly distended posterior inferior iliac spine. The Malapa pelvic remains demonstrate, as do mandibles [4], the presence of two hominids, whose os coxae also differ from Sterkfontein and Swartkrans os coxae (*viz.* the uniquely anteroposteriorly obliquely-oriented UW88-133 ilium). While one can point to similarities between specimens - e.g. straight posterior margin in UW88-14 and Sts65 — in cumulative detail, each is morphologically unique. One might ascribe differences to variation, but this demands abandoning the limits of variability seen in highly variable *Pan*, *Gorilla*, and *Pongo* [1] and forcing morphology to fit the assumption: e.g. posteriorly straight/truncated and rounded/expanded ilium (which alone should impact interpretations of pelvic morphology and bipedalism) are merely extremes of a continuum. Or, one could ask if the increasing acceptance of early hominid diversity in East Africa, and of South African *A. sediba* (and *A. prometheus*?), warrants revisiting the notion of South African "gracile vs robust" australopiths and the allocation of specimens to taxon by site, especially given the serendipity of fossil accumulation.

Many thanks to Lee Berger and Stephanie Potze to access to specimens.

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Poster Presentation Number 35, Th (12:15-14:15)

The River Hrazdan, central Armenia: a context for Middle and Upper Pleistocene hominin expansion and adaptation in the Southern Caucasus

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The Hrazdan river is the key drainage system of central Armenia. It drains Lake Sevan, the largest natural lake of the Southern Caucasus (the modern Republics of Armenia, Azerbaijan and Georgia), and flows 100 km southwards to a confluence with the River Araxes on the Turkish border. Recently discovered Lower [e.g. Nor Geghi 1 (NG1)], Middle (e.g. Alapars 1) and Upper Palaeolithic (e.g. Solak 1) sites demonstrate that the Hrazdan valley was also an important locus for hominin activity in the Middle and Upper Pleistocene. Palaeolithic archaeological sites in the valley occur within sediments and associated palaeosols that are both trapped between and overlie lava flows emanating from volcanoes in the adjacent Aragats and Gegham ranges. They are exposed in section as a consequence of the incision of the Hrazdan due to ongoing tectonism in the region. Pyroclastic deposits from these same volcanic sources and from further afield have provided toolstone, but have also fallen as tephra on the archaeological sites and wider landscape. The Leverhulme Trust-funded Pleistocene Archaeology, Geochronology and Environment of the Southern Caucasus (PAGES) and its forerunner, the Hrazdan Gorge Paleolithic Project (HGPP), have been prospecting for and excavating archaeological sites, mapping and sourcing volcanic and sedimentary geomorphology, examining palaeoenvironmental proxies and dating volcanic strata along a 25 km-long stretch of the Hrazdan valley. Results indicate that the lavas from the Gegham range were intermittently emplaced in the valley during the interval 550 to (at least) 193 ka, each flow burying soils and sediments of the prior landscape and damming the river. The latter process led to the formation of lakes, which persisted until the river breached the dam and subsequent fluvial deposition took place. This succession occurred several times, but all post-dated a major pyroclastic event that emplaced a 39 km2 area of pumices and obsidians, the latter providing >90% of raw material for artefacts found on the NG1, Lusakert 1 (Middle Palaeolithic) and Solak 1 archaeological sites. On the basis of the archaeological sites that have been dated so far, hominin activity occurred during the height of Middle Pleistocene interglacials and in Upper Pleistocene interstadials. Although there is no obvious geomorphological evidence for glaciation, it is hypothesized that the arid conditions associated with cold stages in this region during the Middle and Upper Pleistocene were too harsh to support hominin populations. Future work in the Hrazdan valley as part of the PAGES project will focus on the development of a chronological and palaeoenvironmental framework, thereby allowing for a detailed understanding of the nature of Palaeolithic hominin occupation in this important locality in the Southern Caucasus.

Poster Presentation Number 51, Th (12:15-14:15)

Variation in Late Lower Paleolithic Blade Production: The Case of Masloukh, Lebanon

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The Acheulo-Yabrudian complex of the late Lower Paleolithic Levant (ca. 400-250kyr), is characterized by high technological variability, which is best illustrated by its three facies. These include the 'Acheulean', characterized by handaxes and simple flake production, the 'Yabrudian', characterized by a thick flake and scraper production and the 'Amudian' (Pre-Aurignacian), characterized by blade production. The differences are not absolute, but relative; all technological elements appear in each of the three facies, albeit in varying frequencies [1]. Recently, finer variations were noted within the Amudian facies itself, pertaining specifically to the character of blade production and observed at the sites of Tabun, Qesem and Yabrud I [2]. This picture is complicated even further by the site of Masoulkh [3] that presents an assemblage that differs in important respects from those of other Amudian sites. Masloukh lies north of Beirut, Lebanon and it was excavated in 1969 by Skinner [3]. The archaeological sediments are 1.8 m deep and include three layers (A-C). During the excavation Skinner recognized an increase in the amount of blades towards the upper part of the sequence, but still attributed all layers to the Yabrudian. He referred to the blades as intrusive Upper Paleolithic material although no Upper Paleolithic occupation or clear diagnostic elements were identified anywhere at the site. Shmookler [4], who analyzed the material later, argued that Layers A-B should be regarded as part of the Amudian facies and that only Layer C is of the Yabrudian facies. Following this work, Masloukh has been repeatedly cited as one of the rare examples for a proper Amudian site [5]. Approximately a third of the lithic assemblage retrieved from Masloukh is stored at the University of Columbia and includes items originating from the three layers (n=5,339). Attribute analysis of blades and waste of their production was used to reconstruct the particular character of the blade reduction sequence at the site. The analysis was performed according the same protocol used for the study of the three other sites marked by Amudian blade production: Tabun, Qesem and Yabrud [2]. The results indicate that the blade production of Masoulkh differs from those of other Amudian sites. This is especially apparent in the characteristics of the blades themselves. For example, they show minor traces of cortex, while those from the other sites commonly bear cortex along the lateral or distal end. In addition, about two thirds of the blades have a faceted striking platform, in contrast to the other sites where faceting rarely exceed 50%. They are also commonly characterized by a trapezoidal cross-section, while most Amudian blades are generally characterized by a triangular cross-section. Significantly, the features that distinguish the blades of Masloukh from those of other Amudian sites are highly reminiscent of blades of the subsequent Middle Paleolithic period, possibly hinting at a temporal distinction. The blades' metrics, however, are conform with Amudian measurements and stands on ca. 50 cm in length, in contrast to Middle Paleolithic blades that are generally longer. Three possible explanations can be considered. (1) The blades are intrusive as suggested by Skinner. (2) The blades of Masloukh represent a regional variant of the Amudian blade production, indicating even a higher diversity in terms of regional differences in the relatively confined region of the Levant. (3) The blades of Masloukh represent a relatively late stage of development, suggesting a trend of gradual technological change from the blade production of the late Lower Paleolithic to that of the Middle Paleolithic.

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Podium Presentation: Session 4, Th (17:00)

Geochronology of the Baringo-Tugen Hills-Barsemoi (BTB) Core, Kenya, of the Hominin Sites and Paleolakes Drilling Project (HSPDP)

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The Hominin Sites and Paleolakes Drilling project (HSPDP) has as a main objective to explore and investigate possible causal relationships between climatic and environmental changes and human evolution by: 1) expanding the amount and types of paleoenvironmental data collected at key paleo- anthropological localities to test hypothesis about environmental drivers in hominin evolution; 2) increasing the resolution and quality of paleoenvironmental data available to assess the role of Earth system dynamics in hominin evolutionary processes; 3) building a high-resolution regional framework of climate and habitat change in eastern Africa by comparing overlapping time segments; and 4) developing models of environmental change and ecosystem responses during critical intervals of hominin evolution and then testing these models against high-resolution core paleorecords [1]. Here we present the geochronology of one of the key HSPDP sites, the Baringo locality in the central Kenyan Rift Valley. The Baringo core is 223 meter long and drilled in a sequence comprising a portion of the Chemeron Formation. This formation spans approximately 3.7 Ma, from around 5.3 Ma to 1.6 Ma and contains many paleontological sites, including fossil hominins. In this study, a total of 577 paleomagnetic samples were taken from 543 levels from all types of lithologies found within the core. The study required the application of a new methodological approach to overcome the difficulties of analysing cores near the equator, since the azimuthal orientation is lost in the drilling process. Our study has identified four paleomagnetic reversals interpreted as the Matuyama-Gauss, Gauss-Kaena, Kaena-Gauss and the Gauss-Mammoth transitions. These boundaries provide high-quality chronostratigraphic tie-points that can be integrated with those derived from $^{40}Ar/^{39}Ar$ dating of tephra in the core. The match between paleomagnetic and radioisotopic chronostratigraphy is excellent, and both have been incorporated into a Bayesian age model of the core. Chronostratigraphy based on $^{40}Ar/^{39}Ar$ dating and magnetostratigraphy (presented here) indicate that the HSPDP Baringo core has an age range of ~3.4 Ma to ~2.6 Ma. The magnetic polarity reversals also provide an opportunity for high-precision comparison to global climate records where these reversals are also present. The drill core's time frame incorporates some important First and Last Appearance Datum (FAD and LAD) events in human evolution such at the FAD of the Lomekwian and Oldowan technologies, FAD of the robust australopiths (*Paranthropus*), LAD of *Australopithecus afarensis*, and FAD of genus *Homo*. Here we describe how the BTB core contributes insights into links between environment and evolutionary change in the human lineage.

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Poster Presentation Number 62, Fr (12:15-14:15)

Archaeological evidence for complex gathering in the Upper Palaeolithic: East European perspectives.

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A.N. Rogachev proposed a hypothesis of "complex gathering" during the Upper Paleolithic on the basis of a series of grinding stones, unmodified or with minimal modification [1]. These stones were, according to traces of use, comparable to grinding stones of post-Paleolithic epochs associated with the preparation of plant foods. Rogachev's hypothesis suggested special selection of available plant resources and processing in preparation for long-term storage - therefore all stages of an agricultural economy except planting.

Series of such stones have been found at sites of the Kostenki complex (Kostenki 4-I, Kostenki 9, Kostenki 11, Kostenki 16), as well as elsewhere in Eastern Europe (Chulatovo 2 Vykhvatintsy, Molodovo 5, Babin 1 Voronovitsa). In all cases this includes both upper and lower grinders, often with intensively worn surfaces up to the total loss of their abrasive capacity. The absence of traces of ochre and traces of use on hard substances led to their being related to grinding of plant residues, such as seeds and edible roots.

S. de Beaune collated, classified and interpreted Western European grinding stones at the end of the last century [2]. A similar study was recently undertaken by K. Stepanova for the Eastern European Paleolithic [3], showing the existence of grinding stones of different varieties in all parts of the Upper Paleolithic, from the earliest stages. Their chrono-spatial distribution shows no links with any specific cultural entities: they are known from Aurignacian, Gravettian, Epigravettian, Final Paleolithic and Mesolithic-Neolithic sites. We can also note that each chrono-cultural phase has provided evidence for assemblages with series of grinding stones as well as those without, sometimes from sites that are very close to one another. The association of grinding stones with other types of stone and bone artefact remains an additional problem. The most promising correlation seems a link between pestle-grinders and a large number of splintered pieces, artefacts that are usually associated with the processing of wood, and thus the same organic substance than provides nutritive residues (roots, seeds).

Until the last decade, the hypothesis of "complex gathering" was based on analogy of use-wear traces between Paleolithic and post-Paleolithic grinding stones and pestles. More recent analysis of pestle-grinders , including some artefacts from Kostenki 16, identified starch remains on the surface of pestles [4]. This provides new evidence in favour of their use processing plant resources, and thus in favour of a "complex gathering" economy. Further study of grinder stones was initiated in 2015 by L. Longo (/ADM/, Nanyang Tecnological University Singapore) and N. Skakun, V Terekhina (IHMC, Russia), using modern methods of analysis (S. Hermon, Science and Technology in Archaeology Research Center. The Cyprus Institute). Preliminary results from Eastern European material suggest that it may be possible to reconstruct specific parts of domestic activity within what Rogachev more broadly proposed as "complex gathering".

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Poster Presentation Number 41, Th (12:15-14:15)

The Evolution of Neanderthal Mobility Behaviour

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A database of Neanderthal raw material transports and fauna from assemblages across Europe has been compiled with the aim to explore the evolution of the Neanderthals' mobility behaviour with regard to the environment from the beginning of the Late Saalian (191 ka BP) to the demise of Neanderthals (40 ka BP). Mobility, as observed from the lithic transports in the Palaeolithic, is often interpreted as mirroring the social organisation of a group. As the study of Neanderthal mobility normally focuses on the maximum transport distances of lithics, such a methodology is seen here as inadequate because three equifinal processes (subsistence activity, social transactions, and semi-random lithic scavenging) can account for these distances. Here, two different indicators of Neanderthal mobility are created based on the transport distances, quantities, and number of utilised raw material sources. The first one is the overall mobility, which represents the sum of the effort made to acquire all lithics from all sources. The second indicator is the mean effort per raw material, which quantifies the average effort made to acquire the different raw materials present in that assemblage.

By analysing Neanderthal mobility in terms of these two variables in a series of statistical analyses, it is shown that Neanderthal social organisation evolves from the Saalian to the Early and Late Weichselian. This change is interpreted as reflecting diversification of their subsistence behaviour and as reflecting a tendency to optimise their foraging behaviour through decision making. In subsequent statistical analyses, it is demonstrated that there are no real differences in Neanderthal mobility between the east and the west, and that Neanderthals appear to have preferred semi-open landscapes, but somewhat avoided montane regions. The presence of the Mammoth Steppe was not noted as having either a negative or a positive impact on Neanderthals' level of mobility. The apparent preference for semi-open landscapes and the variation in the different environments implies that they were top carnivores that may have exercised encounter-based hunting, which may explain their body type and injury patterns identified previously.

Podium Presentation: Session 3, Th (14:40)

Premolar root and canal variation in the hominin clade

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Premolar root and canal form varies within and between species in extant hominoids and fossil hominins, and has been used to inform taxonomic and phylogenetic hypotheses within the hominin clade. Previous studies have identified two predominant trends during hominin evolution: a reduction in root number from *Australopithecus* to *Homo*, culminating in a predominance of single rooted maxillary and mandibular premolars in modern humans; and an elaboration of root complexity in megadont and hypermegadont taxa. These studies have been based mostly on the visual inspection of the external morphology of the roots of isolated teeth, or the exposed roots of teeth in jaws, or from images generated by conventional plain radiography and medical computed-tomographic scanning. In this study we build on this previous approach by using microtomography to characterize, in greater detail, hominin mandibular and maxillary premolar external root and canal variation. We use a greatly expanded study sample (n = 410) including most Plio-Pleistocene hominin species (*Australopithecus anamensis, A. afarensis, A. africanus, Kenyanthropus platyops, A. boisei, A. robustus, Homo habilis, H. rudolfensis, H. ergaster, H. erectus, H. heidelbergensis, H. neanderthalensis*, and fossil *Homo sapiens*). Premolar root and canal form was assessed from 2D cross-sectional images at mid-root with a 3D assessment being taken when root form was not clear from the 2D section. We examined 1) degree and pattern of variation within species and 2) patterns of metameric variation along mandibular and maxillary premolar rows within species. These are then used to inform our current understanding of evolutionary transitions in premolar roots during hominin evolution, as well as, the utility of premolar root form in hominin systematics. Our results are consistent with previous findings that maxillary premolar roots express fewer types (five) than mandibular premolar roots (six to ten). The mandibular third premolar expresses the greatest variation in root form and number, and *A. africanus* and *P. robustus* exhibit considerable levels of variation in root form, although this is likely correlated with their relatively large sample sizes. There is also considerable variation within early *Homo*. The within species variation we have identified helps inform our understanding of the developmental processes responsible for root variation, but it also challenges the utility of using premolar root morphology as a phylogenetically informative trait. As is the case for each tooth positions, there is also considerable variation between metameres both within species (16 combinations in maxillary premolars and 22 combinations in mandibular premolars). A primary source of external root form variation is the differential growth of Hertwig's root sheath and, in order to maximize the systematic potential for premolar root number and form, future studies will need to clarify the causes of this differential growth.

