

## **Chronometric and relative dating of the Middle Pleistocene sequence of Schöningen**

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*Published in:*

3rd Annual Meeting of the European Society for the study of human evolution (ESHE)

*Publication date:*

2013

*Document Version*

Verlags-PDF (auch: Version of Record)

[Link to publication](#)

*Citation for published version (APA):*

Richter, D., & Urban, B. (2013). Chronometric and relative dating of the Middle Pleistocene sequence of Schöningen. In *3rd Annual Meeting of the European Society for the study of human evolution (ESHE)* (S. 184). (Proceedings of the European Society for the study of Human Evolution; Band 2). European Society for the Study of Human Evolution.

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3<sup>RD</sup> ANNUAL MEETING OF THE

# European Society for the study of Human Evolution

19–21 SEPTEMBER 2013  
VIENNA / AUSTRIA

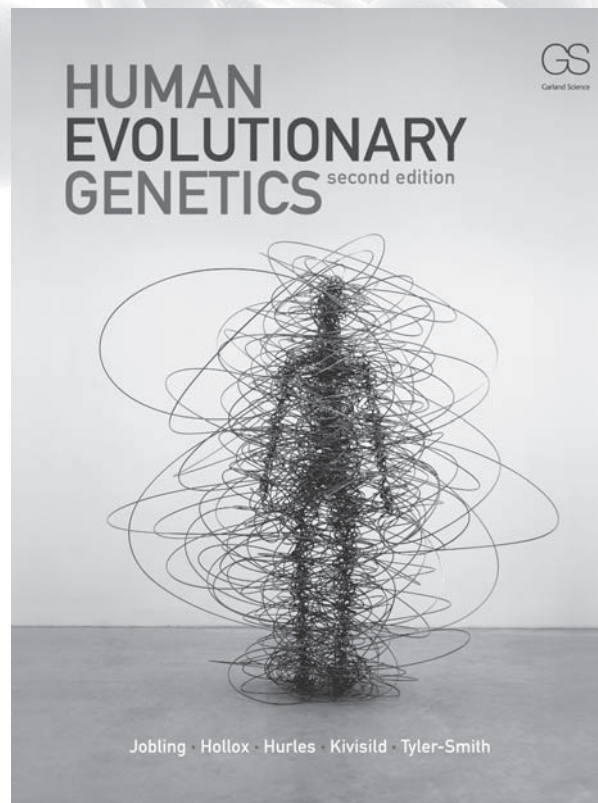


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European Society for the study of Human Evolution (ESHE)

3rd Annual Meeting

Vienna, Austria • 19 – 21 September, 2013



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Dear Participants of the 3rd Annual meeting of the *European Society for the study of Human Evolution*,  
**Welcome to Vienna!**

We are very pleased to welcome you to Vienna, the capital of a lost empire, and still a bridge between the East and West of Europe. The traces of its history can be seen all over the city. Not only tourists benefit from Austria's rich history — science and research have a long tradition here as well: the host of this year's *ESHE* meeting, the *University of Vienna*, will soon celebrate its 650th anniversary. It is among the world's oldest universities and has been an important force in European academia for centuries. The excursion on Sunday will give you a chance to see the site of Krems-Wachtberg (Gravettian "twin" burial) and Willendorf, where the iconic venus figurine was found in 1908. The original figurine is on display in Vienna's beautiful *Natural History Museum*; this museum also recently opened a new permanent exhibition on human evolution.

Our society has experienced a very rapid growth and our membership has surpassed 350 members on the eve of this, our 3rd annual meeting. Another expression of the success of *ESHE* is the growing number of submissions for podium and poster presentations by participants. The proposals have been selected by an editorial committee of experts. However, the limits imposed by the current format of a two-day meeting has obliged us to turn quite a number of podium presentations into posters. It seems that we have stretched the program to the limits of what is possible and one issue to discuss during the business meeting closing this year's conference will be the possibility to extend our yearly meeting beyond two days in the future. Another important issue this year will be to vote on the first renewal of the board of the society. Finally, 2013 will be the first year that the society will award prizes for outstanding student posters.

We are grateful to Professor Gerhard Weber, who this year led the local organization of the meeting with the support of the *Department of Anthropology* of the *University of Vienna*. The *Vienna Micro CT Lab*, the *EVAN-Society*, and the *University of Vienna* are also co-organizers of the meeting and all of these institutions have financially contributed to its success. We would also like to thank the City of Vienna (Präsidialabteilung des Bürgermeisters and Kulturabteilung der Stadt Wien, Wissenschafts- und Forschungsförderung) and the producer of micro-CT facilities *Viscom AG* for their sponsorship and support of the 2013 meeting.

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

In 2014, the meeting of the *European Society for the study of Human Evolution* will take place in Florence, Italy. I have no doubt that this city of art and history will be able to offer many other attractions in addition to the excitement of science.

With best wishes,

**Jean-Jacques Hublin**

*President, European Society for the study of Human Evolution*

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On 12 March 1365 Duke Rudolph IV (the “Founder”) founded the University of Vienna, “Alma Mater Rudolphina Vindobonensis” as it has been called by literary sources, along the lines of the Sorbonne in Paris. The members of this “universitas magistrorum et scholarium” (the fellowship of teachers and learners) were exempt from taxes and military service, they had their own dress code and jurisdiction, the latter carried out by the rector himself.

### Reformation – Stagnation and dominance of the Jesuits

In the course of the Reformation, starting in 1520, the University of Vienna, a “papal institution”, suffered a great loss of prestige. Due to the First Turkish Siege of Vienna in 1529, recurring epidemics, the city’s economic decline, and the increasing competition between universities, the number of students sank, too.



Rudolph IV

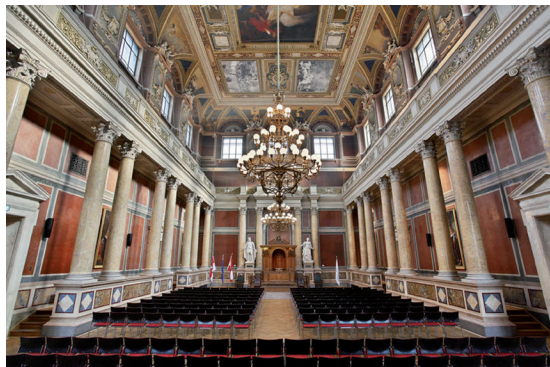
King Ferdinand I tried to counteract this development with new reforms and started to turn the University of Vienna into a Catholic stronghold. For this purpose he installed the Jesuits there in 1551, and gave them two theological chairs. Consequently, tensions and conflicts between the Jesuit school and the university itself arose, making Emperor Ferdinand II pass the 1623 “Sanctio Pragmatica”. Thus, the Jesuits became the teachers at the theological and philosophical faculties, and the student numbers rallied. The Jesuit order was to keep its dominating position for the coming 150 years.

### Enlightened Absolutism: The university as an educational establishment of the state

In the middle of the 18<sup>th</sup> century, Empress Maria Theresia ensured that the Jesuits lost a great deal of their former influence on university life as they had greatly neglected the „secular“ faculties. As both the Church and the university’s own administrative bodies were eliminated, the university became an educational establishment of the state, focussing on the training of civil servants and physicians, but not on the education of scholars.

The empress’s personal physician, Gerard van Swieten, was to implement the new reforms. Obviously, he focussed on the medical and natural sciences. He was the one to transfer the training of the students of medicine to the patients’ bedside, and he also established two new Chairs – Chemistry and Botany. In 1754, the Botanical Gardens of the University of Vienna (Rennweg) were opened to the public.

Joseph II continued with the reforms of Maria Theresia, abolishing both academic jurisdiction and official attire. His laws of tolerance enabled protestants to enrol at the university for the first time in 1778, while in 1782 Jews were admitted to the studies of Medicine and Law. Joseph II was also the one to introduce German as the compulsory language of teaching in 1783.



The main ceremonial chamber

### 1867: “Freedom of research and research-based education”

The year of the revolution 1848 also greatly influenced the University of Vienna. Students demanded the freedom of teaching and learning, and the end of any suppression of academic life. To this day, the most important success of their endeavours has been the – still valid – article 17 of Austrian Fundamental Law: “Freedom of research and research-based Education”. Minister of education Leo Graf Thun-Hohenstein reformed the system of tertiary education radically and invited a great number of professors to Vienna.

### The new Main Building on the Ring

In 1884, Emperor Franz Joseph I inaugurated the new Main Building of the University of Vienna on Ringstraße, which had been erected by Heinrich von Ferstel. This splendid historicist building was designed to resemble the renowned Italian Renaissance universities. However, it could never lay claim to be the central university building even in the early days, and there was never enough room for all departments and institutes. The up-and-coming Viennese Medical School required more space, and by 1915 numerous buildings had been erected in the vicinity of the Main Building to house the “homeless” institutes.



1884: The new main building

### Women at the University of Vienna

It was 532 years after its foundation until the University of Vienna permitted female students to enter its hallowed halls as students in 1897, even if “only” at the Faculty of Philosophy for a start. Elise Richter – she had registered for Romance languages and literature in 1897 – was the first woman to habilitate at the University of Vienna in 1907.

### The turmoil of war and the post-war era (“Wiederaufbau”)

The boom of the University of Vienna nosedived during the First World War: the Main Building was now used as a military hospital, with the Main Ceremonial Chamber (“Große Festsaal”) functioning as a dining hall and lounge, and the Kleine Festsaal (Smaller Ceremonial Chamber) and numerous lecture rooms as operating theatres.



Arcade court

During the worldwide economic crisis of the 1920's, German nationalist tendencies also started to make them-selves felt on academic soil, often growing into full-blown Anti-Semitism. In 1938, after the “Anschluss”, Austria’s affiliation to the German Reich, any dissenting voices are quickly silenced, the result being a kind of academic mass exodus: 45 per cent of all professors and senior lecturers were dismissed on political or “racial” grounds.

By the end of this war, the Main Building had been hit by 26 bombs. The glass roof of the library reading hall was shattered. The Red Army took over the building, but on 16 April 1945 student Kurt Schubert (1923–2007, Emeritus Jewish Studies) succeeded in having the University cleared, and by the end of May 1945 the summer term lectures had started again, despite reconstruction work.