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Podium Presentation: Session 1, Th (9:20)

Recovering archaic human DNA from Pleistocene sediments

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The recovery of DNA from ancient hominins has greatly enriched our understanding of human evolution and migrations. However, skeletal remains of ancient hominins are rare. We therefore investigated whether hominin DNA may survive in sediments in the absence of macroscopically visible skeletal remains. We extracted DNA from 85 sediment samples from seven archaeological sites with known hominin occupation: Caune de l'Arago (France), Chagyrskaya Cave (Russia), Denisova Cave (Russia), El Sidrón (Spain), Les Cottés (France), Trou Al'Wesse (Belgium) and Vindija Cave (Croatia). The layers sampled varied in age between ~14,000 and >550,000 years. The extracts were converted to DNA libraries, from which we isolated DNA fragments bearing similarities to human mitochondrial (mt) DNA by hybridization capture using probes spanning the full mitochondrial genome of a present-day human. To distinguish genuine ancient DNA from present-day contamination, we selected *in silico* only sequences carrying damage-derived nucleotide substitutions. Sufficient hominin mtDNA fragments were recovered from nine sediment samples, collected in four of the archaeological sites, to enable the reconstruction of between 8% and 99% of the mitochondrial genome. Phylogenetic analyses show that eight of these are most similar to known mtDNA sequences of Neandertals; while the ninth sample, collected in Denisova Cave, groups with Denisovan mtDNAs. Taken together, the sequences recovered from sediments retrace a substantial proportion of the mitochondrial diversity of Pleistocene hominins determined from skeletal remains in previous studies. In El Sidrón, Chagyrskaya Cave and Denisova Cave, we detected Neandertal mtDNA in sediment samples from layers where hominin remains have been found. In Denisova Cave, we also detected Neandertal and Denisovan mtDNA in layers near the bottom of the stratigraphy that are devoid of hominin fossils, expanding the known temporal span of both Neandertals and Denisovans in the area. At Trou Al'Wesse, where no Late Pleistocene human osseous remains have been discovered, DNA recovered from the sediment provides direct evidence for the past occupation of the site by Neandertals. We demonstrate that molecular traces of ancient hominins can be detected in Late and Middle Pleistocene cave sediments, including in samples that were stored at room temperature for several years. The methodology presented here can thus be applied to sediments collected at sites where excavations are now completed. Our work opens the possibility to infer the presence of known and yet unknown hominin groups at sites and in areas where no skeletal remains are found.

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

Dental Perspectives on Nursing and Weaning

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Evolutionary anthropologists are increasingly employing knowledge of tooth chemistry and development to document the weaning process in recent humans and non-human primates [1-4]. During lactation, mammals produce calcium-rich milk by drawing on skeletal reserves. Approximately 99% of the calcium in the body is found in bone, and the remaining amount in blood and organ tissues is continuously adjusted to maintain homeostasis. Low-level non-essential elements such barium and lead follow the movement of calcium in the body because they share certain transport pathways. These elements are concentrated in mothers' milk, although barium passes through a partial filtering system, making it proportionately less common than calcium. My colleagues and I have shown that barium/calcium (Ba/Ca) trace element ratios in teeth accurately reflect barium intake via mother's milk, which can be used in concert with growth lines to accurately age early life diet transitions [2]. Barium distributions are determined with laser ablation-inductively coupled plasma-mass spectrometry, and accentuated lines in the enamel are spatiotemporally mapped from incremental features formed after the neonatal (birth) line. Elemental maps of human infants of known dietary histories reveal Ba/Ca transitions close to the neonatal line, demonstrating that the consumption of milk can be identified without a marked temporal delay. We have also documented the timing of early-life diet transitions in captive rhesus macaques, including birth, exclusive nursing, solid food supplementation, and the cessation of suckling. This approach has also been extended to a juvenile Neanderthal, which appears to have nursed exclusively for 7 months, weaning abruptly at 1.2 years of age. Finally, we've documented the nursing histories of four wild-shot orangutan juveniles, revealing that orangutan lactation reflects seasonal resource availability [3]. Two orangutans continued suckling beyond 8 years of age, exceeding the oldest documented weaning ages in any non-human primate. Reconstructing the evolution of human weaning has proven difficult because of the natural processes of organic decay and inorganic modification that occur in bones and teeth after death. This semi-destructive approach may be used to study nursing behavior and determine weaning ages in primates that are difficult to observe in the wild, as well as in well-preserved fossil hominin teeth. This is particularly important given the limitations of other dental proxies for predicting weaning ages in humans and our closest living relatives [4,5].

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Pecha Kucha Presentation: Session 6, Fr (11:00-11:25)

MTA bifaces used as percussive fire-making tools by late Neandertals

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Fire use appears to have been relatively common among Neandertals in the Middle Palaeolithic [1]. Evidence for this practice ranges from occasional fragments of heated flint or charred/combusted bone to many tens of layers of combustion features stacked atop one another, depending on the frequency and degree of burning, the depositional setting and the preservational conditions. However, the means by which Neandertals procured their fire — either through the collection of natural fire or by producing it themselves using tools — is still a matter of debate [see 2]. Presented here is the first direct evidence for regular fire production by Neandertals (Sorensen et al., in prep.). Using microwear analysis in conjunction with experimental data, dozens of late Middle Palaeolithic bifacial tools have been identified that exhibit isolated zones of macroscopic and microscopic traces suggesting repeated percussion and/or forceful abrasion with a hard mineral material. Both the locations and nature of the polish and associated striations are in many respects comparable to those obtained experimentally by obliquely percussing fragments of pyrite (FeS_2) against the 'flat' sides of a biface to make fire. The striations within these zones are always oriented parallel or sub-parallel to the long axis of the tool and are often cross-cut by subsequent flake removals, together arguing against a natural, taphonomic origin for these traces [3]. Such a percussive method is effective at regularly producing sparks that can easily be directed towards flammable tinder material while leaving the edges of the tool sharp for other tasks. These directional percussive and frictive use wear traces are present on bifacial tools recovered from archaeological layers primarily attributed to the Mousterian of Acheulean Tradition (MTA) technoculture (ca. 50,000 years BP) at multiple sites throughout France. Discussed here are the findings from two of these sites: Chez-Pinaud/Jonzac (Charente-Maritime) [3] and Pech de l'Azé I (Dordogne) [4]. MTA bifaces are curated tools used for relatively long periods of time, and therefore possess a higher probability of preserving traces from multiple uses, including more infrequent activities like fire making. Regular evidence for fire use in the MTA layers at the two sites discussed lends further credence to the conclusions outlined here. Moreover, powdered manganese dioxide (MnO_2) - a mineral encountered in multiple Mousterian contexts, including hundreds of fragments recovered from the MTA layers at Pech de l'Azé I - has recently been shown to be a 'tinder enhancer' by lowering the temperature necessary to combust vegetal matter by as much as 100^o C [5]and may have been used as such by Neandertals. While examples of pyrotechnic minerals like pyrite and manganese dioxide are both known from a number of later Middle Palaeolithic sites, the bifacial strike-a-light tools described here were a technocultural feature shared among the MTA peoples that likely represent the 'smoking gun' attesting to Neandertal fire making capabilities.

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Poster Presentation Number 143, Th (12:15-14:15)

Evaluating behavioral effects on modern human shape talar through GMM

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It is known that talar shape varies among hominoids related to differences in locomotion and substrate use [1,2,3]. However, less is known about variability in talar morphology within modern humans [4]. Here we apply (semi)landmark-based methods to explore talar morphological variation between groups of modern humans with different subsistence economies and lifestyles. A template consisting of 15 landmarks, 105 curve semilandmarks and 131 surface semilandmarks was digitized on 3D models of 94 left modern human tali (26 hunter-gatherers, 15 mountain dwellers and 53 farmers). Generalized Procrustes superimposition [5] and Principal Component (PC) analysis based on the group mean covariance matrix was used to explore shape variation within talus models. An Analysis of Variance (ANOVA) was conducted to identify group differences along each PC. Shape variation related to static allometry was investigated by Pearson product-moment correlation coefficients (r) of shape variables (PCs) against the natural logarithm of centroid size.

The first three PCs describe 78.6% of variation in the sample, with PC1 (56.3%) separating hunter-gatherers from farmers/agriculturalists. Positive values along PC1 (hunter-gatherers) reflect mediolaterally wider and dorsoplantarly compressed corpora with enlarged talar necks and heads. Negative values along PC1 (sedentary groups) reflect more cuboidal corpora, a less posteriorly-extended flexor hallucis longus groove, and reduced anterior extension of trochleae and smaller talar heads. Results demonstrate that human talar shape may be influenced by loading differences, presumably due to a combination of substrate/terrain use, lifestyle (nomadic vs. sedentary) and subsistence strategy, resulting in different arthrokinematics during weight bearing by the talus over the course of stance phase (load-bearing). These results could have important implications for the interpretation of fossil specimens and inferring likely ranges of joint movements (arthrokinematics) in extinct taxa. Future studies could increase the sample size to test the effects of subsistence economy and different patterns of mobility.

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Poster Presentation Number 134, Fr (12:15-14:15)

Inferences on Sicilian Mesolithic subsistence patterns from entheseal changes and cross-sectional geometry.

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With the transition from the Pleistocene to the Holocene, major shifts in human subsistence practices took place alongside environmental and ecological changes. Previous studies on upper and lower limb functional adaptations on pan-European Mesolithic skeletal series have evidenced a significant decrease in variables associated with mobility levels [1], and have recently documented the disappearance of the high levels of humeral bilateral asymmetry in mechanical rigidity [2] which were one of the hallmarks of Late Pleistocene hunters [3]. This has been attributed to the shift from terrestrial hunting and gathering to a semi-sedentary exploitation of coastal resources. However, those skeletal series are dominated by Atlantic and Baltic skeletal assemblages, and the scenario may become more fragmented when taking into account Mediterranean Mesolithic sites. Isotopic studies suggest that Sicilian Mesolithic foragers did not develop strongly marine-oriented adaptation, but continued a subsistence manly based on hunting terrestrial mammals [4]. In order to further investigate this issue, we analyzed postcranial functional adaptations using the cross-sectional geometry method (CSG) and entheseal changes (EC) in the humerus, femur, and tibia, as well as the prevalence of external auditory canal exostosis (EAE), which has been associated with frequent swimming in relatively cold sea water (5). Data derive from Sicilian Mesolithic individuals (Grotta d'Oriente, Molara, and Uzzo burials, c. 9500-8500 BP), while the comparative samples consist of Early and Late Upper Palaeolithic and Mesolithic European skeletal series collected from the authors and from the literature. Results from CSG indicate that Sicilian Mesolithic people had robust upper and lower limbs when compared to pan-European Late Upper Palaeolithic and Mesolithic samples. Similar to previous results, humeral bilateral asymmetry in mechanical rigidity is significantly lower ($p<0.001$; Mann-Whitney U-Test) than in the Late Upper Palaeolithic, suggesting a decrease in strenuous unimanual activities such as hunting using manual throwing technology, possibly linked to the introduction of new hunting technologies such as traps and the bow and arrow. Conversely, femoral and tibial CSG suggests a higher level of lower limb exertion when compared with pan-European Mesolithic samples, which is possibly linked to mobility in mountainous terrain. Inferences based on results from EC analysis are tentative, due to the numerous missing values and the need to control for age at death. The results point towards a slightly higher presence of lesions for the fibrocartilaginous entheses of the lower limb compared to the upper limb, supporting the results from cross sections. Results from EAE are consistent with marine activities not being frequent, although a larger sample size and a more solid bioarchaeological and clinical framework for this trait would be desirable. Overall, the analysis is consistent with isotopic data suggesting that, in Sicily, marine food become important only in the late Mesolithic [4], while in the earlier phases terrestrial resources were predominantly exploited, in substantial continuity with previous Epigravettian hunters. This study corroborates a complex scenario of continuity and discontinuity in subsistence at the Pleistocene-Holocene transition, and calls for a more regional bioarchaeological approach of human biological and behavioral adaptations.

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Poster Presentation Number 75, Th (12:15-14:15)

Unexpected Developments in Early Hominin Diet and a Way Forward

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Changes in diet are often associated with biological and/or cultural milestones in hominin evolution. For instance, it is often supposed that the emergence of the genus *Homo* and an increase in the consumption of animal foods were broadly coincident. It is, therefore, difficult to tell the story of human evolution without telling the story of hominin diet through time. Thus, it is notable that long-standing ideas about hominin diet have been challenged of late, possibly calling into question many of the scenarios that have been proposed about the origin of our species.

There are many reasons for this reproblematization of hominin diet. Dental microwear analyses have revealed no evidence of hard-object feeding among the eastern African australopiths, despite long-standing interpretations of dental morphology suggesting a hard-object feeding adaptation among these taxa, and especially the robust australopiths. Stable carbon isotope studies have also suggested that C4 foods (e.g., many tropical grasses and sedges) became important components of the diets of some hominins by about 3.7 Ma, and that some hominin taxa, most notably *Paranthropus boisei*, had diets dominated by C4 foods. This represents a fundamental break from what has been observed in living hominoids, for even when they live in C4 dominated savanna landscapes, they consume small quantities of C4 resources. This dietary change likely resulted in major changes in hominin habitat use, competitive interactions, and predation pressures. It would also have strongly altered the effects of climatic and environmental change on early hominin taxa.

The goals of this presentation are three-fold: 1) to briefly walk through recent developments in early hominin dietary studies; 2) to present unpublished (and published) carbon isotopic data from early hominins and associated fauna across space and time to place hominins within their broader mammalian communities; and 3) to briefly focus on the diet of one taxon, *P. boisei*, whose teeth and jaws make it the apotheosis of the trend towards masticatory robusticity in the hominin lineage, and make the case that its diet could have included large quantities of resources ignored by most researchers.

Poster Presentation Number 36, Fr (12:15-14:15)

Interdisciplinary Research into the Impact of Climate Changes during the Last Glacial on Human Behaviour at Satsurblia Cave, Georgia

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Satsurblia Cave in Western Georgia contains a rich Upper Paleolithic sequence with human occupation prior and after the Last Glacial Maximum (LGM) [1], a time period of harsh climatic conditions. Archaeological research here focuses on exploring relations between climate change and human behaviour [2-3]. However, Last Glacial paleoclimate data for the Southern Caucasus, a crucial geographic corridor for human dispersal, are still missing/sparse. Recent research of the LGM in other regions explores the retreat into refugia as well as changes in mobility and occupation intensity. The latter is commonly measured by quantities of material cultural remains (e.g. lithics and fauna refuse) or date sequences, neglecting issues of site formation and combustion feature as yet another artefact class.

Our interdisciplinary project aims to (1) reconstruct climate by investigating speleothems using metagenomic analysis in combination with a U-series dated carbon and oxygen isotope time-series; and (2) to explore fire use and site maintenances practices as proxies for human behaviour by investigating combustion features through micromorphology and Fourier-Transform-Infrared spectroscopy.

1. Metagenomic analysis using Next Generation Sequencing (NGS) platforms is a highly promising technique in archaeogenetic research that allows analysis of the complete genomic make-up of a sample. We are applying this technique in a new field by sequencing speleothem hosted organics. We are analysing the speleothem sequence data for climate associated biomarkers and are validating the data with well-established techniques, such as U-series dated carbon and oxygen isotope time-series. We sampled speleothems in several archaeological and non-archaeological cave sites in Western Georgia to track climate changes during the Last Glacial, e.g. the Last Glacial Maximum, the Younger Dryas and the Allerød; all have been postulated to drive changes in human demography and mobility. First sequencing data show that we do have aDNA preserved in the speleothems and we will present details accordingly.

2. Archaeological sediments and features, such as combustion features, are mainly produced by human activity and preserve information on these activities, for example site maintenance [4-5]. Site maintenance activities are behaviours directed at keeping a site in a state that facilitates future use. Microcontextual analyses of site maintenance practices can inform us about site use, organisation of space, duration and intensity of occupation. This study focusses on microscopic, sedimentary evidence of site maintenance activities and their diachronic and synchronic variability at Satsurblia Cave using the microcontextual approach, more specifically micromorphological analysis and Fourier transform infrared spectroscopy. The post-LGM deposits at Satsurblia are characterized by several sequences of laterally continuous occupation surfaces with variable combustion features. Pre-LGM deposits contain several loci with discrete lenses of combustion. Our microcontextual analyses show in situ preserved combustion features, rake out, ash dumps, relightening, prolonged and short-term fires, and differences in fuel. Also, we see evidence for natural formation processes, including environmental indicators: freeze and thaw features, dissolution, relocation and recrystallization of ashes.

We will present new paleoclimate data for the Southern Caucasus and reconstructions of human behaviour from microcontextual analysis as well as from lithic and zooarchaeological studies at Satsurblia Cave. This combination of disciplines and methods opens a unique window into the Upper Palaeolithic of western Georgia as well as into human – environment interactions.

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Poster Presentation Number 106, Fr (12:15-14:15)

Biomechanics of the lower jaw in Upper Palaeolithic and Mesolithic hunter gatherers

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Here we revisit the question of the extent to which the modern human mandible reflects loading history and so diet. In particular, we ask if morphology and biomechanics can be used to infer habitual loading of the jaws and so, diet. Many Upper Palaeolithic and Mesolithic groups of hunter-gatherers appear to have had better dental health and a more robust masticatory apparatus than either modern humans or early agricultural populations. Further, a number of studies on modern humans have suggested that mandibular morphology may reflect dietary adaptations. Thus, the shape of the face and the mandible in Inuits is claimed to reflect habitual consumption of dried and tough meat as well their use of teeth as a tool [1-5]. Von Cramon-Taubadel [6] reported on a global scale, a morphological distinction between modern hunter-gatherers and modern agriculturalists that reflects their mode of subsistence. We explore variations in mandibular form and biomechanical performance among Upper Palaeolithic, Mesolithic and recent mandibles. Thus we carry out geometric morphometric analyses of size and shape and compare biting performance using finite elements analysis (FEA) and geometric morphometric analyses of deformation. The material includes CT scans of two Upper Palaeolithic mandibles, Pestera cu Oase Romania, and Sungir, Russia, the former having a recent Neanderthal ancestor; average forms of Mesolithic mandibles from the same or neighbouring regions (Schela Cladovei, Romania and Dnieper Mesolithic, Ukraine); and two modern individuals, a large and a small Russian. All individuals in the study are believed to be male. 3-D mandibular models were obtained by segmentation and reconstruction of clinical CT stacks using Aviso, they were landmarked for GM analyses in the EVAN toolbox and Finite Element Analysis was carried out using VoxFe. Statistical analyses of deformations based on these landmarks were carried out in the EVAN toolbox. Under the same simulated physiological tooth loading conditions and irrespective of the mode of subsistence, larger mandibles develop lower strains than small ones. At the same time, mandibles that have shorter bodies and so, shorter out levers, such as the modern humans, are more efficient in the translation of the muscle into bite forces. The more ancient material in our sample tends to have a longer posterior part of the mandibular body and a wider mandibular ramus resulting in a longer out lever. Therefore, their efficiency in converting muscle to bite forces was markedly lower than that of the modern mandibles. Our studies show that the form (i.e. size and shape) of the mandible is highly correlated with the degree and mode of deformation that arises in biting. PLS analyses indicate that 18% of the total variance in mandibular deformation arising in biting on M^2 correlated with both subsistence, with 45% being correlated with subsistence and biting on I2. The main feature driving the correlation between subsistence and biting performance appears to be the ratio of body length to ramus height. We conclude that changes in mandibular form and biomechanical performance likely reflect food preparation. But does this mean we can use mandibular form and performance in simulated biting to infer jaw loading and even diet? The evidence of this and many other studies is that the jaws of do not achieve the adult form they would have achieved had they been loaded more. These changes in modern mandibles are therefore not adaptive in the sense that they optimise function, they merely reflect under stimulation and so, incomplete growth and development. It is, therefore, unlikely that jaw morphological and functional analyses of cultural transitions can differentiate anything other than broad aspects of jaw loading history, and then only at a population, rather than individual level.

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Podium Presentation: Session 9, Sa (9:20)

Trabecular bone patterning across the human hand: Implications for reconstructing behavior and manipulation in past populations

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In fossil remains, differences in external and internal bone morphology are typically the only direct method to gain insight into an animal's behavior. For hominin behavior, many questions still remain about hand use prior to and after the advent of stone tools, with the accuracy of their interpretations having direct implications for our understanding of the locomotion, cognition, and phylogenetic relationships of hominins. Although current interpretations of hominin manual behavior are hindered by the lack of fossil hand remains, previous research demonstrates that behavioral information may be inferred from external articular surface topology, as well as variation in the cortical/trabecular structure of extant and extinct hominoids, due to bone's ability to remodel in response to biomechanical loading. Refined techniques have recently been developed to better represent the localized remodeling response of trabecular bone [1]. These methods have been used to successfully identify differences in the distribution of trabecular bone that align with predicted variation in loading in the primate first [2] and third metacarpal [3]. However, as of yet, no study has described the pattern of trabecular bone distribution across the human hand. In the present study we use microtomography to quantify the trabecular distribution in 21 bones of the human hand (n = 888) from a temporogeographically diverse range of *Homo sapiens* associated with sedentary and active subsistence strategies to address three aims: (1) establish an "average" distribution between groups; (2) use functionally related bones to examine if the trabecular patterns of bone volume to total volume (BV/TV), elastic modulus (*E*), and degree of anisotropy (DA) are consistent with predicted loading histories; (3) and visualize site-specific BV/TV distributions to identify the direction of predominant load transfer across joints. Results demonstrate generally similar patterns of trabecular structure across the hand between the two groups, suggesting similar hand use. However, higher BV/TV, *E*, and lower DA in the hunter-gatherer group were found to differ significantly in the wrist, thumb, and ulnar side of the hand, which is consistent with a more variable and intense loading regime in these areas. Visualization of these differences support previous predictions regarding hand loading during tool use [4,5], particularly a greater dependence on loading with a flexed wrist on the ulnar side of the hand, and high-intensity loading along an arc of movement during radial-extension and ulnar-flexion. These results are discussed in comparison to the trabecular structure of hand remains from various Neanderthals (Kebara 2, Amud, Tabun) and early modern *H. sapiens* (Qafzeh 8 & 9, Arene Candide 2, Barma Grande 2). Our results support the use of trabecular bone as an indication of joint loading in extant and extinct taxa, and conclude that the incorporation of multiple bones can greatly improve behavioral reconstructions.

We are deeply grateful for the samples provided by the Research Centre for Palaeolithics and Palaeoethnology, Dolni Věstonice (Jiří Svoboda); Museo Nazionale Preistorico dei Balzi Rossi (Elisabetta Starnini); the Museo Archeologico del Finale (Andrea De Pascale); the Sackler School of Medicine at Tel Aviv University (Israel Herskovitz, Alon Barash, and Yoel Rak), Naturhistorisches Museum Wien (Maria Teschler-Nicola, Ronald Muehl), the University of Florence (Jacopo Moggi-Cecchi and Silvia Bortoluzzi), Lapa do Santo material (André Strauss), University of Kent Skeletal Biology Research Center (Tracy L.Kivell), and the Johann-Friedrich-Blumenbach-Institut für Zoologie und Anthropologie der Georg-August-Universitat Gottingen (Birgit Großkopf). For scanning assistance, we thank David Plotzki and Heiko Temming. For insightful discussions, we thank Colleen Stephens, Adam van Casteren, and Zewdi Tsegai. This work was supported by the Max Planck Society (NBS, MMS, TLK, JJH) and the European Research Council Starting Grant [grant number 336301] (TLK and MMS).

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Poster Presentation Number 9, Th (12:15-14:15)

Behaviours as mosaics of new and old traits: What's new in in the Middle Stone Age of Southern Africa?

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One of the most striking features of hominid development is a marked increase in innovativeness regarding object behaviour. The production and use of tools become more and more flexible, variable and complex through time and the interactions of hominids with their habitat are incrementally linked to objects. One time period, which has become increasingly important for our understanding of the beginning of 'modern human behaviour' is the South African Middle Stone Age (MSA), because several key innovations defining the unique behaviour of early anatomically modern humans, such as the use of bone tools and marine resources, symbolic behaviour, heat treatment as well as complementary tool sets like bow and arrow, appeared for the first time. If we want to understand these processes and the emergence of 'modern human behaviour' it is of utmost importance to study innovations in archaeological remains. This allows us to get deeper insights into cultural change and cognitive steps in human evolution. The most common way in Paleolithic research to look at innovations is to identify new tool types and deduce new production techniques by studying the tools. However, it is not enough to focus on the appearance of new tools and techniques as they are just one small part of behaviour. Innovative behaviours are rarely completely new solutions. They are rather mosaics of new and old traits, with the innovative components affecting diverse parts of object behaviour, like tool types, technological processes, form, function, the nature of involved effects and mental concepts [1]. If we really want to understand cultural change and innovative capacities of hominids, we have to identify this mosaic and evaluate what is actually new in a behaviour. To this end cognigrams [2; 3], a relatively new method for understanding complexity, can be used to detect innovative traits in tool behaviour. Cognigrams are based on the commonly used way to analyse tool production, the *chaîne opératoire* [4]. In contrast to the *chaîne opératoire* approach, which is focused on understanding the work piece and the involved technical processes, cognigrams are action-based. They are graphical representations of past behaviour, including all steps, objects and effects involved in a process and reflect the so-called problem-solution distance [5], which is the distance between the recognition of a problem and its solution. By comparing various behaviours illustrated in cognigrams it is possible to not only assess various aspects of complexity (such as the underlying thought process, the length of the operational sequence, the number and nature of objects, subjects and locations involved in the process as well as effects) but also to identify which of these traits are new. The presented study focuses mainly on identifying this mosaic of new and old behavioural traits in the Middle Stone Age of Southern Africa, from new tool types (e.g. retouchers and arrow heads), new artefact groups like organic tools, new production techniques such as polishing bone, and new behaviours like heat treatment of silcrete or hunting with bow and arrow to so far unknown mental aspects (e.g. initiating and anticipating effects of tools without controlling the effect during its agency as observed in heat treatment of silcrete).

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Poster Presentation Number 81, Th (12:15-14:15)

MicroWeaR: a new tool for dental microwear analysis and its application to paleoanthropology and paleontology

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From the 1970s, dental microwear analysis on the tooth surface has been widely employed for the reconstruction of the feeding behaviour and tooth use in both extant and fossil vertebrate taxa. This approach relies on the microscopic scars present on the dental enamel left by ingested foods during the last few (i.e., days, hours) meals of the animal, thereby providing crucial information about short-term changes in the dietary behavior of a species. More specifically, microwear analysis has proven to be an important tool for the dietary ecology of fossil hominins [1,2]. The frequency, morphology, distribution and orientation of the microscopic scars on the enamel surface are a consequence of the action of both chewing forces and type of consumed food on the tooth during the mastication. The most common, traditional way to observe and study these scars is using high definition pictures of a selected working area at low or high magnification, by means, respectively, of a standard stereomicroscope or a scanning electron microscope. There are a number of image analysis software tools for counting and studying these features on a single or multiple images, but all they require a costly license or are generic image processing programs not calibrated for a specific type of analysis such as the microwear one. Here, we propose a new free and open access software to examine and score microwear scars in a semi-automatic way; the code is stored in the MicroWeaR R package. This tool needs an image (at the moment the file formats supported are "jpg", "tif" and "png") as input, with a metric reference for the definition of the scale factor. After loading and scaling of the image, the operator defines the placement and size of a working area. Once the working area is defined, features can be tracked starting a sampling session in which the operator defines 4 points for each scar: the first two for the length and the latter two for the width. Then, the tool classifies automatically each scar within one of the two macro-groups of features: "scratch" and "pit". For each of these two groups, the tool recognizes different sub-categories: "small" and "large" pits, "fine" and "coarse" scratches. In addition, MicroWeaR package provides the user with a summary statistic for each macro- and micro-group (count, mean and standard deviation) and the input picture with the sampled scars that can be exported in different formats. Automatic classification parameters can also be manually edited and set allowing to customize each sampling session. In sum, this easy to use, fast, and semi-automatic tool of classification of the microwear features represents a great advance for the study of the dietary adaptations, paleobiology and paleoecology of any vertebrate, including fossil hominins. Furthermore, due to its free an open access nature, further implementations can be also developed in order to make MicroWeaR a more versatile and powerful tool for dietary assessment of living and fossil species.

*Presenting Author

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Pecha Kucha Presentation: Session 10, Sa (11:25-11:50)

The weapon system behind the point: Early Gravettian hunting technologies at Maisières-Canal

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Hunting and preparing for the hunt – manufacturing, using, and repairing the equipment – were undoubtedly important and time-consuming activities in the lives of Palaeolithic groups [1, 2]. Studying hunting equipment in detail is thus essential for our understanding of a crucial aspect of Palaeolithic human behaviour and allows us to understand developments in human technologies and problem-solving across wide geographical and chronological ranges. Yet, our current knowledge about the development of prehistoric hunting technologies (projecting modes, weapon design) is mainly based on a few important but isolated discoveries of organic remains in Europe, such as the Lower Palaeolithic spears or spear fragments recovered at Schöningen, Lehringen, and Clacton-on-Sea, the Solutrean and Magdalenian spear-thrower hooks, and the arrows and bow fragments from Mesolithic and Neolithic contexts [3].