### Education boom and expansion

Free university admission in the 1970's triggered an educational boom and resulted in a vast expansion of the University of Vienna. Increasing numbers of students necessitated the construction of new buildings and the redevelopment of old ones: Neues Institutsgebäude (New Institute Building, NIG, 1962), University Sports Centre Auf der Schmelz (1973), University Centre (UZA) I, Althanstraße (1982), Juridicum (Law School 1982), Business-Administration Centre, Brünner Straße (1991), Vienna Biocenter, Dr.-Bohr-Gasse (1992), UZA II, Althanstraße (1995), University Campus on the premises of the former General Hospital (1998), and the Hörsaalzentrum (centre of lecture halls) on Campus (2003).

### 21<sup>st</sup> century: Re-organisation – Status quo

With the University Act of 2002, all Austrian universities became autonomous, and therefore more self-dependent and performance-orientated. For the University of Vienna, this meant total re-organisation: as per 1 January 2004 the Medical Faculty became a separate university. Currently, the University of Vienna comprises 15 faculties and four centres. 92,500 students can choose from more than 180 courses, and 9,500 employees, 6,700 of which academic, work at more than 60 locations of the University of Vienna.



Today's campus





In 1919, Rudolf Pöch founded the Institute of Anthropology and Ethnography.

Pöch's famous expeditions to Australia, New Guinea and South Africa enriched both scientific disciplines enormously and in 1927 two new institutes followed: The Anthropological Institute and the Institute for Ethnology. The Anthropological Institute was renamed in 1972 by Emil Breiting, the former director, to the Institute for Human Biology. Until the year 2005, the institute's name was Institute for Anthropology and belonged to the Faculty of Natural Sciences and Mathematics at the University of Vienna. Since 2005 the University of Vienna changed its internal structures, and the institute was renamed finally to Department of Anthropology.



The department is the only of its kind in Austria, but nevertheless traditionally there are narrow and intensive co-operations in education and research with institutes all over Austria. Physical anthropology has always been an interdisciplinary science, including first of all medical sciences. In the late 20's and early 30's the Viennese school of morphology was developed by Josef and Margarete Weninger. Unfortunately, this was simultaneously the beginning of the involvement of physical anthropology in the ideology and practice of National Socialism (Seidler & Rett, 1988). After 1945, the first director was Josef Weninger, who continued with his wife Margarete Weninger the classical tradition of morphology. After Weninger's retirement in 1955, the chair of the Viennese institute was offered to Emil Breiting. He accomplished two important innovations: On the one hand he started the methodological biostatistic orientation, on the other hand, he gave the impulse for the other focal point of research: Questions concerning evolution of hominids (Breiting, 1955).

The development of physical anthropology in Austria was continued by three of Breiting's students: Gertrud Hauser (Institute of Histology, Faculty of Medical Sciences), Johann Szilvassy (who has been head of the Anthropological Department, Museum of Natural History, Vienna), and Horst Seidler (Head of the Department of Anthropology until 2012).

A very close scientific research cooperation started in the early 70's with Andreas Rett, concerning mental handicapped children and questions of social-anthropology (Rett & Seidler, 1980). The work of the Viennese school of morphology and historical anthropology has been continued by Maria Teschler-Nicola, Herbert Kritscher and Johann Szilvassy (all belonging to the Anthropological Department at the Museum of Natural History, Vienna) in education and research. Further developments in the tradition of biostatistics and biomathematics were being carried out by Horst Seidler and Werner Timischl. In 1991, the Tyrolean Iceman research started and collaborations with radiology, statistics, engineering, and rapid prototyping developed. A new interdisciplinary emerged, Virtual Anthropology, which was strengthened in the early 2000s by an additional professorship for biometrics, held by Fred Bookstein. The department in Vienna has built up a reputation as a pioneering institution in the development and application of new quantitative methods to study hominoid ontogeny and phylogeny, for instance the coordination of the largest anthropology grant in Europe (EVAN). In 2009, the department founded the Vienna Micro-CT Lab together with research units from the medical sciences. The lab has an exceptional  $\mu$ CT device that can hold objects of the size of hominin skulls and also perform spiral scans of long bones in high resolution. Since the early 2000's, the department was active in field work in the Pliocene deposits of the Ethiopian Afar Triangle (Galili) where several hominin.

The department is now awaiting the appointment of a new full professor for anthropology (expected in 2014). It is currently organized in groups with overlapping competences in Human Evolution, Human Ecology, Human Ethology and Human Life History.

**Keynote Speech: Thursday, 19 September**  
**19:00 – 20:30, University of Vienna, Großer Festsaal**

**Professor Tecumseh Fitch: *The Evolution of Language: The Comparative Approach***



W. Tecumseh Fitch is Professor of Evolutionary Cognitive Biology at the *University of Vienna*. He studies the evolution of cognition and communication in animals and man, focusing on the evolution of speech, music and language. He is interested in all aspects of pattern recognition and vocal communication in vertebrates. Fitch was born in Boston, USA and after obtaining his Bachelors in biology (1985) he did his PhD in Cognitive and Linguistic Science (1994), both at *Brown University*. After a post-doc in Speech & Hearing Sciences at *MIT/Harvard*, Fitch was a lecturer at *Harvard* from 1999-2002, first in Biology and then Psychology. From 2003 - 2008 he taught at the *University of St Andrews* in Scotland (Reader, School of Psychology). In 2009 he moved to a permanent professorship in Vienna, where he co-founded the new *Department of Cognitive Biology* in the *Faculty of Life Sciences*. He is the recipient of an ERC Advanced Grant, and is a co-author of over 100 publications and one patent.

Fitch served as a Leibniz Professor (*Leipzig University*), and has been a visiting scholar at the *European Institute for Advanced Studies* (Wissenschaftskolleg Berlin: animal vocalization), the *US National Institutes of Health* (Bethesda, MD: brain-imaging), *University of Victoria* (Advanced Systems group: sonification), and the *Max Planck Institute for Evolutionary Anthropology* (Leipzig: evolutionary genetics).

| Friday, 20 September              |                                                                                                                                                                             |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7:00-8:00                         | Registration <i>Oktogon</i>                                                                                                                                                 |
| 8:00-8:15                         | Opening Speech: Jean-Jacques Hublin <i>Großer Festsaal</i>                                                                                                                  |
| Session 1- <i>Großer Festsaal</i> |                                                                                                                                                                             |
| 8:20                              | Stone tool use by wild monkeys: primate archaeological case studies from Thailand and Brazil<br>Michael Haslam                                                              |
| 8:40                              | Searching for stone tools older than 2.6 Ma: how do we know what we are looking for?<br>Sonia Harmand et al.                                                                |
| 9:00                              | Origins of aquatic resource use in East Africa and the implications for breadth of hominin dietary versatility at 2mya<br>Will Archer and David Braun                       |
| 9:20                              | Australopithecus sediba and the earliest origins of the genus Homo<br>Peter Schmid and Lee Berger                                                                           |
| 9:40                              | Did Homo erectus consume a Pelorovis herd at BK (Bed II, Olduvai Gorge)?<br>Manuel Dominguez-Rodrigo et al.                                                                 |
| 10:00-10:30                       | Coffee Break                                                                                                                                                                |
| Session 2- <i>Großer Festsaal</i> |                                                                                                                                                                             |
| 10:30                             | Earliest Human Occupation of North Africa: New Evidence from Ain Boucherit Early Pleistocene Deposits, Algeria<br>Mohamed Sahnouni et al.                                   |
| 10:50                             | Early Acheulian stone assemblages ~1.7-1.6 million years ago from Gona, Afar, Ethiopia<br>Sileshi Semaw et al.                                                              |
| 11:10                             | Insights about the effect of X-ray imaging on recent fossils: facts, deductions, speculations and phantasms<br>Paul Tafforeau et al.                                        |
| 11:30                             | Paleoepigenetics: Reconstructing the DNA methylation maps of archaic hominins<br>David Gokhman et al. (presented by Liran Carmel)                                           |
| 11:50                             | Morphological integration of the bony labyrinth and the cranial base in modern humans and Neandertals<br>Philipp Gunz et al.                                                |
| 12:10                             | New Discovery of Middle Pleistocene Hominin fossils from the cave site “Sunjiadong” at Luanchuan County of Henan Province in Central China<br>Lingxia Zhao and Lizhao Zhang |
| 12:30-14:00                       | Lunch Break                                                                                                                                                                 |

|             | Session 3- <i>Großer Festsaal</i>                                                                                                                                                      | Session 4- <i>Kleiner Festsaal</i>                                                                                                                                                 |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 14:00       | Adaptation to bipedalism from Ardipithecus to Homo erectus. What did genes ? What did gravity ? The evolutionary relevance of the hidden link between both<br>Christine Tardieu et al. | The signature of a modern human exit out of Africa?: Middle Palaeolithic occupation in the Thar Desert during the Upper Pleistocene<br>James Blinkhorn                             |
| 14:20       | Development, integration, and modularity of the pelvis: implications for fossil hominin evolution<br>Kristi L. Lewton                                                                  | New data on the radiocarbon chronology of the Stretleskayan at Kostenki (Voronezh, Central Russia)<br>Paul Haesaerts et al.                                                        |
| 14:40       | Paranthropus boisei – generalist or specialists?<br>Gabriele Macho                                                                                                                     | Continuities and discontinuities in the East European Early Upper Palaeolithic: the Kostenki model<br>Andrey Sinitsyn                                                              |
| 15:00       | Reading function from long bones: implications for the reconstruction of early hominin postural and locomotor behaviours<br>Laurent Puymeraul and Paul O’Higgins                       | Innovative and traditional aspects of the Uluzzian technology at Fumane cave<br>Marco Peresani et al.                                                                              |
| 15:20       | Second maxillary molars confirm a dimorphism of Australopithecus at Sterkfontein Member 4<br>Cinzia Fornai et al.                                                                      | Direct radiocarbon dating of the earliest Upper Palaeolithic ornaments in Europe and the Levant<br>Katerina Douka et al.                                                           |
| 15:40-16:00 | Coffee Break                                                                                                                                                                           |                                                                                                                                                                                    |
|             | Session 5- <i>Großer Festsaal</i>                                                                                                                                                      | Session 6- <i>Kleiner Festsaal</i><br>Specialized Thematic Session: Formal cognitive models in Palaeolithic archaeology                                                            |
| 16:00       | La Cotte de St Brelade (Jersey): Re-evaluating Neanderthal subsistence behaviour and landscape use<br>Geoff M. Smith                                                                   | The Expert Cognition Model in Human Evolutionary Studies<br>Thomas Wynn et al.                                                                                                     |
| 16:20       | Omnivorous Neanderthals: New perspectives on diet and environmental knowledge from the Middle Palaeolithic<br>Karen Hardy                                                              | Interacting Cognitive Subsystems: a theoretical mental architecture for interpreting evidence in the archaeological record concerning cognitive evolution<br>Philip Barnard et al. |
| 16:40       | The Plants in the Every Day Life of Homo Sapiens Sapiens from Kostenki Region of the Russian Plain<br>Galina Levkovskaya et al.                                                        | The origins of Me: Material engagement and the making of the self-conscious species<br>Lambros Malafouris                                                                          |
| 17:00       | Evidence of processing and consumption of starch-rich underground storage organs at Dolní Věstonice II (Czech Republic)<br>Alexander Pryor et al.                                      | The Neuropsychology of Numbers and the Paleolithic Record<br>Karenleigh A. Overmann                                                                                                |
| 17:20       | The earliest fishhook tradition in Europe<br>Robert Sommer et al.                                                                                                                      | Art without Symbolic Thinking: The Embodied Origins of Visual Artistic Expression<br>Manuel Martín-Loeches                                                                         |
| 17:40       | "Fur and feathers / tooth and claw" – Magdalenian exploitation of small game and birds at Gönnersdorf und Andernach<br>Elaine Turner and Martin Street                                 | Deciphering Patterns in the Archaeology of South Africa: The Neurovisual Resonance Theory<br>Derek Hodgson                                                                         |
| 18:00-20:00 | Poster Session 1: Open Bar                                                                                                                                                             |                                                                                                                                                                                    |