In this paper we demonstrate how to exploit the full potential of a much more durable and ubiquitous type of remains, lithic armatures, in the study of Palaeolithic hunting practices. We present the results of a collaborative project that combines technological and functional analysis with experimental archaeology, and aims at understanding the manufacture and use of a specific lithic projectile type, the Early Gravettian tanged point. Our archaeological material comes from the Gravettian occupation phase of the open-air site of Maisières-Canal (Belgium), dated between 33 and 32 cal BP [4]. This stratigraphically well-isolated sequence has yielded an important collection of tanged points that are in excellent state of preservation.

A combined study of the finished armatures and the related shaping waste allows us to present a new, more comprehensive view of the characteristics and constraints of the shaping method. The points were made on large, thin blades produced by hard or soft stone percussion, and subsequently shaped by several generations of direct, flat, invasive (sometimes overshot) removals with an organic hammer. These points, which all display a long, elaborately shaped tang, thus form a distinct tool type with a unique *chaîne opératoire* and a very particular morphology in terms of weapon design and hafting systems.

Many of the points show clear macroscopic and microscopic damage from impact that can be attributed to their use as armatures. The morphology, the organisation, and the orientation of the traces allowed us to propose specific hafting modes that were tested experimentally. The experimental program focused on both the details of the hafting mode and the mode of projection. In addition, alternative tool uses such as butchering were considered, and the points were framed within the broader functional context of tanged and non-tanged tools recovered at the site. The results allow evaluating what kind of weapon system the tanged points were part of, and what their place was in the Early Gravettian technology. We argue that when approached from an experimental and techno-functional point of view, lithic projectile points can help us understand the development of hunting technologies as well as broader patterns of technological change.

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Pecha Kucha Presentation: Session 6, Fr (11:50-12:15)

RESOLUTION: Radiocarbon, tree rings, and solar variability provide the accurate time scale for human evolution

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Scientific studies of the colonization of Europe by Anatomically Modern Humans (AMH), which occurred between 50 and 30 ka cal BP (calibrated years Before Present), are vital to throw light on the mystery surrounding our recent evolutionary past. Since the XIX century, one of the key themes in the study of human evolution has been the nature of the possible relationship between Neanderthals and our own species. Important issues to be investigated are whether they lived contemporaneously, and if so for how long and where and when Neanderthal went extinct. Despite the substantial progress made to accomplish these goals, the detailed timing of human evolution is still far from being resolved, as a result of the lack of a solid age control. In this context highly precise and accurate calibration of radiocarbon ages, back to ca. 50 ka ago, is critical to limit archaeological speculations, to develop solid chronologies of palaeoenvironmental change and to reconstruct solar variability through the last glacial period. 14C concentration in the atmosphere has not been constant in the past and radiocarbon ages must be corrected and converted to calendar ages by comparison to an absolutely dated 14C archive, a process called calibration. Although considerable progress has been made in the last 15 years, the updated international calibration curve, IntCal13 [1], has still insufficient precision in the age range of 15-50 ka cal BP, largely due to lack of well dated archives of atmospheric 14C concentrations [2]. Discrepancies and limitations are evident leaving room for inaccuracies in age estimates and ambiguities in chronological interpretation. As established already for the Holocene and the Late Glacial [3], atmospheric 14C data sets from tree rings would be ideal to drastically improve the calibration. They are essential to resolve the chronology of sequences involving only a few human generations, because of their annual structure and the direct link of the 14C content of tree-ring cellulose and the atmospheric 14C concentration during tree ring growth. At present, the calibration based on tree rings goes back in time to 14.2 ka BP, and before this time, the resolution of the calibration curve drops substantially compared to the tree-ring based section. Segments of tree-ring series exist in Glacial times, but they were considered irrelevant due to the absent link to any absolute time scale. Only since several years a new method to use these floating sections was developed [4,5]. This powerful option relies on the synchronous response of cosmogenic isotopes, 14C and 10Be, because their common production mechanism is controlled mainly by solar activity changes (in the time range of decades to a few centuries) and geomagnetic field strength. Atmospheric 14C variations recorded faithfully in the tree-ring chronologies have a mirror image in variations of 10Be in ice cores (taking into account the respective geochemical pathways through modeling). Over the past decade 10Be data sets from polar ice cores have been established and improved considerably, and likewise the accuracy of ice core timescale has been tested. Several examples demonstrate that even when 'floating', tree-ring chronologies have a tremendous potential. In the RESOLUTION project we will use existing tree-ring samples in the time range of 15-50 ka cal BP and complemented by new trees of new fieldwork on known Mediteranean tree sites to fill gaps in knowledge on the presence of subfossil trees in Europe. Based on those trees, reconstruction of the atmospheric 14C will help us to resolve the discrepancies between archives in the glacial period and accomplish the definitive high resolution chronology of European human evolution.

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Poster Presentation Number 146, Fr (12:15-14:15)

Modularity in the proximal and distal femur of primates with implications for the evolution of locomotor diversity

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Biological organisms are built out of a series of modules that can be genetically, developmentally, and/or functionally integrated. Understanding modularity is important for evolutionary studies, as the degree of modularity in a system has been positively correlated with its flexibility and "evolvability." The shape of the femur has shown to be a good correlate of locomotor pattern in extant primates, and thus, finding evidence of discrete, phenotypic morphofunctional modules in the femora of primates has implications for the evolution of different locomotor patterns, including bipedality. There are many functional and developmental reasons why there may be more phenotypic modules present in the proximal, as compared to the distal, femur. The proximal femur has a relatively complicated ontogenetic path in comparison to the distal femur; the tissue that eventually forms both the femoral head and neck and the greater trochanter is derived from a single chondroepiphysis, from which two secondary ossification centers derive - one for the femoral head/neck and one for the greater trochanter. This contrasts with the distal femur, which is formed from a single secondary ossification center whose secondary ossification begins prior to birth. In addition to differences in development, there is evidence that the femur is acted on differentially during growth, producing epigenetic changes. These changes generally affect only certain aspects of the femur and not the femur in its entirety.

Three-dimensional geometric morphometric data were collected on an extant sample of 759 proximal and distal femora across all anthropoid taxa to test three expectations of modularity in the femur: (1) that there are at least two modules in the proximal femur with a boundary dividing the femoral head from the greater and lesser trochanters; (2) that the entire distal femur is a single module; and (3) that all primate taxa follow the same pattern of modularity, as patterns of integration and modularity have been shown to be conserved among primates in other regions of the skeleton where there are significant phenotypic differences. Results indicate that in all primate taxa, the proximal and distal femur are separate morphological modules. All of the hypothetical modules tested in the proximal femur for all genera were strongly correlated, and so all hypotheses of modularity in the proximal femur were rejected. In the distal femur, two different patterns of modularity were apparent. For most primates, the landmarks comprising the anterior portion of the distal femur formed a separate module from the landmarks comprising the posterior portion of the distal femur. However, *Gorilla* presented a different pattern with the boundary between modules dividing the distal femur into a medial and lateral component. In Gorilla, this pattern of modularity could be related to selection for a form that could support large body weights during terrestrial locomotion. Among extant great apes, *Gorilla* has the most strongly enlarged medial condyle as compared to lateral condyle as well as the most varus position of the knee. These results indicate that for most primates, patterns of morphological modularity are conserved even when great phenotypic diversity is present. However, even though functional modules may be conserved, they are not immutable when selection is strong enough. Thus, number and partitioning of modules is not necessarily a constraint on evolvability.


PDF

Poster Presentation Number 88, Fr (12:15-14:15)

Synchrotron X-ray microtomography in nondestructive adult age at death estimation: visualizing cementum annulations in a historical human assemblage

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Age at death estimation in archaeological or palaeoanthropological adult specimens remains one of the most challenging areas of physical anthropology. Establishing a model for nondestructively ageing adult teeth is a critical step to approaching fossil teeth of unknown age and to verifying life history profiles of human ancestors, an avenue that has mainly been confined to the developing dentition and hence juveniles. Challenges facing age estimation in adults include highly individualized physiological manifestations of degenerative processes upon which many ageing methods are based and the differential preservation of skeletal or dental components affected by diagenetic changes. Tooth cementum is a connective tissue that is incrementally deposited over the root to provide new attachments for the periodontal ligaments in response to repositioning the tooth for effective occlusion [1]. Unlike enamel and primary dentine, cementum is deposited continuously throughout the life of the tooth. The layers are visualized microscopically as alternating light and dark bands that are thought to result from seasonal changes in mineralization and collagen orientation [1,2]. Acellular cementum generally grows over the coronal two-thirds of the root and compared to cellular cementum is thought to be less influenced by factors other than chronological age. Because acellular cementum is infrequently resorbed or remodelled, it has been used to estimate age at death, season of death, and reproductive patterns in mammals. A limited number of studies examine cementum annulations in known age archaeological human material, and a method to nondestructively assess cementochronology in humans has not been published. Here we present a pilot study aiming to image cementum annulations by propagation phase contrast synchrotron X-ray microtomography [3]. We examine 21 human canines, ranging between ages 20 to 81 years, from an 18th to 19th century known age collection excavated at St. Luke's Church in London, England. We scan transverse segments of cementum in the apical region of the middle third of the root. We cut virtual transverse sections from these scans and use these sections to perform blind counts of annulations. Because it is not completely clear when cementum annulations begin relative to tooth formation [2], it is generally accepted that the first annulation is formed at the age of tooth emergence [4]. Using tooth specific root half complete and three-quarters complete ages [5], estimated ages averaged from two sets of counts by two observers demonstrate a statistically significant linear relationship with age at death (r^2=0.55, p<0.001; r^2=0.60, p<0.001). Interobserver variation shows a mean absolute difference of 3.9 years, indicating high agreement using the intraclass correlation test (ICC=0.98, p<0.001). Intraobserver variation shows a mean absolute difference of 2.3 years for observer one (ICC=0.98, p<0.001) and 3.2 years for observer two (ICC=0.94, p<0.001). The overall mean absolute difference between real age and estimated age is 15.2 years, with a tendency to underestimate age in the majority of cases; this difference is lower in individuals under 50 years (6.8 years, n=10) compared to those over 50 years (22.8 years, n=11). Visibility of annulations is indeed dependent on the degree of specimen preservation, especially regarding diagenesis. Considering the microscopic nature of the structures, the setup used in this pilot study is very close to its resolution limit. With further refinement of scanning parameters this approach presents a promising alternative to current destructive methods of cementum annulation analysis.

We thank the European Synchrotron Radiation Facility for their in-house beamtime access.

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Pecha Kucha Presentation: Session 2, Th (11:00-11:25)

A possible explanation for stases in early hominin artefacts — using extant primates as an example

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Early hominin artefacts are in many ways mysterious. One mystery concerns periods of stasis in early stone tool forms (shapes/types). Though debated, many agree that the low level of variability in these stone tool forms not only across time but also across locations and even across hominin species requires an explanation. In this talk, we will consider one prominent example of stone tools associated with a claim for stasis (the Oldowan). Any explanation for stone tool forms might specify the relative importance of each of three main possible factors: 1) environmental "pressures" (e.g. type and size and locations of available suitable raw material), 2) genetic factors (e.g. genetic predispositions for certain behaviours, but also, in part, bodily features) and 3) cultural influences (i.e. the effects of social learning). Implicitly at least, the currently favoured Oldowan explanation places medium to heavy weight on cultural factors. What might this mean? At an extreme, a fully cultural explanation might state that Oldowan tool shapes were – and had to be – learned culturally. This approach then would explain the apparent stasis in forms by reference to high-fidelity cultural transmission (such as imitation). Here, we offer a potential alternative explanation for Oldowan (and potentially beyond) stasis which more heavily leans towards genetic and the environmental factors. Following the so-called "zone of latent solutions" approach (a concept borrowed from comparative cognition), the cultural factor can be further split up: while low-fidelity social learning is widespread in the animal kingdom (and can safely be assumed during the Oldowan), high-fidelity social learning is much more restricted. Our approach hypothesizes that the Oldowan might have lacked high-fidelity copying. If so, the Oldowan forms themselves would have had to be re-invented by individuals. The similarities in forms then come from similarities in evolved general individual cognition (i.e., without the need to postulate "genes" for certain stone tool shapes). This approach can currently explain stone tool stasis at least as well as the predominating cultural approach – without the need to postulate a pure reliance on single factors (e.g. without assuming very high levels of copying fidelity through extreme cultural conformity – but also without assuming genetically enforced stone tool shapes as the direct result of natural selection).

Pecha Kucha Presentation: Session 10, Sat (11:50-12:15)

Early monumental art in Eurasia - new information on the wooden Shigir idol

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More than a 100 years ago mining activities in Shigir peat bog started and they provided a very rich body of prehistoric organic finds. In 1890 a wooden sculpture was found, which today is on display in Sverdlovsk regional museum with a preserved height of c. 3.4 m. The figure shows a distinct sculptured head and the body is decorated by some abstract human faces and geometric ornamentation. Some years ago conventional radiocarbon dates suggested a Boreal context for the find (c. 7.800 calBC). In 2014 a Russian-German team started new research, the results of which can be summarized as follows: The working traces on the surface indicate the manufacture of the sculpture with stone tools from green larch wood. The tree was more than 120 years old. Seven new AMS-dates confirm the Stone Age context of the object. Results vary considerably, probably due to the treatment of the sculpture with consolidants. However, AMS-results on the samples from the innermost part of the sculpture should provide the most relevant dates, and these assign the object to a phase at the end of the Younger Dryas up to the early Preboreal. The new AMS-dates move the find back in time about 1500 years and make it by far the earliest monumental wooden sculpture of the world. The presence of figurative art at that time in the Transural region is further confirmed by a decorated perforated antler found in the same peat bog. The new results are in accordance with evidence from recent excavations of peat bog sites in the Urals such as Beregovaya 2 by M. Zhilin and S. Savchenko, where different Mesolithic layers of the Preboreal to the Atlantic period could be identified. The Shigir sculpture proves that hunter-gatherers produced complex monumental art at that time. Evidence for the production of monumental anthropomorphic sculptures made of stone steles was also found at the Göbekli Tepe site in southeast Turkey, dated to the 10th / 9th millenium calBC (Pre-Pottery Neolithic). The new information demonstrates that wood was an important material for art production as early as the beginning of the Holocene and complex art is no exclusive element of the societies of the fertile crescent at that time.

Poster Presentation Number 118, Fr (12:15-14:15)

Early Pleistocene paleohabitats of Eastern Europe: Evidence from the Oltet River Valley of Romania

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Present evidence suggests that neither intrinsic (i.e., related to characteristics of the organism) nor extrinsic (i.e., related to external factors) hypotheses can fully explain the initial dispersal of hominins out of Africa and/or into Eurasia in the early Pleistocene. Though *Homo erectus* is known from Dmanisi, Georgia at ~1.85 Ma, other well-dated European hominins have not been recovered before 1.4 Ma (Orce Basin, Spain). There are two potential interpretations of these data: 1) some barrier (either physiological or environmental) prohibited hominin dispersal into Europe until ~1.4 Ma, or 2) hominins were present but paleontological investigations have not yet uncovered convincing evidence of their presence. Current paleoenvironmental data suggest that hominin dispersals into Europe may have been facilitated by climatic changes, but few data describing the paleoenvironmental conditions in Eastern Europe, a region through which hominins are hypothesized to have dispersed, are available for the early Pleistocene. Over the last five years, research conducted by the Oltet River Valley Project in Romania has sought to add to our current understanding of paleoenvironmental conditions in Eastern Europe during the early Pleistocene. Previously excavated sites in this region represent some of the richest paleontological localities in Eastern Europe, though these collections are little known and underutilized. Here we present preliminary paleoenvironmental reconstructions from several early Pleistocene localities from Romania, with the goal of determining whether this region may have been conducive to hominin dispersal at this time. We have reinventoried and reanalyzed over 2000 fossils from excavations conducted in the 1960s, resulting in the identification of several taxa not previously recognized from these assemblages. Mesowear and stable isotope analyses of ungulate dentition suggest a predominantly browsing signal, though ecomorphological analyses reveal that these ungulates were open-adapted. This mosaic pattern has been noted for other Pleistocene European sites and may indicate a habitat type with no modern equivalent. Coupled with continued analysis of previously excavated materials, comparisons to other pencontemporaneous paleontological localities in Europe, and new survey and recovery of fossils from sites in the Oltet River Valley by our team, these data have the potential to further shed light on paleoenvironmental conditions during this critical time period in hominin evolution.

Poster Presentation Number 15, Th (12:15-14:15)

A techno-functional study of the Aterian technocomplex at Ifri n'Ammar.

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The tanged tools of the Aterian technocomplex have generally formed the central point in debates on early indications of hafting [1]. However, in order to obtain a true understanding of the specificity of this technocomplex, it is essential to study entire assemblages and understand the characteristics of the tanged and non-tanged tool component, both on a technological and on a functional level. Until today no functional studies were yet undertaken on complete Aterian tool assemblages. We present the results of the technological and use-wear analysis of the non-tanged tool component of the Aterian assemblage of Ifri n'Ammar (Morocco) and focus on aspects of tool use and hafting.

The rock shelter of Ifri n'Ammar, located in the eastern Moroccan Rif, is known for its rich stratified lithic assemblages, dating to 83 ± 6 ka to 130 ± 8 ka for the upper levels and to 145 ± 9 to 171 ± 12 ka for the lower levels [2]. In the framework of the recently published dating results of other maghrebian sites [3], Ifri n'Ammar takes an important position within discussions on the chronological attribution of the Aterian: a large time span extended from MIS 6 to MIS 3 [3]. The sequence has provided a large diversity of tool morphologies which offer the possibility to contribute to the discussion about use and hafting of tanged and non-tanged tools. Aside from the tanged tools and foliates, the material from comparable Aterian assemblages can be defined by the presence of side scrapers, end-scrapers, denticulates, such as blades, bladelets or Levallois cores [4]. Despite the frequent presence of post-depositional surface alterations, reliable functional interpretations could be identified on a large number of tools. Previous studies had already confirmed that the tanged tools were used while hafted for hunting and animal processing activities [5]. Also a variety of tasks and gestures could be identified on the non-tanged tools based on a combination of diagnostic macro- and microscopic wear traces. Interestingly, also the non-tanged tool component shows evidence of hafting, indicating the existence of a variety in hafting techniques. The integration of the functional results on the non-tanged and tanged tool component allows addressing questions on tool variability, diversity in tool morphology and site function. We argue that the results highlight the importance of the site for improving our understanding of the North African MSA.

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Podium Presentation: Session 12, Sa (17:20)

The Upper Paleolithic site of Les Prés de Laure (France) sheds new light on Palaeolithic weaponry

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The upper Paleolithic site of "Les Prés de Laure" was discovered in 2012 in a small valley southeast of France (Jabron valley). Situated on an ancient fluvial terrace, it corresponds to the first well-preserved open-air site identified in this region. Several stratigraphic layers composed of fine overbank deposits of the Jabron River have been identified and dated between 27ka and 23ka cal. BP, providing unprecedented data on the end of the LGM, a period that is poorly known in Southeastern France. Indeed, even though important sites are known for this chronological period (e.g., the Balzi Rossi sites where burials and Gravettian figurines, i.e. "Venus", were discovered), most of them were excavated in the early 20th century and the accuracy of some sequences is therefore debatable. The site of Les Prés de Laure with its well-preserved context and modern excavation is therefore crucial to document the end of the Gravettian period in this region.

Among the multiple layers of the site, we focus on one particular stratigraphic unit (SU), namely the SU L17, where a human occupation proves to be oriented mainly towards the acquisition, exploitation and consumption of horses. Gently sloping towards the northeast, this brown organic and well-structured layer composed of fine alluvial silts corresponds to an ancient fluvial paleosoil, suggesting a period of landscape stability favorable to human settlement. Micromorphological analyses and grain size studies indicate the occurrence of multiple sedimentary events of very low intensity, while radiocarbon dating suggests decreased sedimentary rates coherent with soil pedogenesis. The artifacts are distributed in the whole excavated area and their orientation, slope and dimensional repartition indicate no major taphonomic movement.

The lithic assemblage has a techno-economic profile characterized by the import of isolated products and a few in situ knapping events. Faunal remains, exclusively horses, are intensively altered and fractured. Among the discoveries, a composite barbed point has been identified with no equivalent up to now. The stratigraphical context, the results of the technological, wear and residue analysis of this discovery together with a new set of experiments will be presented. The find permits new insights on the lamellar component and the design and evolution of hunting weapons in the Gravettian. This hunting weapon also raises challenging questions on processes such as microlithization and geometrization in Upper Paleolithic contexts.

Poster Presentation Number 27, Th (12:15-14:15)

The lithic assemblage and bone tools from the Lower Palaeolithic site of Marathousa 1, Megalopolis, Greece: first results

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The Middle Pleistocene lithic variability in South-East Europe is poorly understood due to the scarcity of well-preserved, excavated assemblages. In this paper, we present preliminary results from the study of cultural material unearthed at the Lower Palaeolithic site of Marathousa 1 (MAR-1), Megalopolis, Greece, during the excavations of three field seasons (2013-2015). The MAR-1 lithic assemblage is associated with elephant and other faunal remains bearing cut-marks. It is composed of small-sized flakes and flake fragments, retouched tools, cores that are commonly small and exhausted, as well as many debris and retouch products, such as shattered pieces, chips and re-sharpening or retouch flakes. So far, there are no indications of bifacial debitage and a key aspect of the material refers to the small size of the blanks. The MAR-1 industry fits well in a group of important European sites with flake-based, "small-tool" non-handaxe industries, such as Isernia, Ficoncella, Bilzingsleben, Schöningen, Vértesszőlős and La Polledrara, many of which, like MAR-1, have yielded evidence of elephant or other mega-fauna exploitation. Based on the on-going analysis of the lithic material from three field seasons, we discuss aspects of assemblage composition and the role of raw material types, the main technological and typological traits of the industry, as well as the potential contribution of the MAR-1 evidence in broader discussions about Middle Pleistocene lithic techno-complexes and subsistence strategies in Europe. With regard to the MAR-1 toolkit, there seems to be an emphasis on blanks with a sharp, potentially working edge, which typically occurs opposite to a backed edge. In this respect, the evidence from Marathousa 1 and the focus on backed pieces recalls traits and morphologies that appear also in much younger, Middle Palaeolithic industries of Central Europe, such as that from Tata (Hungary). The technological objectives behind the production of the MAR-1 small blanks and tools, as well as their function, are issues that remain to be further investigated. Finally, we briefly present bone flakes, and faunal material with flake and impact scars. These specimens suggest that hominin exploitation of the carcasses was not restricted only to defleshing, marrow extraction and bone processing for nutritional needs, but included also the knapping of bones, potentially with the aim of using the knapped products as tools.

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Pecha Kucha Presentation: Session 6, Fr (11:25-11:50)

Inbreeding, Allee effects and the extinction of Neanderthals

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It is common to assume that the extinction of Neanderthals, at a time when Anatomically Modern Humans (AMHs) made their move into Europe, must be explained in terms of a marked difference — cognitive, technological, or social — between the two species [1-4]. Here we present two models that suggest that no such highly contested [5] differences need to be invoked to account for the demise of Neanderthals.

We show that, even without competitive interaction between the two populations, under certain conditions a relatively small size of the population of Neanderthals might have been sufficient for Neanderthals to have gone extinct. We have implemented two independent models–one a deterministic matrix model, the other an individual-based stochastic simulation model, both drawn from conservation biology–that consider two mechanisms through which Neanderthals might have suffered from a weakness in numbers. The first is inbreeding, which is more likely to occur in small populations, and which leads to a reduction in the first-year survival of off-spring. The second mechanism is a decrease in the proportion of females breeding at low densities due to, for example, a difficulty in finding mates, a reduction in the number of alloparents, a dependence of food capture on collaborative efforts, and so forth. Both models show that such so-called Allee-effects, together with the effects of inbreeding, make small populations, such as those suggested of late Neanderthals, especially vulnerable to reaching inviable sizes.

The significance of our study is threefold. First, it teaches us that earlier attempts to explain Neanderthal extinction have missed out on a set of factors of crucial importance: the adverse effects of living in a population of small size. Second, our study can serve as a null model, which in further studies can contain various additional factors, such as, climate, interbreeding, competition for resources, and/or any agreed on difference between Neanderthals and AMHs. Finally, third, one of the reasons why palaeolithic archaeologists are so preoccupied with comparing Neanderthals and AMHs arguably is the assumption that differences between the two *must* be found if we are to understand the demise of the former. Our results suggest that this requirement might be more apparent than real, and thus that we should relax our contrastive biases when interpreting the archaeological record.

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Poster Presentation Number 128, Fr (12:15-14:15)

The phalangeal morphology of La Ferrassie 1 compared to modern humans using three-dimensional geometric morphometrics

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La Ferrassie 1 is the skeleton of an adult Neanderthal male. It was discovered in 1909 and has been the subject of extensive studies since then. The fossils are dated to about 43 to 45 thousand years ago. The individual itself was around 45 years old when he died. Until now, no geometric morphometric analyses of the La Ferrasie 1 manual phalanges has been performed. We aim to close this gap in our knowledge by assessing how the manual proximal phalanges compare to those of modern humans. The manual proximal phalanges of La Ferrassie 1, except the second ray due to poor preservation, were scanned with a CT scanner. Those of 67 modern humans from across the globe were scanned with a NextEngine desktop laser scanner. These data were subsequently used to create surface models in Geomagic. Sixteen landmarks were chosen on the phalanges and digitised in Landmark. Principal component analyses were performed subsequently on each of the rays. Two-block partial least squares analyses were performed to assess covariation between the rays. Initial analyses indicate that the phalangeal morphology of La Ferrassie 1 falls outside of the 95% confidence interval and, therefore, is distinct from it. This is particularly visible in the third and the fourth proximal phalanges. The covariation between the rays of La Ferrassie 1 is similar to that of modern humans. La Ferrassie 1 is, however, relatively robust compared to modern humans, which in dorsoventral view is more pronounced distally and in mediolateral view more pronounced proximally. The sole exception being the fifth ray in mediolateral view, where La Ferrassie 1 is equally more robust both proximally and distally. There is a general similarity between the phalangeal morphology and the covariation between the phalanges of La Ferrassie 1 and modern humans, which would be expected, since Neanderthals and modern humans are closely related. The phalangeal morphology of La Ferrassie 1 is, however, significantly different from modern humans; he has proximal phalanges that are distally mediolaterally wider and proximally dorsoventrally thicker. The interaction between robusticity and shape is complex [1] and with an extremely small sample size for Neanderthals in this analysis it is difficult to draw any firm conclusions on the behavioural or adaptational implications , or whether these differences have a genetic basis or are plastic responses. The proximal phalanges of Neanderthals have previously been observed to be more robust than those of modern humans . Nevertheless, the phalangeal morphology of La Ferrassie 1 does not simply seem to be a product of increased robusticity, since it is expressed in different ways in different parts of the phalanges.

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Poster Presentation Number 129, Th (12:15-14:15)

Anatomical Adaptations in the Bonobo Thumb

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The enhanced dexterity of modern humans is associated with a highly mobile thumb. This high mobility is largely due to the saddle-shaped configuration of the trapeziometacarpal (TMC) or basal thumb joint and strongly developed thenar musculature. Other catarrhine primates have a fully opposable thumb associated with a saddle-shaped TMC joint similar to humans. In non-human primates, however, there is a direct conflict between the locomotor function (where stability prevails) and the manipulative function (where mobility prevails) of the thumb. By comparing the anatomy and biomechanics of the thumb in non-human primate species employing different locomotor types, we seek to investigate the functional adaptations in primate thumb anatomy and improve our understanding of how the thumb is adapted to these conflicting mechanical demands. In a first study, we have focused on the bonobo, which has well developed manipulative abilities (e.g. tool use) but also loads the thumb during various arboreal locomotor modes (e.g. vertical climbing, suspensory locomotion). We use state-of-the-art imaging techniques (microCT, CT) along with detailed dissections of unembalmed cadaveric material to quantify the 3D geometry of the internal and external structure of the TMC joint as well as of the surrounding soft tissues. Additionally, we have obtained static CT-scans during specific hand movements and positions to investigate the thumb kinematics and contact biomechanics during functional tasks. Preliminary results show that bonobos have well-developed thumb muscles with similar basal thumb joint loading when compared to modern humans. This can explain the high dexterity and tool use observed in free-ranging bonobos. However, in bonobos there is a functional coupling between the thumb and index finger as shown by their specific muscle configuration. Ultimately, our goal is a full documentation of the thumb anatomy in bonobos, baboons and gibbons in addition to the well documented human anatomy, identifying interspecific variations, and investigating the biomechanical implications of different anatomical configurations.

Poster Presentation Number 85, Th (12:15-14:15)

Diet, encephalisation and the evolution of the human mandible: a catarrhine approach to mandibular and dental reduction

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Mandible and teeth occupy a special place in the study of human evolution. Within the hominin clade, we observe a trend of reduction in size and robusticity, which is evident in the genus *Homo* and extreme in anatomically modern humans. Dietary-linked factors have been suggested as drivers of mandibular and dental reduction in *Homo*: the consumption of meat, the use of lithic tools, the adoption of fire for cooking and, during the Holocene, the onset of agriculture [1,2,3]. Other trends transformed the anatomy of the genus *Homo*. The hominin brain enlarged during Pleistocene, with *H. neanderthalensis* and *H. sapiens* displaying an exceptional expansion of their braincase. Being physically connected to the cranium, an increase in brain volume may have altered the morphology of hominin mandibles and tooth rows [4]. Demonstrating the validity of one hypothesis over the others is a difficult task. Variations in diet, food processing and brain volume occurred somewhat simultaneously and may have influenced one another. One way of testing these hypotheses is to adopt a comparative approach and to look at our closest primate relatives. In particular, catarrhines share several anatomical and behavioural traits with hominins and modern humans, which make them an excellent candidate for comparison in the study of the evolution of the lower jaw [5]. In this work, we investigated the functional requirements and the structural constraints acting on the catarrhine and hominin lower jaw. We tested the hypothesis that structural constraints played a major role in the onset of the trend of reduction. We analysed the hominin clade as part of the variability of catarrhines, in order to define the morphological, phylogenetic and evolutionary boundaries imposed on *Homo* simply by belonging to the order of Primates. We used Geometric Morphometric data and traditional metrics on mandible, teeth and neurocrania of 74 catarrhine species, including 11 hominin species. We tested for correlations between mandibular robusticity, dental size and independent variables linked to diet and food processing. These variables were divided into four categories: Diet Quality (DQ), Micro-Wear (MW), Chewing Cycle Length (CCL) and Tool Use (TU). The correlations were tested by performing a phylogenetic ANCOVA, including body mass as a covariate. Because of the high levels of error associated with some of the independent variables used, we randomised them and repeated the analysis 1000 times. In addition, we used two-blocks Partial Least Squares (PLS) on morphometric data to test for shape covariation between mandible and neurocranium in great apes and hominins. We did find significant correlations between mandibular robusticity, dental size and the dietary variables, but a significant interaction between the independent variable and body mass was always present. The levels of significance observed in the analysis were not repeated after randomization, indicating that significance may have been achieved by chance. A significant pattern of covariation exists between mandible and neurocranium in modern *H. sapiens*, associating a shortened head to a more gracile mandible (reduced ramus breadth, longer corpus and wider gonial angle). We did not observe the same covariation pattern in *Pan* and *Gorilla*. Our results suggest that encephalisation may have structurally constrained the lower jaw in late Pleistocene hominins and Holocene humans, which are characterised by large brains. It is not possible to discard the importance of diet and food processing factors in the evolution of the hominin lower jaw, although, according to our results, the use of such variables may be misleading because of their associated levels of error. In addition, no strong correlations were found, indicating that, even if diet and food processing played fundamental roles in the trend of reduction, they did not leave a marked trace on hominin anatomy.