| Poster Session 1: Friday 18:00-20:00                                                                                                                                                                                                                                                |                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Authors of odd-numbered posters (1, 3, etc.) are expected to be present for the first hour (18:00-19:00).<br>Authors of even-numbered posters (2,4, etc.) are expected to be present for the second hour (19:00-20:00). Authors may use the additional hour to visit other posters. |                                                                                                                                                                                                  |
| Room A                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                  |
| 1                                                                                                                                                                                                                                                                                   | <i>Signals in the Skull: Quantifying and mapping phylogenetic signal in the cranium of strepsirrhine primates</i><br><b>Gemma Price et al.</b>                                                   |
| 2                                                                                                                                                                                                                                                                                   | <i>Biomechanical aspects of facial ontogeny in Macaca fascicularis as revealed by Finite Element modelling</i><br><b>Ekaterina Bulygina (Stansfield) et al.</b>                                  |
| 3                                                                                                                                                                                                                                                                                   | <i>Patterns of craniofacial pneumatization: the consequence of skull shape and functional loading?</i><br><b>Laura Fitton et al.</b>                                                             |
| 4                                                                                                                                                                                                                                                                                   | <i>Cranial base variations in extant Hominoidea and fossil Hominins</i><br><b>Antonio Profico et al.</b>                                                                                         |
| 5                                                                                                                                                                                                                                                                                   | <i>Cranial form and masticatory biomechanics: finite element simulations of biting among normal and artificially deformed modern humans</i><br><b>Viviana Toro Ibacache et al.</b>               |
| 6                                                                                                                                                                                                                                                                                   | <i>Morphological integration of upper and lower jaws in extant hominids</i><br><b>Stefanie Stelzer et al.</b>                                                                                    |
| 7                                                                                                                                                                                                                                                                                   | <i>The degree of glabella and supraorbital ridge expression – the meaning for phylogenetic study</i><br><b>Wioletta Nowaczewska and Łukasz Kuźmiński</b>                                         |
| 8                                                                                                                                                                                                                                                                                   | <i>How Thick-Headed Are We? Differences between Robust and Gracile Cranial Vault Thickness of Modern Humans</i><br><b>Frances Rivera</b>                                                         |
| 9                                                                                                                                                                                                                                                                                   | <i>3D reconstructions from standard digital photographs of human crania</i><br><b>David Katz and Martin Friess</b>                                                                               |
| 10                                                                                                                                                                                                                                                                                  | <i>Diet-related variation in global human cranial shape</i><br><b>Marlijn Lisanne Noback and Katerina Harvati</b>                                                                                |
| 11                                                                                                                                                                                                                                                                                  | <i>Sex and diet in fossil hominins: Is sexual dimorphism in cranial form associated with sexual dimorphism of masticatory function?</i><br><b>Miguel Prôa et al.</b>                             |
| 12                                                                                                                                                                                                                                                                                  | <i>Sex Determination of Human Skeletal Remains Using Next Generation Sequencing Technology</i><br><b>Eppie R. Jones et al.</b>                                                                   |
| 13                                                                                                                                                                                                                                                                                  | <i>Digit ratio, physical strength and facial shape: A lesson from ontogeny</i><br><b>Katrin Schaefer et al.</b>                                                                                  |
| 14                                                                                                                                                                                                                                                                                  | <i>New hominin remains from the Nachukui Formation, West Turkana, Kenya (West Turkana Archaeological Project)</i><br><b>Sandrine Prat et al.</b>                                                 |
| 15                                                                                                                                                                                                                                                                                  | <i>Distribution of Ages-at-Death of Fossil Hominins from the Early Pleistocene site of Drimolen, South Africa: Preliminary Results and Behavioral Implications</i><br><b>Tommaso Mori et al.</b> |
| 16                                                                                                                                                                                                                                                                                  | <i>A morphometric assessment of the Australopithecus sediba cranium (MH1) in relation to other Plio-Pleistocene African hominin crania</i><br><b>Martin Friess and J. Francis Thackeray</b>      |
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| 19 | <i>A Quantitative Analysis of the Distal Tibia Homo habilis</i><br><b>Gisselle Garcia and William Harcourt-Smith</b>                                                                                                       |
| 20 | <i>Spatial and temporal variation in the body size of early Homo</i><br><b>Manuel Will and Jay T. Stock</b>                                                                                                                |
| 21 | <i>Do non-human primates provide a good analogy for hominin dispersal?</i><br><b>Katharine MacDonald et al.</b>                                                                                                            |
| 22 | <i>Foramen magnum orientation and the cervical lordosis</i><br><b>Ella Been et al.</b>                                                                                                                                     |
| 23 | <i>Evolution of the human hip joint in relation to our permanent bipedal gait and posture: 3D functional and comparative approaches</i><br><b>Noémie Bonneau</b>                                                           |
| 24 | <i>A global study shows that population history is a better predictor of the shape of the human os coxae than climate</i><br><b>Lia Betti et al.</b>                                                                       |
| 25 | <i>Asymmetry and Cephalopelvic Disproportion</i><br><b>Victoria Tobolsky</b>                                                                                                                                               |
| 26 | <i>The functional morphology of the seventh cervical vertebra in primates</i><br><b>Nakita Frater and Peter Schmid</b>                                                                                                     |
| 27 | <i>A comparative analysis of vertebral microstructure in Neanderthal and modern human infant spines</i><br><b>Kate Robson Brown et al.</b>                                                                                 |
| 28 | <i>The primate upper arm: A study on the deltoid index</i><br><b>Sandra Mathews et al.</b>                                                                                                                                 |
| 29 | <i>New researches on the "Altamura man": morphology of the scapular glenoid cavity of a Neanderthal skeleton</i><br><b>Fabio Di Vincenzo et al.</b>                                                                        |
| 30 | <i>A preliminary assessment of the thoracic remains of the El Sidrón Neandertals (Asturias, Spain)</i><br><b>Markus Bastir et al.</b>                                                                                      |
| 31 | <i>A new method for assessing hominoid clavicle curvatures: functional, ontogenetic and phylogenetic implications</i><br><b>Anna Barros and Christophe Soligo</b>                                                          |
| 32 | <i>The integration of the lower limb diaphyses with body shape: Whole-limb assessment of human variation with implications for the interpretation of Neanderthal behaviour</i><br><b>Thomas G. Davies and Jay T. Stock</b> |
| 33 | <i>The biomechanical role of trabecular bone in the siamang (Symphalangus syndactylus) manual proximal phalanx</i><br><b>N. Huynh Nguyen et al.</b>                                                                        |
| 34 | <i>Trabecular bone distribution in the hominoid third metacarpal head reflects predicted loaded joint position</i><br><b>Zewdi J. Tsegai et al.</b>                                                                        |
| 35 | <i>Trabecular bone architecture in the thumb of Homo and Pan: handedness and evidence for taxonomic differences</i><br><b>Nicholas Stephens et al.</b>                                                                     |
| 36 | <i>Denisovan girl manual phalanx: developmental age and patterns of bone formation from x-ray volumetric microscopy</i><br><b>Maria Mednikova et al.</b>                                                                   |
| 37 | <i>Microevolutionary Trends On Proximal Hand Phalanges</i><br><b>Fotios-Alexandros Karakostis and Konstantinos Moraitis</b>                                                                                                |



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| 38            | <i>Covariation between hands and feet: 3D geometric morphometrics applied to human proximal phalanges</i><br><b>Anneke H. van Heteren et al.</b>                                                                                            |
| 39            | <i>Virtual biomechanical analysis of the lower limbs of a Neandertal</i><br><b>Tara Chapman et al.</b>                                                                                                                                      |
| 40            | <i>One tarso-metatarsal association from the Middle Pleistocene site of the Sima de los Huesos (Atapuerca, Burgos, Spain)</i><br><b>Adrián Pablos et al.</b>                                                                                |
| 41            | <i>Marathon Man: evidence of stress fracture in a Homo antecessor metatarsal from Gran Dolina site (Atapuerca, Spain)</i><br><b>Laura Martín-Francés et al.</b>                                                                             |
| 42            | <i>Neandertal adaptation to close-range hunting: metabolic cost of bent-hip bent-knee gait</i><br><b>Martin Hora and Vladimir Sladek</b>                                                                                                    |
| 43            | <i>The Neanderthal patella: topographic bone distribution and inner structural organization</i><br><b>Amélie Beaudet et al.</b>                                                                                                             |
| 44            | <i>The meaning of hominin bipedalism : epistemological issues</i><br><b>Mathilde Lequin</b>                                                                                                                                                 |
| <b>Room B</b> |                                                                                                                                                                                                                                             |
| 45            | <i>What can fireplaces tell us? A methodological approach to investigate the use life of late Upper Palaeolithic hearths</i><br><b>Frank Moseler</b>                                                                                        |
| 46            | <i>Burning the land: an ethnographic study of non-domestic fire use by recent and sub-recent foragers and implications for the interpretation of past fire practices in the landscape</i><br><b>Fulco Scherjon et al.</b>                   |
| 47            | <i>Wildfire and A Landscape of Fear: A new approach to examining the initial uptake of fire by plio-pleistocene hominins</i><br><b>Adam Caris</b>                                                                                           |
| 48            | <i>Fire production in the deep past? The expedient strike-a-light model</i><br><b>Andrew Sorensen</b>                                                                                                                                       |
| 49            | <i>Extending the luminescence dating range to cover the full Quaternary</i><br><b>Christina Ankjærgaard et al.</b>                                                                                                                          |
| 50            | <i>Extending the age range of the OSL method for dating Pleistocene sedimentary deposits using quartz grains</i><br><b>Marion Hernandez and Norbert Mercier</b>                                                                             |
| 51            | <i>New data about the chronology of middle Pleistocene (MIS 5-3) Mousterian sites of southwest France: A multi-method (OSL, IRSL and TL) and multi-material (quartz, feldspars and flint) approach</i><br><b>Marine Frouin et al.</b>       |
| 52            | <i>Developing a chronostratigraphic framework for human cultural change spanning the North African Middle Stone Age through to the Neolithic using Single Grain OSL: the example of Rhafas (NE Morocco)</i><br><b>Nina Dörschner et al.</b> |
| 53            | <i>Two Waves of Paleolithic Settlers Migrations to North West Beringia in Pleistocene End (End of Karginsky Interstadial)</i><br><b>Nikolay Drozdov and Stanislav Laukhin</b>                                                               |
| 54            | <i>Paleoclimatic Events Conductive to the Migrations of the Paleolithic People from the Southern Siberian Mountain Range to the North</i><br><b>Stanislav Laukhin</b>                                                                       |
| 55            | <i>Shilo-Shumilov Low and Beginning of Sociosphere Forming</i><br><b>Aleksey Firsov and Stanislav Laukhin</b>                                                                                                                               |
| 56            | <i>The Upper Paleolithic of the Ikh Tulberin Gol(Northern Mongolia): new excavations at the Tolbor 16 open-air site</i><br><b>Nicolas Zwyns et al.</b>                                                                                      |
| 57            | <i>Variability among Russian Mid Upper Palaeolithic backed bladelet assemblages: preliminary results</i><br><b>Natasha Reynolds</b>                                                                                                         |

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| 58 | <i>Evolution, Cultural Influences or the Migrations in Paleolithic of Georgia</i><br><b>Nikoloz Tushabramishvili and Tamar Meladze</b>                                                                                                                            |
| 59 | <i>Systems of adaptation during the Middle to Upper Palaeolithic transition in Eastern Europe – the examples of Crimea and the Middle-Don Region</i><br><b>Guido Bataille</b>                                                                                     |
| 60 | <i>Exploring Neanderthal and modern human occupation east of the Carpathian Mountains: New fieldwork in the Dniestr valley (Ukraine)</i><br><b>Philip R. Nigst et al.</b>                                                                                         |
| 61 | <i>The Ecological Catastrophe of the Time of Existence of Kostenki-Streletskaya Culture at the Russian Plain (Data on Kostenki 12/III Site) and Formation of Late Mousterian Layers in Six Cave Sites of the Western Caucasus</i><br><b>Vasilii Lyubin et al.</b> |
| 62 | <i>Stratzing/Krems-Rehberg in its lithic landscape: Economic behaviour in the late Aurignacian of the Middle Danube region</i><br><b>Luc Moreau et al.</b>                                                                                                        |
| 63 | <i>Palaeoenvironments, Anatomically Modern Humans and Neanderthals: The contribution of Pod Hradem Cave (Czech Republic) to recent debates</i><br><b>Ladislav Nejman et al.</b>                                                                                   |
| 64 | <i>All in one go? – Modes of blade and bladelet production and their implications for the Proto- and Early Aurignacian distinction. New insights from the Aurignacian of Labeko Koba (Basque Country, Spain)</i><br><b>Yvonne Tafelmaier</b>                      |
| 65 | <i>Characterizing the later part of the MSA sequence at Sibudu, KwaZulu-Natal, South Africa</i><br><b>Guillaume Porraz et al.</b>                                                                                                                                 |
| 66 | <i>Holley Shelter: How an old excavation contributes to our understanding of behavioral variability within the MSA</i><br><b>Gregor D. Bader and Nicholas J. Conard</b>                                                                                           |
| 67 | <i>Al-Kharj 22, a Nubian Complex site in central Saudi Arabia</i><br><b>Yamandú Hieronymus Hilbert et al.</b>                                                                                                                                                     |
| 68 | <i>A microscopic characterization of water induced stone tool edge damage and its implications for interpreting the lower pleistocene archaeological record</i><br><b>Jonathan Reeves and Ignacio de la Torre</b>                                                 |
| 69 | <i>An attempt to monitor the process of use-wear formation on quartzite stone tools</i><br><b>Antonella Pedergnana and Andreu Ollé</b>                                                                                                                            |
| 70 | <i>The first petrographic determination of grain de mil flint from the Aquitaine Basin of South-western France: a new key to understanding Palaeolithic social organisation</i><br><b>Solene Caux</b>                                                             |
| 71 | <i>Keeping the White Weaponry: Developing a Methodology for Investigating Pleistocene Osseous Projectile Point Maintenance and Discard</i><br><b>Michelle C. Langley</b>                                                                                          |
| 72 | <i>Identifying lances, javelins, and mechanically-launched projectiles using macrofracture analysis and fracture propagation velocity: a controlled experiment</i><br><b>Radu Iovita et al.</b>                                                                   |
| 73 | <i>Stone tool production and utilization by bonobo-chimpanzees (Pan paniscus)</i><br><b>Itai Roffman et al.</b>                                                                                                                                                   |
| 74 | <i>Aptitude, practice and teaching: Tracking human cognitive evolution through skill acquisition experiments in early flaked stone technologies</i><br><b>Nada Khreisheh</b>                                                                                      |
| 75 | <i>Comparing ethnolinguistic affiliation and eco-cultural niches in Papua New Guinea: Archaeological Implications</i><br><b>Nicolas Antunes et al.</b>                                                                                                            |
| 76 | <i>Mosaic habitats and human evolution</i><br><b>Hannah O’Regan et al.</b>                                                                                                                                                                                        |

| Saturday, 21 September            |                                                                                                                                                                                                           |                                                                                                                                   |
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| Session 7- <i>Großer Festsaal</i> |                                                                                                                                                                                                           |                                                                                                                                   |
| 8:00                              | <i>New Excavations at La Ferrassie: Preliminary Results on some of the Lithic Industries</i><br><b>Alain Turq et al. (presented by Laurent Chiotti)</b>                                                   |                                                                                                                                   |
| 8:20                              | <i>New Data on the Context of the Middle Paleolithic Bone Tools from Abri Peyrony and Pech-de-l’Azé I (France)</i><br><b>Shannon P. McPherron et al.</b>                                                  |                                                                                                                                   |
| 8:40                              | <i>Radiocarbon dating the extinction of European Neanderthals</i><br><b>Tom Higham et al.</b>                                                                                                             |                                                                                                                                   |
| 9:00                              | <i>Châtelperronian bone tools from the Grotte du Renne, Arcy-sur-Cure</i><br><b>Francesco d’Errico et al.</b>                                                                                             |                                                                                                                                   |
| 9:20                              | <i>The “transitional industries” and their makers</i><br><b>Jean-Jacques Hublin</b>                                                                                                                       |                                                                                                                                   |
| 9:40-10:00                        | Coffee Break                                                                                                                                                                                              |                                                                                                                                   |
| Session 8- <i>Großer Festsaal</i> |                                                                                                                                                                                                           |                                                                                                                                   |
| 10:00                             | <i>The paradox of cold adaptation among modern humans and Neandertals: Developmental variation in the ontogeny of the crural index</i><br><b>Jay T. Stock et al.</b>                                      |                                                                                                                                   |
| 10:20                             | <i>The KC4 maxilla (Kent’s Cavern, England) and the age of the arrival of early AMH to western Europe</i><br><b>Chris Proctor et al.</b>                                                                  |                                                                                                                                   |
| 10:40                             | <i>The potential for catastrophic impact of the Campanian Ignimbrite (CI) tephra on human evolution: new data from the Lower Danube loess steppe</i><br><b>Kathryn E. Fitzsimmons et al.</b>              |                                                                                                                                   |
| 11:00                             | <i>The role of mollusc exploitation in Levantine Upper Palaeolithic subsistence: zooarchaeological, radiometric, and isotopic investigations on Ksâr’ Akil (Lebanon)</i><br><b>Marjolein Bosch et al.</b> |                                                                                                                                   |
| 11:20                             | <i>Patterns of change in Nenet landscape: Ethnoarchaeological study at Yangana Pe, Polar Ural Mts. Russia</i><br><b>Sandra Sázelová et al.</b>                                                            |                                                                                                                                   |
| 11:40-13:00                       | Lunch Break                                                                                                                                                                                               |                                                                                                                                   |
|                                   | Session 9- <i>Großer Festsaal</i>                                                                                                                                                                         | Session 10- <i>Kleiner Festsaal</i>                                                                                               |
| 13:00                             | <i>New ESR datings of Acheulian levels at Atapuerca Dolina and Galeria Sites and their position in the European prehistoric context</i><br><b>Christophe Falgueres et al.</b>                             | <i>Behaviour, adaptation and environment in the Turkana Basin during the later Quaternary</i><br><b>Marta Mirazon Lahr et al.</b> |