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Poster Presentation Number 37, Th (12:15-14:15)

Territorial mobility of early modern humans in Crimea. Strontium isotope analyses of the human remains from Buran-Kaya III.

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The site of Buran-Kaya III in Crimea, provides an exceptional archaeological sequence that ranges from the Middle Palaeolithic to the Neolithic and has been recently reassessed thanks to new excavations and multidisciplinary studies. Within the sequence, three layers attributed to the Gravettian sensu lato (6-2, 6-1, 5-2) have yielded abundant assemblages of lithic and bone artifacts as well as more than 200 dental, cranial and post-cranial remains of anatomically modern humans. Human remains from the layer 6-1, that is dated to 31.9 ka B.P. (36.9-35.5 ka cal. B.P.) represent the oldest Upper Palaeolithic modern humans from Eastern Europe showing post mortem treatment of the dead. Here we present the results of biogeochemical analyses that were undertaken in order to discuss the geographic origin and/or mobility of the Gravettian human groups. Strontium isotope ratios [$^{87}Sr/^{86}Sr$] were measured on the dental enamel of 11 permanent teeth found between 2001 and 2009 in the layer 6-1. The measurements were obtained by laser-ablation MC-ICP-MS. In order to interpret the results, a preliminary baseline map was built with the goal to assess the bioavailable $^{87}Sr/^{86}Sr$ at the site (a rock shelter that opens in cretaceous limestones) as well as on the other geological substrates that are present in the region. This was done by collecting plant samples at 16 locations, and in particular on secondary sedimentary rocks between the Alma and Kacha valleys as well as tertiary deposits located North-West to the site, at the edge between the Crimean Mountains and the steppe area. All plant samples were analysed by solution MC-ICP-MS. The plant samples growing at the vicinity of the site yielded a $^{87}Sr/^{86}Sr$ mean ratio of 0,7092, that is consistent with known values for similar marine sedimentary rocks. Dental enamel of the 11 teeth yielded a measurable Sr isotope signal. For each tooth, two LA lines were run and the average difference between two lines is 0.00025, showing the good reproducibility of the measure and little intra-tooth variability. The mean $^{87}Sr/^{86}Sr$ value obtained for the 11 human teeth is close to, but lower than those of the local plants. Our results also show some variability between the teeth that includes intra- and inter-individual variation. All these results are discussed in terms of possible geographic movements and territorial mobility patterns of these individuals.

Poster Presentation Number 117, Th (12:15-14:15)

A comparative study of the Late Middle European Pleistocene Montmaurin-La-Niche (MLN). Preliminary results.

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Among several caves settled in the limestone mountain shaped by the Save and Seygouade rivers near Montmaurin, 75km south-west of Toulouse (France), La Niche is the one, with Coupe-Gorge, which has yielded human remains collected by Raoul Cammas in 1949 (one cervical vertebra, one well-preserved mandible bearing its 6 molars) and recognized among the fauna by Cammas and André Tavoso in 1986 (one dorsal vertebra, one fragmentary left tibia). Work done by Crégut-Bonnoure and colleagues [1] on the faunal assemblage has attributed the level bearing hominins to the OIS 7 placing the Montmaurin-La-Niche (MLN) in an intermediate location between Middle Pleistocene fossils such as those from Arago (Tautavel, France) and Sima de los Huesos (Atapuerca, Spain), in the one hand, and Neandertals, in the other hand. Here we have made a morphological comparative study using some selected features with a taxonomical signal. In order to cluster the specimens we have used the correspondence analysis using the R package "ca". Moreover, a metrical and morphological study was carried out on the teeth, including an analysis of the dental inner features by means of micro-computed tomography (microCT). Results highlight the primitiveness of the MLN mandible whereas a more fully Neandertal morphology was expected regarding the time range of the fossil. Although a geochronological study of La Niche cave is pending, it will be an interesting exercise to confront the predominant primitive morphology of this mandible with the quantitative results of a future geochronological analysis. Thus, it is possible to test these anthropological results against the different models, like the accretion [2] and two-phases model [3], to explain the variability of the European Middle Pleistocene hominins. It will be also tested the evolutionary scenario proposing a settlement of Europe by some waves of population sharing a common ancestor [4], as well as a complex history of wipe-outs and new occupations, as well as genetic mechanisms, like drift, founder effect, directional adaptation and hybridization [5].

For the access to the MLN mandible, the authors thank Dominique Grimaud-Hervé, Liliana Huet, Stéphanie Renault from the Musée de l'Homme. They are grateful to José Braga and Jean Dumoncel for the micro-CT data that they provided and to Patricia Wils (USM2700, MNHN, Paris) for her technical support.

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Pecha Kucha Presentation: Session 6, Fr (11:25-11:50)

Living on the edge - new Neanderthals from the Altai Mountains

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The first evidence for the presence of Neanderthals in Central Asia was the discovery of the Teshik-Tash child , but research over the last 80 years expanded the Neanderthal range further east into the Altai Mountains of Siberia. This area is especially interesting, as recent genetic analyses suggest that besides Neanderthals, another archaic group, the Denisovans also inhabited this region. At Denisova cave, Neanderthal and Denisovan remains appear interstratified, and genetic evidence of recent gene flow between the two groups suggests interaction between them . Up until recently, the Neanderthal material known from the Altai was very fragmentary, with five teeth and a few postcranial fragments from Okladnikov cave and two phalanges and possibly a deciduous incisor from Denisova cave. Though Turner's analyses emphasized their similarity to Neanderthals, later studies by Shpakova and Derevianko saw modern affinities. In general, the Okladnikov teeth are rather small and lack of some of the derived traits seen in Neanderthals such as mid-trigonid crests in the lower M1 and dm2. The postcranial material from Okladnikov cave is fragmentary and not very diagnostic, but flattened and wide phalanges, as well as the mediolaterally flattened humeral diaphysis are reminescent of Neanderthals. Due to the rather undiagnostic morphology of both the Okladnikov and Denisova remains, their assignment to Neanderthals has been primarily based on ancient DNA. Only mtDNA is known from Okladnikov cave while a high coverage nuclear genome has been published from Denisova. The discovery of a large hominin assemblage at a new site, Chagyrskaya cave allows us to study the morphology of the Altai Neanderthals in much more detail. Since 2008, our team has been excavating Chagyrskaya cave in the Charysh valley, about 70 km southwest of Okladnikov cave, and about 100 km west of Denisova. The Pleistocene deposits are 2.5 m thick, dating to the transition between OIS 4 and 3 based on 14C dates and environmental data. The site is one of the richest in the Altai, with more than 100,000 lithics and about 200,000 animal bones excavated up to date. The uppermost layers 1-4 are Holocene, and do not contain much cultural material. Layers 6a, 6b, 6v/1 and 6v/2 contain a Middle Palaeolithic industry, referred to the Sibiryachikha culture showing analogies to the Micoquean of Crimea and Eastern Europe. We identified more than 75 hominin fragments coming from at least five individuals. The majority of the material comprise isolated teeth and phalanges, but we have also recovered large parts of a right arm and shoulder girdle and a left foot. The Chagyrskaya assemblage preserves a large number of Neanderthal traits in the dentition such as midtrigonid crests on the lower molars and strongly shoveled upper incisors with a convex labial surface. The postcranial material also shows several features seen in Neanderthals, like the presence of a dorsal sulcus on the axillary border of the scapula, large and rounded apical tufts on the phalanges and robust first metacarpals with large M. opponens pollicis crest. We will discuss the morphology of these specimens in a comparative context and their implications for our understanding of Neanderthal geographic variability.

Poster Presentation Number 22, Fr (12:15-14:15)

Preliminary dating of deep layers at Sima de las Palomas del Cabezo Gordo (Torre Pacheco, Murcia, Spain)

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At Sima de las Palomas (125 m.asl; lat.37o47'59"N, 37.793508; long.0 53'45"W, -1.859436) skeletons SP92,-96,-97 dating from ≈50 ka were embedded in a partly-cemented éboulis, Conglomerate A, that along with surrounding sediments provided remains of 10 Neanderthals, Mousterian artifacts, and dates from between ≈ 37 and ≈ 65 ka taking account of confidence intervals for U-series, OSL and 14C determinations [1 and refs]. Conglomerate A plausibly fell between Heinrich 5 (47 ka) and 6 (61ka) in MIS-4. Below it, Conglomerate B, a thin (10-15 cm) albeit uncommonly hard bed of heavily-cemented dense scree, completely sealing underlying sediments, in 1999 had given a $^{230}Th/^{234}U$ disequilibrium estimate on calcite of 56+13/-10 ka. Excavation in 2016 of the sedimentary deposit below Conglomerate B uncovered two Neanderthal incisor teeth (photographed before cleaning; to be published in detail elsewhere). The deposit contains abundant Palaeolithic and palaeontological finds, including burnt bone fragments, perhaps Neanderthal domestic refuse thrown 5 m down the shaft from its mouth.

U-series dates have been determined of 67.70±0.405 and 65.07±0.038 ka ($^{230}Th/^{238}U$, $^{234}U/^{238}U$), undertaken at the University of Reading on calcite crystals extracted from a block of Conglomerate B. Sub-samples were extracted from the sample via micro-drilling and then analysed on Thermo-Fisher iCAPQ ICP-MS for ^{238}U, ^{232}Th, and ($^{230}Th/^{232}Th$) and ($^{234}U/^{238}U$) ratios. Samples were run also on a BeGe Gamma detector where ($^{230}Th/^{232}Th$) and ($^{234}U/^{238}U$) ratios were determined and combined with MS data.

Below Conglomerate B, five samples (V1 to V5) of sediment were collected from the exposed excavation profile for dating by optically stimulated luminescence (OSL). Samples were prepared and measured at the Luminescence Dating Laboratory of the Research Laboratory for Archaeology and the History of Art at the University of Oxford using instruments manufactured by RisøNational Laboratories (Denmark) and Freiberg Instruments (Germany). Palaeodose determinations were obtained from sand-sized (180-250 mic) quartz mineral grains, using a single-aliquot regenerative (SAR) dose-measurement protocol, and provided preliminary MIS-4/MIS-5 age estimates ranging from 90.3±7.3 ka to 130.2±11.9 ka. It is possible that the sedimentary deposit is contemporaneous, geologically-speaking, notwithstanding the overlapping errors of the estimates 102.1±12.0 ka (X6889; V1), 97.0±9.0 ka (X6890; V2), 125.0 ±13.6 ka (X6891; V3) and 130.2 ±11.9 ka (X6892; V4), with noteworthy uncertainty affecting 90.3±7.3 ka (X6893; V5), and pertinent aspects are commented on.

The dates presented accord with the excavated stratigraphical sequence in which the published Neanderthal skeletal remains lay above Conglomerate B that is dated here to the MIS-5a/MIS-4 transition. It sealed a deep sedimentary deposit from which stage MIS-5 estimates are offered here, and which has yielded up Neanderthal teeth and Mousterian artifacts.

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

Dental morphological heterogeneity in the Late Pleistocene *Homo* from Qafzeh and Amud, Israel.

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The Late Pleistocene *Homo* from the Levant is of central interest to the debate about the evolution of anatomically modern humans,their migration between Africa and Eurasia, and their relation to Neanderthals. Qafzeh cave (Nahal Mizra, 120-90kya) and Amud cave (Nahal Amud, 70-50kya) are prominent sites which yielded well preserved Late Pleistocene cranial remains [1,2]. The Qafzeh fossil record is most commonly regarded as early modern humans, probably representing an early wave of migration from Africa. The Qafzeh humans show a combination of modern and archaic features, and morphological variation within the site is remarkably high. It has thus been speculated that they might represent hybrids in a geographical transition zone [3], although it is disputed whether modern humans and Neanderthals were contemporaneous in this region. On the other hand, the Amud specimens are traditionally attributed to Neanderthals. Nonetheless they lack many morphological characteristics of classic (western) Neanderthals while showing traits that also appear in modern populations. They might thus be seen as atypical Neanderthals [4], or possible hybrids. In this contribution, we focus on some postcanine maxillary and mandibulary teeth (P3, P4, M2) to describe dental features of these morphologically ambiguous populations. We undertook micro-CT scanning of the Levantine specimens which allowed accessing the internal details of their dentition. The comparative dental sample comprised recent modern humans from different geographical populations (Africa, Australasia, Europe), upper Paleolithic modern humans, early anatomically modern humans, Neanderthals (NEA), and Middle Pleistocene humans. Landmarks and curve semilandmarks were collected from the 3D surface models representing the occlusal aspect of the enamel-dentine-junction (EDJ), and of the cementum-enamel junction (CEJ). The data were analyzed using geometric morphometric techniques (in EVAN Toolbox 1.71 and R software) following the guidelines published in [5]. The shapes of the data-set for six tooth types from Qafzeh - and two tooth types from Amud - could be visualized for comparing Neanderthals and modern humans. The Qafzeh teeth showed peculiar patterns such as the buccal shift of the occlusal ridge relative to the base in upper premolars, the rather large hypocone in the upper M2, the relative mesial shift of the lingual cusp of premolars, and the heart-shaped occlusal ridge for the lower M2. The Qafzeh upper P3 and P4, the lower P3, and the lower M2 cluster clearly with modern humans. However, variation among the Qafzeh specimens is strikingly high, particularly between Qafzeh9 and Qafzeh11. The upper M2 and the lower P4 are not well suited to separate groups, and the Qafzeh specimens are intermediate between NEA and modern humans. Amud1, represented only by upper P4 and M2 owing to heavy tooth wear, clustered with moderns but is distinct from the Qafzeh specimens. Amud1 upper P4 has a typical NEA shape, but a higher crown. Its M2 shows a marked reduction of the talon, more than in Qafzeh and other moderns. If we considered the results from CEJ only (allowing a larger sample), the Qafzeh specimens plot within moderns while Amud1 is intermediate. In summary, based on 3D investigation of posterior teeth, we confirm both, Qafzeh modern human morphological affinities and high morphological variability, while Amud1 is more ambiguous. While our geometric morphometric approach allowed an accurate and objective quantification of Qafzeh and Amud dental crown morphology, the factors explaining morphological affinities and shape heterogeneity for these Levantine Late Pleistocene Homo still need to be explored.