| 13:20       | The Atapuerca evidences in the debate about the (dis) continuity of the European settlement during the Early Pleistocene<br>José María Bermúdez de Castro et al.                           | Bifacial technology at Sibudu and its implications for our understanding of the Still Bay<br>Nicholas J. Conard et al.                                                          |
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| 13:40       | The "Homo erectus" from Turkey. New results from the anthropological study of the Kocabaş reconstructed skull and the chronological framework on the Denizli Basin<br>Amélie Vialet et al. | Advances in the study of the Middle Palaeolithic of Arabia<br>Huw Groucutt et al.                                                                                               |
| 14:00       | Systematics and Homo erectus: a reassessment of the Asian material<br>Jeffrey Schwartz                                                                                                     | Searching for consistencies in Châtelperronian pigment use<br>Laure Dayet Bouillot et al.                                                                                       |
| 14:20       | A fine scale survey of the worldwide similarity between humans and archaic hominids and its implication on the proposed admixture scenario<br>Cindy Santander et al.                       | New Views and Dating Results on the Neanderthal Occupation at La Cotte de St Brelade, Jersey<br>Becky Scott et al. (presented by Matt Pope)                                     |
| 14:40-15:00 | Coffee Break                                                                                                                                                                               |                                                                                                                                                                                 |
|             | Session 11- <i>Großer Festsaal</i>                                                                                                                                                         | Session 12- <i>Kleiner Festsaal</i>                                                                                                                                             |
| 15:00       | Sima de los Huesos al dente: a “modern” Neanderthal?<br>María Martínón-Torres et al.                                                                                                       | Accessing hominin cognition: a case study in the British Lower to Middle Palaeolithic<br>James Cole                                                                             |
| 15:20       | The Qesem Cave dental material: A first morphometric analysis based on µCT images of mandibular teeth<br>Gerhard Weber et al.                                                              | Humeral Biomechanics and Habitual Behavior: Is the Humeral Rigidity of Neandertals and Upper Palaeolithic Moderns Unique?<br>Colin Shaw et al.                                  |
| 15:40       | Hominid paleobiodiversity at Java during the Early-Middle Pleistocene. New insights from the inner tooth structural morphology<br>Clément Zanolli et al.                                   | Land-sea correlation of the Last Interglacial via the Blake palaeomagnetic Event: implications for Neandertal occupation history of north western Europe<br>Mark J. Sier et al. |
| 16:00       | Middle Pleistocene hominin teeth from China and implications for our understanding of human evolution in Eurasia<br>Song Xing et al.                                                       | Chronometric and relative dating of the Middle Pleistocene sequence of Schöningen<br>Daniel Richter and Brigitte Urban                                                          |
| 16:20       | How ‘modern’ are the earliest Homo sapiens?<br>Shara Bailey et al.                                                                                                                         | An Acheulean Millstone workshop older than 650 ka at la Noira, Brinay, France<br>Marie-Hélène Moncel et al.                                                                     |
| 17:00-19:00 | Poster Session 2                                                                                                                                                                           |                                                                                                                                                                                 |
| 19:00-20:00 | ESHE General Assembly                                                                                                                                                                      |                                                                                                                                                                                 |
| 20:30-23:00 | Closing Party<br>Weingut Fuhrgassl-Huber, Neustift am Walde 68, 1190 Wien<br><a href="http://www.fuhrgassl-huber.at/">http://www.fuhrgassl-huber.at/</a>                                   |                                                                                                                                                                                 |

| Poster Session 2: Saturday 17:00-19:00                                                                                                                                                                                                                                              |                                                                                                                                                                                                       |
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| Authors of odd-numbered posters (1, 3, etc.) are expected to be present for the first hour (17:00-18:00).<br>Authors of even-numbered posters (2,4, etc.) are expected to be present for the second hour (18:00-19:00). Authors may use the additional hour to visit other posters. |                                                                                                                                                                                                       |
| Room A                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                       |
| 77                                                                                                                                                                                                                                                                                  | Late juvenile cranial growth and the diagnosis of Australopithecus sediba<br><b>André Strauss et al.</b>                                                                                              |
| 78                                                                                                                                                                                                                                                                                  | Development of subadult Homo heidelbergensis from Atapuerca during puberty: evidence from the analysis of the occipital sinuses in brain endocasts<br><b>Eva María Poza-Rey and Juan Luis Arsuaga</b> |
| 79                                                                                                                                                                                                                                                                                  | The impact of geographic variation and allometry on the postnatal development of modern human facial features<br><b>Sarah Freidline et al.</b>                                                        |
| 80                                                                                                                                                                                                                                                                                  | Ontogenetic and static allometry in contemporary human male faces, and why it matters<br><b>Sonja Windhager et al.</b>                                                                                |
| 81                                                                                                                                                                                                                                                                                  | Fetal development of the modern human chin: The 3D shape variation is bounded to spatial arrangement of the hyoid bone, the tongue and suprahyoid muscles<br><b>Michael Coquerelle et al.</b>         |
| 82                                                                                                                                                                                                                                                                                  | Postnatal growth changes in suprahyoid muscle configuration, mandible morphology and hyoid position in modern humans, chimpanzees and Neanderthals<br><b>Sandra A. Martelli et al.</b>                |
| 83                                                                                                                                                                                                                                                                                  | New neonatal brain size estimation in hominin lineage<br><b>Petr Tuma et al.</b>                                                                                                                      |
| 84                                                                                                                                                                                                                                                                                  | A conserved pattern of postnatal endocranial development in extant hominoids<br><b>Nadia Scott et al.</b>                                                                                             |
| 85                                                                                                                                                                                                                                                                                  | Virtual reconstruction of the KNM-ER 42700 (H. erectus) endocast<br><b>Simon Neubauer et al.</b>                                                                                                      |
| 86                                                                                                                                                                                                                                                                                  | Turning on the 'radiator': numerical modeling analyses to test an old and elusive theory<br><b>José Manuel de la Cuétara et al.</b>                                                                   |
| 87                                                                                                                                                                                                                                                                                  | Temporal lobe surface anatomy and the bony relieves in the middle cranial fossa. The case of the El Sidrón (Spain) Neandertal sample<br><b>Antonio Rosas et al.</b>                                   |
| 88                                                                                                                                                                                                                                                                                  | The Parietal Lobe and Human/Neanderthal Behavioral Differences<br><b>Benjamin Campbell</b>                                                                                                            |
| 89                                                                                                                                                                                                                                                                                  | Morphological description and comparison of the endocasts from Qafzeh (Israel)<br><b>Dominique Grimaud-Herve et al.</b>                                                                               |
| 90                                                                                                                                                                                                                                                                                  | Geometric morphometric analysis of ear ossicles in African apes and modern humans<br><b>Alexander Stoessel et al.</b>                                                                                 |
| 91                                                                                                                                                                                                                                                                                  | How the brain got language-ready<br><b>Cedric Boeckx</b>                                                                                                                                              |
| 92                                                                                                                                                                                                                                                                                  | The evolution of the language faculty: why the environment was key<br><b>Evelina Leivada et al.</b>                                                                                                   |
| 93                                                                                                                                                                                                                                                                                  | Language and the Evolution of Complexity<br><b>Pedro Tiago Martins and Evelina Leivada</b>                                                                                                            |
| 94                                                                                                                                                                                                                                                                                  | Pere Alberch's phenotypic morphospace adapts to language ontogeny: Network analyses reveal typical and atypical phenotypes<br><b>Lluís Barceló-Coblijn et al.</b>                                     |

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| 95  | A reassessment of the Middle Pleistocene human dental remains from Visogliano (Trieste, Italy) based on high-resolution phase contrast microtomography<br><b>Claudio Tuniz et al.</b> |
| 96  | The Pontnewydd Pleistocene hominin remains and their morphological affinities<br><b>Tim Compton and Chris Stringer</b>                                                                |
| 97  | Additional human fossil remains from Regourdou (Montignac-sur-Vézère, Dordogne, France)<br><b>Asier Gómez-Olivencia et al.</b>                                                        |
| 98  | Morphological and Morphometrical study of the two Neanderthal mandibles from Grotta Guattari (Latium, Italy)<br><b>Julie Arnaud et al.</b>                                            |
| 99  | Hyperostosis Frontalis Interna In A Neanderthal From Marillac (Charente, France)<br><b>María Dolores Garralda et al.</b>                                                              |
| 100 | The “Negrito Hypothesis” and Modern Human Phenotypic and Genetic Diversity in Asia<br><b>Hugo Reyes-Centeno et al.</b>                                                                |
| 101 | Peschanitsa Mesolithic Man from Northern Russia according to craniometric data<br><b>Denis Pezhemskiy and Ekaterina Bulygina (Stansfield)</b>                                         |
| 102 | The Late Palaeolithic to Neolithic transition in Northwest Africa: Body size, mobility and habitual activity<br><b>Isabelle De Groote</b>                                             |
| 103 | Cranial variation among fossil and modern humans in the Americas: some perspectives on the peopling of the New World<br><b>Manon Galland and Martin Friess</b>                        |
| 104 | Diet or infection pressure on selection of FADS polymorphisms in hominins?<br><b>Josephine Joordens et al.</b>                                                                        |
| 105 | The Influence of Latitude and Island Ecology on Macaque Dental Morphology<br><b>Nicole Grunstra and Robert A. Foley</b>                                                               |
| 106 | Mandibular and molar root size variation in great apes<br><b>Melanie Bäuchle et al.</b>                                                                                               |
| 107 | New synchrotron-based visualization technique for incremental growth lines and stresses in fossil teeth<br><b>Adeline Le Cabec et al.</b>                                             |
| 108 | Dentine growth patterns in human fossil teeth assessed by high resolution Magnetic Resonance micro-imaging<br><b>Luca Bondioli et al.</b>                                             |
| 109 | Undressing teeth: Trigonid crest patterns at the enamel dentine junction of the Sima de los Huesos molars<br><b>Marina Martínez de Pinillos et al.</b>                                |
| 110 | Unique within his group: High incidence of chipping enamel may reflect a specialized behavior in the El Sidrón neandertal group<br><b>Almudena Estalrrich et al.</b>                  |
| 111 | Microtomographic-based structural analysis of the immature Neanderthal mandible from Archi, Southern Italy<br><b>Federico Bernardini et al.</b>                                       |
| 112 | A microCT-based longitudinal study of the dental developmental pattern in the Neandertal child from Pech de l'Azé, France<br><b>Priscilla Bayle et al.</b>                            |
| 113 | New Dental Remains From the Middle Paleolithic Layers of the Chagyrskaya Cave, Altai Mountains<br><b>Alexandra Buzhilova</b>                                                          |
| 114 | Evolutionary History And Biological Diversity Of Homo Sapiens In Southeast Asia: Contour Shape Analysis Of Modern Human Upper Molars<br><b>Julien Corny and Florent Détroit</b>       |

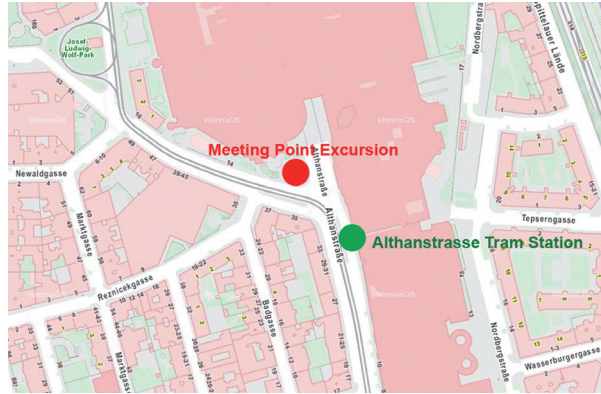


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| 115    | <i>Oblique wear and molar enamel thickness topography in early agriculturalists</i><br><b>Mona Le Luyer et al.</b>                                                                                 |
| Room B |                                                                                                                                                                                                    |
| 116    | <i>Integrating multiple lines of Neanderthal dietary evidence. A case study from eastern and southeastern Iberia</i><br><b>Domingo C. Salazar-García et al.</b>                                    |
| 117    | <i>Hunting Bear During The Late Mousterian. Evidence From The North Of Italy</i><br><b>Matteo Romandini et al.</b>                                                                                 |
| 118    | <i>The recent mousterian settlement of Grotta Reali at Rocchetta a Volturno (Molise, Italy)</i><br><b>Carlo Peretto et al.</b>                                                                     |
| 119    | <i>Evidences of fur procurement by Neandertals from the Mousterian deposits of Riparo Tagliente in the Lessini Mountains (Verona, Italy)</i><br><b>Ursula Thun Hohenstein and Marco Bertolini</b>  |
| 120    | <i>Assessing the role of bone retouchers from the Mousterian to the Aurignacian in the North of Italy</i><br><b>Camille Jéquier et al.</b>                                                         |
| 121    | <i>Bone retouchers made from cave bear (Ursus spelaeus) bones from sedimentary unit 5 of Scladina Cave (Belgium)</i><br><b>Grégory Abrams et al.</b>                                               |
| 122    | <i>Ancient bone retouchers at Gran Dolina site: A recurrent technical behaviour during the Middle Pleistocene</i><br><b>Antonio Rodríguez-Hidalgo et al.</b>                                       |
| 123    | <i>Taphonomical analysis of the carnivore modification in Sima de los Huesos (Atapuerca, Spain) human sample</i><br><b>Nohemi Sala et al.</b>                                                      |
| 124    | <i>Actualistic experiments to establish the biostratinomic sequence at Neumark-Nord 2</i><br><b>Lutz Kindler et al.</b>                                                                            |
| 125    | <i>A landscape perspective of hominin behaviour at Schöningen 13II-4 “Spear Horizon”</i><br><b>Jarod Hutson et al.</b>                                                                             |
| 126    | <i>"Surf 'n' Turf": Evidence from the German Rhineland for long range movement of Magdalenian individuals between inland and coastal environments</i><br><b>Martin Street and Michelle Langley</b> |
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| 142 | <i>Exploration, Isolation, or Seasonal Migration? Idiosyncratic technological organization in the Late Middle Palaeolithic re-colonization of Britain, MIS 3</i><br><b>Rebecca Wragg Sykes</b>                   |
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| 144 | <i>Understanding British Late Middle Palaeolithic Landscape-use using the Pixel Difference Method and GIS</i><br><b>Hannah Cutler</b>                                                                            |
| 145 | <i>Neanderthals of the North? Re-investigating the fallow deer from Hollerup and their implication for a possible pre-Weichselian occupation of southern Scandinavia</i><br><b>Trine Kellberg Nielsen et al.</b> |
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| 148 | <i>Had Neanderthals a modern behaviour? Hominid-carnivore experimental approach</i><br><b>Marián Cueto et al.</b>                                                                                                |
| 149 | <i>Modern human dispersal into Eurasia: Preliminary results of the multi-disciplinary project on the replacement of Neanderthals by modern humans (RNMH)</i><br><b>Kitsuhiro Sano et al.</b>                     |
| 150 | <i>Dispersal of Early Humans: adaptations, frontiers and new territories (The Ancient Human Occupation of Britain Project 3)</i><br><b>Chris Stringer and Silvia Bello</b>                                       |
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| 152 | <i>The Disappearance of the Neanderthals: An analysis through demographic parameters modeling</i><br><b>Anna Degioanni et al.</b>                                                                                |
| 153 | <i>The Neanderthal behaviors from a spatio-temporal perspective: an interdisciplinary approach to interpret the archaeological assemblages</i><br><b>María Gema Chacón et al.</b>                                |
| 154 | <i>Interpretation of the Neandertal Record through Cloninger’s Bio-Cognitive Model</i><br><b>Kayleen D. Duckworth and Frederick L. Coolidge</b>                                                                  |



The excursion on Sunday, 22 September 2013 will start at 08:00 from the “Biozentrum Althanstrasse”, Althanstrasse 14, 1090 Wien. (tramway “D” goes from the main university building, which you know from the meeting, directly to Althanstrasse)



The excursion of the **3rd Annual Meeting of the ESHE** will lead us to two very important archaeological/anthropological excavation sites in the vicinity of Vienna. At the same time, we will have the opportunity to visit one of the most beautiful areas of Austria, the “Wachau”. This picturesque, 40 km long, valley between the towns of “Melk” and “Krems” was formed by the Danube river and already settled during the Upper Paleolithic. A place in the Wachau known from much more recent times is “Dürnstein” where King Richard the Lion-Heart of England was held captive by Duke Leopold V.



Our first destination is Willendorf, right in the middle of the Wachau on the north shore of the Danube. The famous “Venus from Willendorf” was discovered there in 1908 by the workman J. Veran during excavations conducted by archaeologists Josef Szombathy, Hugo Obermaier and Josef Bayer. The 11cm high figurine was carved from an oolithic limestone, which is not local in the Wachau, about 25,000 years ago. We will have the opportunity to visit the local Willendorf museum that provides an overview of the historical facts and a nice collection of casts from comparable figurines, and we will also see the excavation site itself, including a recent stratigraphic profile.



Willendorf site



Willendorf Museum

Since the museum is rather small, we need to separate into four groups with 30 people each. Two groups will walk to the excavation site (3 min. walk from the museum) and get a guided tour there, the other two groups will visit the museum. For the latter, however, only one group at a time can enter the museum itself, the other is asked to stay in the kiosk area or at the tavern next to it. After 30 min. the excavation site and museum groups will switch.

The buses will then bring us to the shipping pier in Melk where we take a cruising ship down the Danube to Krems, passing Willendorf, Spitz, Weißenkirchen, and Dürnstein. During the cruise (about 1h 50min.) you have the opportunity to take lunch on-board (not covered by the excursion fee, menu between € 13-15.-).



Cruiseship Wachau





Excavation Krems Wachtberg

In Krems, the buses will wait to bring us near the Krems-Hundssteig and Krems-Wachtberg excavation sites. These are among the most important sites for the Gravettian period and prominently known for the “twin-burial” of newborns that were covered with a mammoth scapula, embedded in red ochre, and decorated with ivory beads (~ 27,000 years old). We will have a guided tour of both sites. There are, however, again logistical challenges to overcome with a party of 120. We will therefore split into two groups of 60 people. In the first group moving to the site should be all participants who need to return to Vienna earlier, and thus not attending the full tour, which

will continue with a “Heurigen” visit after the Wachtberg. From where the buses can stop, it will still be 10-15 min. walk, including ~60m elevation. For a limited number of participants with disabilities / walking difficulties we can offer a minivan and another passenger car that can reach the site directly (please indicate at the registration desk if you need this service or if you need to return early). The second group will stop in the heart of Krems and have about an hour to walk through the town and up to the site before tours switch.

As the last destination on our tour, we will visit a “Heurigen” in Krems-Stratzing. The Wachau is one of the most important areas for growing wine in Austria, with a tradition going back to the Roman settlements. Particularly white wines such as “Grüner Veltliner”, “Roter Veltliner”, “Riesling”, “Muskat Ottonel”, and “Müller Thurgau” are cultivated on the many terraces built into the gentle hills on the north shore of the Danube.

From the Heurigen, we will go straight back to Biozentrum Althanstrasse in Vienna, where the tour ends. Included in the excursion fee are all bus rides, shipping cruise, entrance fees to the Willendorf museum, and site tours. Not included are lunch on the Danube ship and food and drinks at the Heurigen.

Sunday, 22 September: Excursion schedule

| Hours         | Event                                              | Location                                    |
|---------------|----------------------------------------------------|---------------------------------------------|
| 08:00 – 09:15 | Bus ride Vienna - Willendorf                       | Althanstr. 14, 1090 Wien                    |
| 09:15 – 10:30 | Willendorf Excavation Site and Willendorf Museum   | Willendorf 68, 3641 Aggsbach Markt          |
| 10:30 – 11:00 | Bus ride Willendorf - Melk                         | DDSG, Räcking 1, 3390 Melk                  |
| 11:00 – 12:50 | Cruising ship Melk - Krems                         | DDSG, Franz-Zeller-Platz 1, 3500 Krems      |
| 13:00 – 13:15 | Bus ride Krems Hotel Alte Post and Kremstalstrasse | Schwedengasse & Kremstalstrasse, 3500 Krems |
| 13:15 – 15:30 | Krems Hundssteig & Wachtberg                       | Josef-Kinzl-Gasse, 3500 Krems               |
| 15:30 – 17:30 | Heurigen                                           | 3552 Stratzing                              |
| 17:30 – 18:30 | Bus ride Stratzing - Vienna                        | Althanstr. 14, 1090 Wien                    |

Abstracts

European Society for the study of Human Evolution

Vienna September 2013



Poster Presentation Number 121, Sa (17:00-19:00)

## Bone retouchers made from cave bear (*Ursus spelaeus*) bones from sedimentary unit 5 of Scladina Cave (Belgium)

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Evidence of Neanderthals using bear remains as knapping tools is rare. In this context, Scladina Cave (Belgium) collections prove to be an exceptional sample. In the sedimentary unit 5, which dates from MIS 5 (5d to 5b), twenty-six bone retouchers have been identified. The morphology of the blanks and the knapping marks are comparable with bone retouchers found in other Middle Paleolithic sites (Auguste, 2002; Jéquier et al., 2012; Mallye et al., 2012). Moreover, many lithic splinters found still embedded in the indentations and grooves confirm the use of these fragments as knapping instruments. The refitting work which takes into account these retouchers and non-modified bones, helped to identify that six retouchers have been made from three cave bear bones (a right femur, a right and left tibias). Among these retouchers, four (and two unused fragments) have been refitted together and reconstitute the almost complete right femur diaphysis. The presence on these bear bone fragments of cut marks, scraping marks, impact notches and fractures typical of percussions on green/fresh bones, points toward anthropogenic modifications. The absence of carnivore tooth marks also suggests that Neanderthals were the main, if not the only, agent responsible for their production. The anthropogenic marks also support the idea of the recovery of a still relatively fresh bear carcass or carcasses. So far, no arguments support the idea of bear hunting or the scavenging of an individual in or close to Scladina Cave. The analysis of these exceptional remains increases the interest in the Scladina Cave collections and brings new insights into the use of bear bones by Neanderthals. The numerous anthropogenic marks and their frequent overlapping allows for a clear interpretation of the operational sequence: disarticulation and defleshing of the bones (cut marks), fracturing (impact notches and breakage pattern), preparation (scrapping marks) and adjustment (negative flake scars). The sophistication of the operational sequence where each action succeeds another in the production of a bone tool is a major argument in favor of predetermination that guided the Neanderthal actions, and is similar to that described for the lithic reduction sequences.