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Podium Presentation: Session 5, Fr (10:00)

A human dentine proteome from Les Cottés, France.

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Hominin teeth represent a major source of phylogenetic, taxonomic and life history data in palaeoanthropology, not least because of their recognisability within the palaeontological record. Furthermore, given the density and hardness of both dentine and enamel, these tissues are proposed to be preferred sources of biomolecular research when compared to bone, especially in older contexts or degradation-intense environments. Finally, hominin teeth form a major element in the description and naming of new hominin populations or species. Recently, a palaeoproteomics study demonstrated that ancient hominin protein sequences can be phylogenetically informative, even between relatively closely related populations such as Neanderthals, Denisovans and modern humans [1]. In that particular case, several protein sequences where identified that contain phylogenetically informative protein sequences of 'archaic' or Neanderthal ancestry. Several basic questions arise from the preceding work, including whether the dentine proteome includes similarly informative proteins, whether such proteins are consistently observable in the Late Pleistocene record, and whether tandem mass spectrometry would be capable of, technically, observing the modern human sequence variant for the COL10α1 protein in particular. Here, we apply shotgun proteomics (LC-MS/MS) to an incisor found in the backdirt at Les Cottés. This tooth has been removed from its original stratigraphic position during initial excavations at the site in 1880-1881, and was identified during recent fieldwork conducted at the site in 2013. The dentine and the root are of yellowish hue, similar to that of the teeth and bones excavated at the site and as usual for Pleistocene remains in the area. Although knowledge of its stratigraphic position is therefore limited, the colouring of the tooth and its discovery in the back dirt of the previous excavation suggests a) it derives from the archaeological sequence [2] found at the site and b) is 50 to 35,000 years old [3, 4]. We took two small dentine samples (<10 mg), and applied an updated ancient protein extraction protocol alongside a more standard ZooMS extraction protocol [1, 5]. Analysis of this ancient dentine proteome provided insights into the preservation of a Late Pleistocene dentine proteome, including the presence of several proteins that are phylogenetically informative on the relation of this tooth with modern human populations. Of particular note is the retrieval of several sequences aligning to COL10α1, the same protein as previously identified in the Grotte du Renne hominin proteomes [1]. In particular, for the Les Cottés tooth we observe the modern human sequence variant, as opposed to the archaic sequence variant observed for the Grotte du Renne Châtelperronian hominins [1]. We therefore confirm that proteins with phylogenetically informative amino acid sequences are repeatedly observable in the Late Pleistocene biomolecular record and that for COL10α1 both archaic and modern human amino acid sequence variants can be detected in small dentine samples. Dentine is therefore a suitable tissue for the phylogenetic analysis of ancient hominin tissues, in addition to enamel and bone.

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Podium Presentation: Session 8, Fr (17:20)

New insights into the peopling of Ancient Australia

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Understanding the colonisation of Greater Australia and the events that formed the population structure of the First Australians is still some way from resolution. Despite the increased evidence that identifies that introgression events did occur between modern humans, Neanderthals and the enigmatic Denisovans across Eurasia, research on the fossil record has revealed that there is no evidence for a genetic contribution from *Homo erectus* in SE Asia to the DNA of the First Australian populations [1]. The fossil record directly undermines the longstanding multi-regional continuity hypothesis for the region, and is now supported by our more recent genomic research [2]. Certainly the fossil and archaeological record has provided an understanding of some general patterns, but the narrative that is emerging from our recent research on the DNA of the First Australians has identified several key events that resulted in the formation of the continents population structure [2]. Some of the results, such as the divergence from Papuan populations and a significant demographic expansion at the outset of the Holocene, conflict with traditional archaeological/palaeoenvironmental models for Australia. Others results, however, do support some longstanding archaeological models [3], such as the creation of a significant barrier to gene flow between east and west populations with the onset of the Last Glacial Maximum. Further unexpected results emerge when we compare genetic patterns with those from historic linguistics. In this presentation we provide an overview of these key events and suggest how they challenge and/or complement our understanding of ancient Australia's population history. We also suggest that more targeted archaeological and linguistic research is now required to help provide further understanding of the peopling of ancient Australia. Finally, and it is important to add, this research has been undertaken in close partnership with Aboriginal Australians. Such collaborations are necessary and indeed represent a moral imperative of such research if it is to continue to contribute to the narrative of the origins of the first Australians, and help develop a clearer understanding of the processes that resulted in the peopling of the continent.

The research would not have been possible without the support of the nine Aboriginal co-authors who helped discuss the aims of the project with their communities and assisted with the collection of samples. This research was funded by The Danish Research Foundation The Lundbeck Foundation The Australian Research Council (Discovery grants DP110102635 and DP140101405 and by a Linkage grant LP140100387). Swiss National Science Foundation (SNSF)

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Pecha Kucha Presentation: Session 10, Sa (11:00-11:25)

Surf and turf? A comparison of coastal adaptations by modern humans vs. Neanderthals and their evolutionary implications

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When, how and why did humans first exploit coastal landscapes and resources? These questions have become a frequent theme in paleoanthropological research as evidence for such behaviors stretches back into the late Middle Pleistocene. Based on recent studies within Africa, scholars have proposed a crucial role for coastal adaptations in the origin of modern humans, their cognitive evolution, and the earliest dispersals out of Africa along a coastal route [1-3]. Interest has focused mainly on coastal adaptations of early *Homo sapiens* during the African Middle Stone Age (MSA), although some scholars claim that Neanderthals during the Middle Paleolithic (MP) of Europe exhibited similar behaviors [4]. However, this is not universally accepted [5].

Here, we provide a long-term, inter-species and evolutionary perspective on the earliest evidence for coastal adaptations dating to the end of the Middle Pleistocene and Late Pleistocene (MIS 6-3). We performed a systematic review, directly comparing the behaviors of modern humans (MSA of Africa) contemporaneous with Neanderthals (MP of Europe), an approach which expands on previous studies of smaller scope. Our main aim was to assess whether both species were adapted to coasts, if their behaviors differed, and if so, to what extent. We achieved this by conducting a detailed literature research and applying the same criteria for each site. We thereby provide an objective and comparative assessment of the archaeological evidence, including subsistence, settlement systems, and lithic and non-lithic technologies. Based on this review, we assess similarities and differences in coastal adaptations between modern humans and Neanderthals, and discuss the wider evolutionary implications.

A total of 27 MSA and 31 MP sites provide credible evidence for the use of marine resources and coastal landscapes between MIS 6-3. Overall, our comparisons found more similarities than differences between the coastal adaptations of MSA modern humans and Neanderthals. The remaining disparities are all in degree, not kind. Among these gradual differences, modern humans consistently exploited a wider range of marine resources more intensively -shellfish in particular - indicating higher proportions in the diet of *Homo sapiens*. Accordingly, some MSA sites, but none from the MP, yielded true shell midden deposits. MSA shellfish-bearing sites are more often associated with large lithic assemblages, intense and repetitive occupations on coastal landscapes, and more evidence for perforated shells and other elements of complex material culture. The only categorical difference between the two species is the frequent production of shell tools on bivalves exclusively by Neanderthals. These multifaceted differences can best be explained by diverging adaptive behavioral strategies, with some populations of modern humans pursuing a subsistence and mobility system more strongly focused on longer-term residential settlements on coasts and their resources.

In both *Homo sapiens* and Neanderthals, coastal adaptations constitute a consistent behavioral signature for over ~100,000 years in several regions among independent populations. In the context of the general MSA and MP archaeological records, coastal adaptations are best conceived as an "add on" to previous subsistence and settlement patterns, complementing more frequently exploited inland resources and landscapes ("surf and turf"). Still, both species increased their dietary breadth and quality - with marine foods being particularly rich in brain-selective nutrients - and added options for occupation and range expansion, which may have ultimately contributed to higher cognitive capacities, dispersal abilities and behavioral flexibility. To what extent the gradual differences between the two species stimulated different evolutionary trajectories or translated into categorical disparities via threshold effects, is a complex question worthy of more attention.

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Pecha Kucha Presentation: Session 6, Fr (11:00-11:25)

Functional morphology of the hominin foot based upon the early Pleistocene footprints from Happisburgh, England.

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Fossilised footprints are the most direct, unequivocal evidence of locomotor behaviour and can be a source for inferring kinematic and other biological data. Advances in 3D modelling have been pivotal in pioneering methodological approaches to documenting and studying footprints[1,2]. Nevertheless, environmental conditions and other risks of immediate damage to these fragile fossils often necessitate rapid digital recording. This was particularly evident in the case of Happisburgh, Norfolk where footprints were uncovered but then imminently destroyed by tidal action. The rush to record as much as possible in a brief time frame can result in poor resolution modelling or cause a delay in their recording. Upon inspection of rapidly captured 3D models, resolution and point cloud density may be poor, resulting in reduced depth dimensionality accuracy and loss of topographical features. In this study we developed an approach to circumvent the problems in analysing poor-resolution 3D data by adopting a 2D geometric morphometric approach to investigate the morphological affinity of the Happisburgh footprints with Pliocene, Pleistocene and Holocene footprints. By applying 2D methods, depth dimensionality is removed, thereby avoiding problems of poor depth resolution and erosion of the prints. The sample consists of footprints from seven localities: Site G (n=17) and site S (n=10) at Laetoli, Tanzania (Pliocene); Ileret, Kenya (n=12); Happisburgh, England (n=14); Terra Amata, France (n=1) (Pleistocene); Formby Point, England (n=71) and Walvis Bay, Namibia (n=146) (Holocene). The 21 2D landmarks used for the analysis synthesize the functional morphology of the foot. We tested for changes in size/shape and for multivariate correlation between specific regions of the foot to determine if the Happisburgh individuals share a morphological affinity with the Pliocene, Pleistocene and/or the Holocene anatomically modern prints (AMHs). Results show a clear division in footprint shape between the Pliocene and Pleistocene hominins, and AMHs, with the Happisburgh hominins sharing the closest morphological affinity with Ileret. We demonstrate that foot proportions of hominins significantly changed from the Pliocene and Pleistocene, although AMH children have considerable overlap in shape/size with earlier hominins, owing to developmental patterns of the foot. The footprints are found to narrow and lengthen from the Pliocene to the Holocene, resulting in increased stature and mass predictions. The greatest shape change occurred in the shortening of the hallux and toe extremities, which likely affected the lever mechanics of the foot. This trend is apparent in comparisons of Pliocene (Laetoli) and early Pleistocene (Ileret and Happisburgh) footprints, and appears to continue to the Holocene (Formby Point and Walvis Bay) samples. Determining the nature and rate of this pattern over time will require additional samples from intervening periods. The medial longitudinal arch (MLA) is significantly posteriorly displaced with time and becomes well-developed at Happisburgh, a trend which continues into the Holocene. Posterior displacement of the MLA, first identified in the Ileret hominins, would have increased lever efficiency of the foot, promoting locomotor efficiency from the early Pleistocene, as expected in habitual bipeds. This is enhanced by a more adducted hallux than that of the Laetoli hominins. We demonstrate that certain aspects of functional morphology can be inferred from footprints using 2D geometric morphometric data. These analyses have allowed a determination of the morphological affinity of the Happisburgh footprints with those of Pliocene and Pleistocene hominins, despite obstacles linked to the quality of 3D models from Happisburgh. Our analyses reveal evolutionary trends in footprint shape from the earliest footprint discoveries dating from ~3.66Ma to the Holocene. We plan to extend this work to other fossil footprint sets.

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Poster Presentation Number 32, Fr (12:15-14:15)

New radiometric dating of Micoquian site Pietraszyn 49a (SW Poland) and its consequences

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The area located north to the Carpathian and Sudetes is well known from great number of sites representing Micoquian or Keilmessergruppen (locally known as Pradnik cycle). Despite a great number of sites, their chronology remains an open question due to the fact that most sites provided only single radiometric dates or their age estimation is based directly on site-stratigraphy [1]. Obviously, in these circumstances the discussion of culture complex diversity or relationship between Micoquian and so called transitional industries such as Szeletian or Jerzmanowician in Central Europe is limited [2, 3]. The open-air site Pietraszyn 49a, located in SW Poland, provided a large cluster of stone finds representing Micoquian of the late Middle Palaeolithic (over 10 thousand of lithics). They were recorded within sandy and silty layers deposited within a fluvial-denudation valley. The valley cuts glacio-fluvial sediments of the Oder-Warthe glacial (MIS6). Short time of exposure of cultural remains and small dynamics of erosional processes resulted in an excellent state of preservation of flint artefacts. The aim of our work is to present a chronological framework for Pietraszyn 49a. Therefore, pIRIR225- luminescence dating was applied to coarse-grained K-feldspars. The 3 samples taken from inside the channel yield ages ranging from 58 $\pm$ 5 ka-64 $\pm$ 6 ka pointing to a period of channel-activity around the MIS 4-MIS 3 transition. The age of the glacio-fluvial sediments is at 145 $\pm$ 14 ka and confirms a correlation with the penultimate glacial cycle of the deposits from below the channel-infill. The dating-results of Pietraszyn site 49a lead us to some conclusions. The first one concerns the previous radiometric attempts of age assessment of finds from site Pietraszyn 49, located ca. 200 m to the west from Pietraszyn 49a. According to Fajer et al. [4], artefacts from the site 49 were deposited within Middle Pleistocene sediments, representing the oldest phase of Micoquian in Central Europe. In the light of our numerical dating artefacts from site 49 appeared to be of the same age as specimens from site 49a. Secondly, our dating confirmed that assemblages with shaped tools occurred practically from the beginning of MIS3. Dates from Pietraszyn correlate with time range of layer 9b of Kulna Cave (Moravia, Czech Republic) but probably they are older than V-III archaeological levels at Ciemna Cave [2, 3]. In this context layers 7a, 7c and 6a at Kulna Cave (Moravia), Šipka Cave (Silesia) and Stajnia Cave [2, 3] seems to be younger from the Pietraszyn 49a.

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Podium Presentation: Session 3, Th (14:20)

Bonobo striated muscle anatomy suggests relative stasis and mosaic evolution within panins, and supports bonobos as the most appropriate extant model for the common ancestor of panins and hominins

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Genomic evidence suggests that the modern human (hominin) and common chimpanzees/bonobo (panin) lineages separated c.8 million years ago. The recent publication of 40 complete common chimpanzee/bonobo genomes clarified that their lineages split c.2 million years ago, and the patterns of subsequent gene exchange between the two species. Given that the gross morphology of striated muscles reflects the profound differences in posture, locomotion and dexterity between modern humans and common chimpanzees/bonobos, we explored the differences that have accumulated between the hominin and panin lineages, and within the panin lineage, in the past 8 Ma. Until very recently comprehensive data about the soft tissues of panins were only available for common chimps, but thanks to the foresight of researchers at the Antwerp Zoo, a collaboration between the Antwerp Zoo and the Applied Veterinary Morphology group of the University of Antwerp enabled a team of researchers to dissect seven bonobo cadavers (including foetal, infant, adolescent, and adult individuals of both sexes). Data - which range from major differences, such as the presence or absence of individual muscles, to more detailed observations about their morphology (e.g., numbers of muscle bellies), attachments (e.g., which digits they attach to) and innervation - were collected for the muscles of the head and neck (HN), forelimb (FL), trunk and hindlimb (HL).