**References:** Auguste, P., 2002. Fiche éclats diaphysaires du Paléolithique moyen : Biache-Saint-Vaast (Pas-de-Calais) et Kulna (Moravie, République tchèque). In: Patou-Mathis, M. (Ed.), Retouchoirs, compresseurs, percuteurs... Os à impressions et éraillures, Société préhistorique française, Paris, pp. 39-57. Jéquier, C.A., Romandini, M., Peresani, M., 2012. Les retouchoirs en matières dures animales : une comparaison entre Moustérien final et Uluzzien, Comptes Rendus Palevol 11, 283-292. Mallye, J.-B., Thiébaud, C., Mourre, V., Costamagno, S., Claud, É., Weisbecker, P., 2012. The Mousterian bone retouchers of Noisetier Cave: experimentation and identification of marks, Journal of Archaeological Science 39, 1131-1142.

Poster Presentation Number 49, Fr (18:00-20:00)

## Extending the luminescence dating range to cover the full Quaternary

Christina Ankjærgaard<sup>1</sup>, Mayank Jain<sup>2</sup>, Naomi Porat<sup>3</sup>, Klaudia Kuiper<sup>4,5</sup>, Jan Wijbrans<sup>4</sup>, Jakob Wallinga<sup>1,6</sup>

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The field of human evolution lacks generally-applicable dating techniques which are able to cover the full evolution of the genus *Homo* within the past 2.5 million years. Available methods have a limited time range (OSL, radiocarbon) or are applicable only in very specific settings (U-Pb, Ar/Ar, U-Th). As a consequence, key questions to *when* hominins migrated out of Africa and *when* they arrived into Europe remain unanswered. Optical stimulated luminescence (OSL) dating is used extensively to determine the time of deposition and burial of Late Quaternary sediments due to the wide abundance of quartz on earth. Application of this method is usually limited to the past 150,000 years due to early saturation of the quartz fast component blue OSL signal. One approach to extending the age range was suggested by Jain (2009), using violet light to directly measure deep traps in quartz not accessible by the standard blue stimulation. In this study, we further investigate the applicability of the Violet Stimulated Luminescence (VSL) signal for dating Quaternary deposits (Ankjærgaard et al., accepted). To test the applicability of the VSL signal on geological samples, we investigate multiple samples from a core in the south-central Netherlands which penetrates a 35-m thick sequence of Middle to Late Pleistocene deposits of aeolian and fluvial nature (Boxtel core, Schokker et al., 2005). The samples were previously dated using quartz OSL (Schokker et al., 2005) and feldspar infrared stimulated luminescence dating (Wallinga et al., 2007; Kars et al., 2012). Because dose rates are very low, a reliable quartz OSL chronology is available up to 300,000 years; providing an excellent opportunity to test VSL dating for this younger range. In addition, we study a section in northern Israel exposing nine basalt flows (K-Ar dated 0.7-1.5 Ma; Mor 1984) containing six layers of paleosols bracketed between the basalt layers. New <sup>40</sup>Ar/<sup>39</sup>Ar ages for the basalts provide independent age control for the quartz extracted from the palaeosol layers. Preliminary VSL measurements are presented, indicating the feasibility of extending luminescence dating to cover the full Quaternary.

Acknowledgements: This work is financed by Technology Foundation STW (STW.10502)

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Poster Presentation Number 75, Fr (18:00-20:00)

## Comparing ethnolinguistic affiliation and eco-cultural niches in Papua New Guinea: Archaeological Implications

Nicolas Antunes<sup>1</sup>, Marian Vanhaeren<sup>1</sup>, Wulf Schiefenhövel<sup>2</sup>, William Banks<sup>1</sup>, Solange Rigaud<sup>1,3</sup>, Francesco d’Errico<sup>1,4</sup>

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Hundreds of languages, belonging to the Austronesian and Papuan language families, are spoken in New Guinea. (Foley, 1986). The former spread into New Guinea some 4000 years ago, most likely from Taiwan (Melton, 1995; Lynch, 2002) or mainland Southeast Asia (Bellwood 1978). The latter, characterized by a higher diversity, probably reflects an earlier human colonization, which happened 40,000 years ago (Swadling 1983, Pawley 2005, Golson 2005). Also, genetic studies supplies grounds to explain the region’s extraordinary language diversity: a single wave followed by stationary diversification or multiple waves followed by language evolution consisting of local drift or mixing. In both scenarios, environmental factors (suitable areas, climate fluctuations) and historical contingencies (e.g., contacts, trade, war) may have contributed to shaping present-day linguistic geography (Serjeantson, 1982). In order to explore to what extent linguistic geography is linked to environmental factors, we applied two predictive algorithms, typically used to reconstruct a species’ ecological niche (GARP: Stockwell and Peters, 1999 and Maxent: Phillips, 2006) to the two main language families and 41 ethnolinguistic groups belonging to these families as defined by Ross (2005), and adapted by one of us (Schiefenhövel, in prep). The ethnolinguistic groups are represented by a random sample of village occurrences within each group’s present-day geographic distribution. High resolution (30 arc-second grid resolution) environmental variables were used to produce the niche estimations and included 19 bioclimatic parameters derived from monthly precipitation and temperature values (worldclim, Hijmans et al. 2005 ), along with 5 topographic parameters linked to altitude and topography. Results indicate that the regions occupied by Papuan and Austronesian speaking populations appear to differ ecologically, in a number of regards. The Papuan ecological niche is most influenced by wetness and altitude, and Austronesian by temperature. At a more refined scale, the distinct linguistic groups show a range of variability in how they correspond to their respective niche estimations: 1) the language group only occupies a small subset of its potential niche, 2) the language group occupies a territory larger than its potential niche, 3) the language group and its potential niche closely overlap. Observed mismatches suggest that environmental variables such as temperature, precipitation or topography influence linguistic geography. However, other factors, independent from environment, certainly have an important influence on cultural and linguistic geography. By closely documenting language-environment relationships and exploring situations in which they co-vary, we attempt to shed new light on the mechanisms that govern the complex relationships between natural and cultural parameters and how they influenced settlement patterns.

Acknowledgments: This research is funded by the Labex Sciences Archéologiques de Bordeaux (LaScArBx), the European Research Council (FP7/2007-E2013, grant no. 249587, TRACSYMBOLS), and PhD grant attributed to N.A. by the French Ministry for Education and Research.

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

## Origins of aquatic resource use in East Africa and the implications for breadth of hominin dietary versatility at 2mya

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There is general agreement that hominin diet underwent dramatic changes shortly after the time stone artifacts appear in the record. It is generally assumed these changes are associated with dietary expansion through the exploitation of large terrestrial mammal resources. Here we present a series of analyses that suggest the absence of aquatic resources in discussions hitherto of early Pleistocene hominin diet may be partially attributable to prevailing zoo-archaeological methodology. We employ a series of archaeological, ethnographic and experimental datasets to argue that aquatic resource use was an important component of hominin subsistence by 1.95 mya. We present experimental and archaeological data on (1) bone fragmentation, (2) taxonomic diversity, (3) bone surface modification, (4) skeletal element proportion (5) size profile distributions and (6) crocodilian scavenging, to develop our argument. We suggest that the emergence of aquatic resource exploitation was associated with a specific set of relative advantages compared to reliance on an exclusively terrestrial resource base. These include (a) a reduction in energetic investment relative to economic return, (b) a decrease in the technological costs of resource acquisition, and (c) a reduced level of inter-specific competition associated with aquatic foraging opportunities and consequently an elevated probability of capitalization. The incorporation of aquatic soft-tissues into the hominin diet at a time of the year when other resources are depleted of fat may have been a more important component of hominin dietary strategy than was previously assumed. This strategy would have allowed a maintained seasonally consistent source of calorie-dense foods. The seasonal contexts within which specific aquatic species are accessible, suggest that exploiting them may have offset fluctuations in hominin energetic intake associated with variability in the seasonal availability of terrestrial food.