Among 166 HN and FL muscle characters there are 16 differences between common chimpanzees and modern humans, and new HL data have added 12 more differences. Since the panin-hominin split c.8 Ma the divergence rate for striated muscle gross morphology has been c.3.5 characters per million years, similar to that between common chimpanzees and bonobos. But if you only look at major differences (see above) the common chimpanzee vs. bonobo rate of two major character state changes in c.2 Ma is >2.5 times lower than the common chimpanzee vs. modern human rate of 20 major changes in c.8 Ma. Moreover, all of the differences between common chimpanzees and bonobos are features that one, or other, of the two species shares with modern humans, and while the four common chimpanzee-modern human features involve HN and HL muscles, the three bonobo-modern human similarities involve FL muscles. The rate of HN and FL striated muscle evolutionary change in the hominin clade (4 in 8 Ma, or 0.5 per Ma) is twice the rate in the panin clade (8 in 8 Ma, thus 1 per Ma). Moreover, no derived muscle features were generated within the panin clade, whereas there are several within the hominin clade. Similarly, all of the 12 differences in HL muscles between common chimpanzees/bonobos and modern humans are derived changes in the lineage leading to modern humans, and since the split between common chimpanzees and bonobos the only two changes within the panin clade are within the lineage leading to common chimpanzees. The bonobo lineage is a striking example of evolutionary stasis, for among 124 HN and FL muscles there is not even a minor change in c.2 Ma.

In summary, among 124 head-neck (HN) and forelimb (FL) muscles there were only four minor changes in the panin clade in c.8 Ma, and all were reversions to the ancestral condition. In the c.2 Ma since the common chimpanzee-bonobo split there have been no changes in bonobos, so with respect to striated musculature bonobos are the better model for the last common ancestor (LCA) of chimpanzees/bonobos and modern humans.

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Poster Presentation Number 3, Th (12:15-14:15)

The Evolutionary Origins of Autonoetic Thinking

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Modern human memory systems have largely been informed by non-associative learning (habituation and sensitization) and associative learning (classical and operant conditioning). Associative learning includes the episodic memory system, which is the ability to recall specific experiences with 'what, where, and when' qualities. According to this definition, it has been argued [1] that many animals including birds and mammals meet the behavioral definition for episodic memory, and thus, it has a long evolutionary history. Human episodic memory, however, is qualitatively different as it includes the ability to place oneself in past and future events (autobiographical memory). Further, it has been argued [2] that humans have the unique capability of sensing that time is relative and subjective (autonoetic thinking). These features provide a particularly rich form of memory that also allows detailed simulation of future events (constructive episodic simulation). In fact, it has been claimed that it is not the sole purpose of episodic memory to recall prior episodes with complete fidelity but its evolutionary adaptiveness was the ability to recall the essence of prior events in order to solve novel problems [3]. The neural basis for human episodic memory is a complex network involving the hippocampus, parahippocampal cortex, entorhinal cortex, amygdala, precuneus, and retrosplenial cortex. In conjunction with the prefrontal cortex, this neural network creates a highly specialized system for the formation and use of episodic memories. All hominins prior to modern *Homo sapiens* undoubtedly possessed a basic form of episodic memory. As recent paleoneurological evidence points to a parietal lobe expansion in modern *Homo sapiens* [4], it may be hypothesized that one possible discrete cognitive shift associated with this expansion may have been the emergence of autonoetic thinking, autobiographical memory, and constructive future simulation. Archaeology, in the guise of narrative imagery, provides strong evidence for autonoetic thinking in the Later Stone Age of Africa and Upper Palaeolithic of Europe (e.g., snares, weirs, managed foraging, parietal and mobile art), but earlier evidence is controversial (e.g., the curated Acheulean handaxe as a material scaffold of the autonoetic self). In this paper, we explore the possibility that autonoesis and true autobiographical memory were two of the cognitive abilities that evolved relatively late in human evolution, and provided *Homo sapiens* with an advantage over more archaic forms.

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Poster Presentation Number 48, Fr (12:15-14:15)

A small mammal assemblage from Hohle Fels, Ach valley: preliminary indications of the paleoenvironment during the Middle Paleolithic

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Hohle Fels cave, one of the best studied sites of the Swabian Jura in Germany [1], has a long sequence of Pleistocene deposits dating from the Middle Paleolithic to the Magdalenian and a material record that includes some of the earliest portable art in Europe including beads, flutes and figurines made of ivory and bone [2]. The Middle Paleolithic period is associated with Neanderthals and the Swabian Mousterian, which has yielded few organic tools. The associated material culture has no strictly symbolic artifacts marking a clear distinction between Neanderthal populations and the intensely symbolic early Aurignacians. These observations together with changing environments, possible inter-population competition and internal social-economic dynamics of the Aurignacian represent the foundation for the Kulturpumpe hypotheses. Understanding the landscape and environment that these cultural groups inhabited is a one of the key goals of our continued research and excavation at the site. Regularly found at Hohle Fels are numerous microfauna specimens: skeletal remains of species of less than 150g live weight which, due of their sensitivity to variations in environmental conditions, make them excellent indicators of the palaeoenvironmental conditions of a region. Studies of microfauna can be used to reconstruct the ecosystems of the distant past. These results can be compared with other data sets from Hohle Fels and with other sites to inform our understanding of hominin paleohabitats. This poster presents results of a taxonomic and taphonomic study of a small mammal (Rodentia and Insectivora) sub-sample from Hohle Fels. The material comes from excavation unit 25 and geological horizons 10 and 11, which date to the Middle Paleolithic. The rodent assemblage demonstrates the frequent occurrence of the five species of vole (Microtus) as well as the Norwegian lemming *(Lemmus lemmus)* and the collared lemming *(Dicrostonyx sp.)* as cold-indicative taxa, and the insectivore genera *Sorex* and *Neomys* indicating moist warm regions. During the Middle Paleolithic in Hohle Fels the most common species was the field vole *(Microtus arvalis/agrestis)*. Next to the field vole, the narrow-headed vole *(Microtus gregalis)* and the root vole *(Microtus oeconumus)* were present. While the narrow-headed vole prefers dry tundra regions with grassy plains or open grassy areas in forests, the root vole prefers damp, densely-vegetated areas but is also found in tundra and taiga regions. This indicates that the paleoenvironment of the surrounding area was most likely moderately moist pastures. A detailed taphonomic analysis of post-depositional modifications and predation of crania and post-crania indicate interaction with predators and post-depositionally biasing agents. For the taphonomic we examined both dental and postcranial elements as well as indications of digestion, breakage (Andrews 1990), oxide and burning. Most the assemblage exhibited light or moderate digestion. Only 3 humeri of GH 10 were heavy digested. A look at the teeth confirm the picture of the postcranial, since the teeth were mostly digested to a light or moderate grade. We noted a few heavily digested specimens, particularly from GH 10. The most frequent oxide staining categories on the bones and teeth are categories 1 and 2, which describe the proportion of bone surface covered as between 10 - 25%. Burning was found on a small number of postcranial and dental elements. These results are comparable to other studies of microfauna in the Ach Valley [3, 4] and southern Germany [5].
Excavations and analyses at Hohle Fels have been funded by the Minstry of Science of Baden-Württemberg, the Deutsche Forschungsgemeinschaft, the University of Tübingen, the Heidelberg Academy of the Sciences and Humanities, the Heidelberg Cement cooperation and the Deutsche Akademische Austauschdienst.

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Poster Presentation Number 93, Th (12:15-14:15)

The odonoglyphic patterns of the Central Asia and Altai Mountains Middle Paleolithic populations: preliminary results of the comparative analysis

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Odontoglyphics is a branch of dental anthropology focused on study of variability of dental fissure and groove's patterns. It was suggested and elaborated by soviet dental anthropologists in 1970th [1, 2]. Since that time odontoglyphic traits were included in the standard protocols of dental research of ancient, historical and modern groups [3]. It was proved that the groove pattern of molar's occlusal surface represents an independent and hierarchically organized system. The number and location of some of tubercular grooves are obviously important for population differentiation. The location of intersections between tubercular grooves and inter-cusp fissures reveal high level of inter-group variability as well. All previous odontoglyphic studies have been devoted to intraspecific variability of Homo sapiens sapiens grooves pattern. In our work odontoglyphic traits were first time used for analysis of intra-specific variability within genus Homo. The upper permanent molars from Middle Paleolithic cave sites of Central Asia (Teshik-Tash, Obi-Rakhmat) and Western Siberia Altai Mountains (Denisova, Chagyrskaya) were analyzed. The samples from Teshik-tash, Obi-Rakhmat and Chagyrskaya represent Homo neanderthalensis while the teeth form Denisova cave are attributed to Denisovans or to Homo altaiensis group with unclear taxonomical status within genus Homo. All teeth were of children or young adult individuals so the enamel wear was minimal. The full description of crown fissures and tubercular grooves was made for each tooth. The data obtained were compared with 258 samples of Upper- Paleolithic - Middle Age Homo sapiens from different regions of Siberia, Central Asia and Eastern Europe. All of these are children teeth of 2-4 and 10-12 years old (upper border of age depended of the enamel wearing). The results revealed that Siberian and Central Asian Neanderthals have the additional tubercular grooves on metacone and hypocone which is absent in Homo sapiens and Denisovans samples. We can suggest that these grooves can be used as effective diagnostic trait of Asian Neanderthals. It needs further research to be clarified is these grooves are equally characteristic to European Neanderthals and Homo heidelbergensis.

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Podium Presentation: Session 11, Sa (15:20)

The Northern Route of human dispersal in Asia: New evidence from the site of Tolbor 16, Mongolia

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The fossil record suggests that two major human dispersals occurred along the Eurasian steppe belt during the Late Pleistocene. At least once, Neandertals and Modern Humans (MH) moved west to east across Central Asia while the whereabouts of the Denisovans remain unclear [1,2]. Little is known regarding the frequency, the timing, and/or the context of these long distance population movements; archeological documentation is scarce and difficult to interpret. Here we present new data regarding the early occurrence of Upper Paleolithic in North Mongolia and discuss the main implications for the models of population dynamic. In 2013, the site of Tolbor 16 has yielded an assemblage buried in a laminated loess matrix below the previously reported Early Upper Paleolithic (EUP) component [3]. Micromorphological, geochemical and particle size analyses describe a sedimentary regimecharacterized by alternating episodes of pedogenesis and slope processes; possibly relating to variations in precipitation regime. OSL and radiocarbon dates place the earliest human occupation of the site at the beginning of the MIS3 and based on the lithic analysis, the assemblage is clearly assigned to the Initial Upper Paleolithic (IUP). Chronological and stratigraphic data confirm that the emergence of the Upper Paleolithic in the region is represented by a chronological succession of at least two distinct variants, the IUP and the EUP in an environmental setting that undertakes cyclic variations in ambient moister. Beyond the regional level, the technological and chronological consistency of the IUP from the Siberian Altai, the Cis- and TransBaikal region, Mongolia and possibly North China, lead to consider long distance movement/contacts as the most plausible explanation for the pattern observed [4]. Although no human remains are directly associated with the IUP phenomenon,we established that the IUP from the Tolbor Valley is contemporaneous with the Ust-Ishim MH remains found in Western Siberia and dated of around 45 ka cal BP [1]. Hence, the data at hand for Central and Northeast Asia suggest that the IUP phenomenon documents an early dispersal of modern humans. Alternatively, it could derive from contacts between incoming MH groups and local populations. Either way, the IUP assemblage from Tolbor 16 brings archeological support for the existence of a Northern Route for human dispersal across Asia [2, 4, 5].

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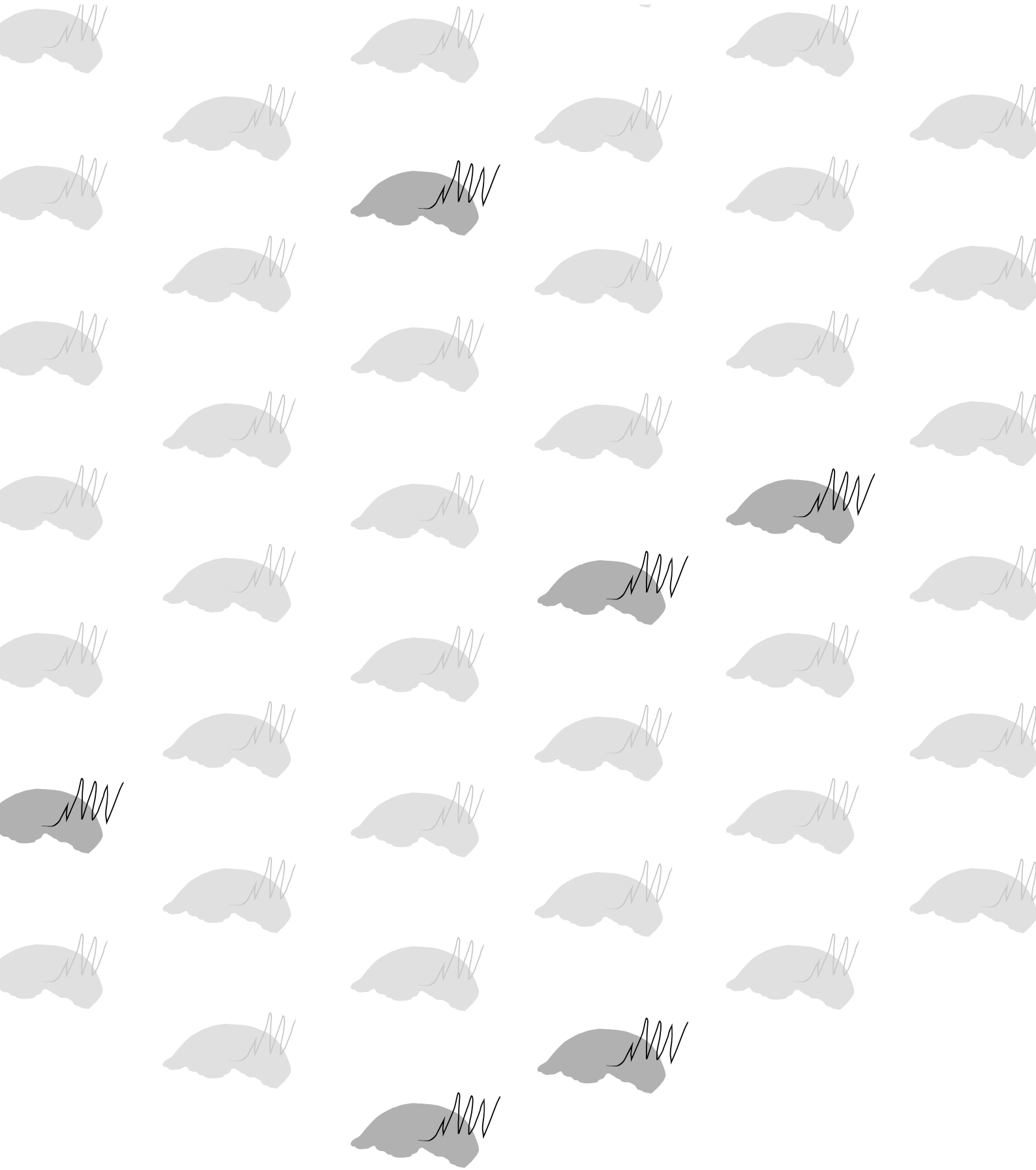

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