Poster Presentation Number 98, Sa (17:00-19:00)

## Morphological and Morphometrical study of the two Neanderthal mandibles from Grotta Guattari (Latium, Italy)

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The current data on the peopling of the Italian peninsula, suggests a delay in the acquisition of Neanderthals' autapomorphies due to geographic isolation. In Europe, first Neanderthal derived features appeared around 450 ka BP whereas in Italy the specimens show an archaic morphology by the presence of plesiomorphic features and the first autapomorphies will be individualized from the MIS 9 (350 ka ca.). We propose in this work a revision of two Italian mandibular fossil remains attributed to *Homo neanderthalensis*, Guattari 2 and Guattari 3, in order to replace them in the European evolutionary context through a morphological and a morphometrical study. The reference sample is composed of 72 adult specimens consisting of 24 *Homo neanderthalensis*, 41 modern humans and 6 fossils from the Middle Pleistocene. The study is based on the combination of several methodologies associating 2D and 3D data. Each mandible was measured and 40 relevant features for evidencing evolution pattern were evaluated in order to apply multivariate analysis on qualitative data. These preliminary analyses were completed with geometric morphometrics to analyze the structure of the mandibular symphysis. After making a 3D model of the specimens with a surface scanner NextEngine, we have built the mandibular symphysis outlines through the positioning of 3 anatomical landmarks (*infradentale*, intersection of the digastrics fossae, *infradentale posterior*) and 41 semi-landmarks. An Elliptical Fourier Analysis was applied on the outlines after a simple procedure of dimensionality reduction (PCA) and an alignment by a Procrustes superimposition. Fourier descriptors were analyzed with PCA and FDA, using three human groups as a priori groups: Middle Pleistocene Specimens, Neanderthals and Modern humans. The results obtained show, as expected, that Guattari 2 and 3 fall within Neanderthal variability in a morphological and morphometrical point of view even if compared to Neanderthals from the same chronological range, a discrepancy in the expression of features in both specimens is noted. Furthermore, these two specimens present a high inter-individual variability which can be attributed to several factors: sexual dimorphism or different chronology, discussed in this present work. Finally, the application of Elliptical Fourier Analysis on the mandibular symphysis outlines turns out to be an optimal method to discriminate the mental structure of the three human groups taken into consideration, especially between Neanderthals and Middle Pleistocene specimens.

Acknowledgements: Carlo Peretto, Dominique Grimaud-Hervé, Giorgio Manzi, Giacomo Giacobini, Florent Detroit, Antoine Balzeau, Thomas Ingicco, Julien Corny, Raffaele Sardella, Luca Bellucci, Luciano Bruni

Poster Presentation Number 134, Sa (17:00-19:00)

## The first peopling of Europe: the Italian case

Marta Arzarello<sup>1</sup>, Carlo Peretto<sup>1</sup>

1 - Università degli Studi di Ferrara

The prehistoric record of the Italian peninsula contributes significantly to the definition of technical behaviours adopted during the first peopling of Europe. The sites of Pirro Nord (Apricena, FG) (Arzarello et al., 2012; 2010; 2009) and Cà Belvedere di Montepoggiolo (Forlì) (Arzarello & Peretto, 2010; Muttoni et al, 2011; Peretto et al., 1998), dated respectively to 1,3 – 1,5 My ago by biochronology and to ~0,85 My ago by ESR, suggest that the first Europeans had a uniform technology (in line with the other European sites dated to around 1 million years ago), but strongly influenced by the characteristics of raw material. In both sites the raw material, always flint, originates from site's surrounding area and there is a previous selection of collected pebbles in terms of quality (absence of internal fractures and homogeneity). In Pirro Nord the reduction sequences are strongly adapted to the dimensions of the pebbles: the small pebbles are exploited by a centripetal debitage, whereas the larger pebbles are exploited by an opportunistic debitage and utilization of several striking platform using an unipolar debitage. In Cà Belvedere di Montepoggiolo the reduction sequences are longer than in Pirro Nord, but again finalized to obtain not predetermined blanks by an opportunistic method, or more rarely by a centripetal method. Although more ancient, in Pirro Nord the centripetal production seems to have a component linked to a clear concept of predetermination understood as the morphology of researched blanks (Potì, 2013). The re-touched blanks are absent in Pirro Nord and very rare in Cà Belvedere di Montepoggiolo. Both sites are following the trend already observed on all oldest European sites and Mode 1 sites in Africa, which consists of intensive exploitation of raw material with the aim to produce blanks with at least one cutting edge, with only one difference, and that is the complete absence of shaping elements probably in relation to the activities carried on in the site.

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Poster Presentation Number 66, Fr (18:00-20:00)

## Holley Shelter: How an old excavation contributes to our understanding of behavioral variability within the MSA

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While MSA research in the last decades concentrated much on the Cape region of Southern Africa, only three sites near the eastern coast have been well studied and described in the last few years. These include the well-known sites of Sibudu, Umhlatuzana and Border Cave. In order to increase our knowledge about the geographic variation within the MSA of southern Africa, we expanded our focus to new or till now insufficient documented sites in KwaZulu-Natal. Holley Shelter lies about 25 kilometers northeast of Pietermaritzburg in KwaZulu-Natal, South Africa. Gordon Cramb excavated this site in the 1950s and 1960s. The archaeological material, however, was studied only in a sporadic manner (Cramb, 1952, 1961). According to Cramb, the site is comprised of thin LSA deposits, overlying a much thicker MSA sequence. In 2013 we conducted a technological study of the stone artifacts, including attribute analysis and examination of reduction sequences. Our aim was to characterize the different assemblages, investigate their variation over time, and compare Holley Shelter with other sites in KwaZulu-Natal. We analyzed a sample of 900 lithic artifacts out of a total of 4000 pieces in a three week study season. The selected artifacts cover the entire 1.2 m thick stratigraphy. Our preliminary results suggest the existence of different occupational events at the site due to marked variations in the composition of raw material as well as proportions of tools, blanks and core-types. Most of the layers are highly dominated by blades. The often pointed blades are very long and thick, with a maximum length of up to 13, 4 cm. Tools occur in very high frequencies up to 45%, which is uncommon for MSA assemblages. The knappers produced most of these tools on blades and pointed blades. Furthermore, we observed different core reduction strategies, classified mostly as “platform” -cores. But also “parallel” or “bipolar”-cores after Conard et al. (2004) are present to a more limited extent. In addition to the high number of tools belonging to the MSA, the technological attributes of the sample show clear MSA-characteristics such as faceted butts and thick pointed forms. None of the layers yielded typical LSA artifacts. The MSA assemblages of Holley Shelter also do not include the *fossiles directeurs* of the Howiesons Poort or Still Bay. On a regional level, none of the MSA assemblages at Sibudu are comparable to those from Holley Shelter. Hence, we conclude that the assemblages are either older than the MSA sequence at Sibudu (> 80 ka) or it reflects a high degree of regional variability in this part of South Africa.

Acknowledgements: We thank our colleagues from the KwaZulu-Natal Museum, especially Carolyn Thorp and Gavin Whitelaw for providing access to the archaeological material from Holley Shelter and for providing us with lab space. We also thank Peter Cramb for making the remaining collections from his father's excavations at Holley Shelter available for our research. This research was funded by the ROCEEH-project (The role of culture in early expansions of humans) of the Heidelberger Academy of Science and the Deutsche Forschungsgemeinschaft.

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Poster Presentation Number 106, Sa (17:00-19:00)

## Mandibular and molar root size variation in great apes

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Studying within-group variation and sexual dimorphism in living primates and especially in great apes, is essential for classifying hominoid fossils. Paleoanthropologists often focus on dental and mandibular measurements, as those are the most abundant anatomical structures in the fossil record (e.g. Wood 1981, Fabbri 2006). Historically, dental crown measurements have been used for taxonomical and functional analyses rather than dental roots (Lucas et al. 1986, Scott and Lockwood 2004). The enamel crown, however, is exposed to wear and taphonomic decay, contrary to roots which are embedded in bone and not affected by dental wear. So far very little is known about inter- and intraspecific variation and sexual dimorphism in mandibular molar roots in relation to mandibular size. Here we study variability of mandibular molar roots and the mandible among great apes (*Pan*, *Gorilla* and *Pongo*) between and within groups, and assess the co-variation between measurements on roots and on the mandibular bone. In particular we focus on comparing patterns and degrees of sexual dimorphism. In all great apes, males on average feature a larger overall mandibular size than females. This sexual difference is statistically significant in *Gorilla* and *Pan*, but not in *Pongo*. We also find that at all molar positions the robusticity index (measured by the ratio of width and height of the respective mandibular section, Wood 1991) is higher in females than in males, which means that females have a relatively flatter mandibular body than males. In all three species molar roots are generally larger in males than in females, but there is large overlap and not all mean differences reach the level of statistical significance. *Gorilla* and *Pan* molar roots show similar patterns and degrees of sexual dimorphism, except in M3 where the degree of dimorphism is much larger in *Gorilla* (45%) than in *Pan*. The degree of sexual dimorphism in *Pongo* is generally larger than in *Gorilla*. Moreover, there are species differences in the pattern of sexual dimorphism as male *Pongo* roots are not only larger than females, but also differ in shape. Our study shows that intraspecific variability in great ape molar root and mandibular size cannot be generalized from one genus to another and is highly dependent on the measurement. We demonstrate the importance of understanding the patterns and degrees of variability in great apes to assess anatomical variation in the fossil record. Moreover, we emphasize the necessity of considering various measurements, when sexing fossils.

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

## How ‘modern’ are the earliest *Homo sapiens*?

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Previous research (reviewed in Trinkaus, 2005) has suggested that the African and western Asian contemporaries of Neandertals, generally considered to be the earliest *Homo sapiens*, are not particularly ‘modern’ looking in their cranial anatomy. Here we test whether the dental morphological ‘signal’ agrees with this assessment. We examined and recorded dental morphological variation in the earliest *H. sapiens* and asked: how ‘modern’ are they dentally? We used a Bayesian statistical approach to classifying individuals into two possible groups based on dental non-metric traits. The classification was based on dental trait frequencies and sample sizes for two ‘known’ samples of 120 Neandertals and 106 Upper Paleolithic *H. sapiens* individuals. A cross-validation test of these individuals resulted in a correct classification rate of 95%, which is even better than the results of a previous study using the same method based on fewer individuals (Bailey et al 2009). Our early *H. sapiens* sample included 41 individuals from Southern Africa (Die Kelders, Klasies River Mouth and Equus Cave), Northern Africa (Temara, El Harhoura, Dar es Soltan) and the Levant (Qafzeh, Skhul). We treated our early *H. sapiens* individuals as ‘unknown’ and calculated the probability that each belonged to either the Upper Paleolithic or Neandertal sample. While understanding that technically these individuals did not belong to either group, we hypothesized that if the earliest *H. sapiens* were already dentally modern then, when forced into a group, they should fall into the Upper Paleolithic *H. sapiens* group. We also hypothesized that if there had been significant admixture in the Levant during the initial dispersal out of Africa - as has been sometimes proposed based on paleontological - and more recently on genetic - evidence (Green et al 2010) that these samples would have the largest proportion of individuals classified as Neandertal. Our results indicated that this was not the case. While a surprising number (27%) of early *H. sapiens* did classify as Neandertal, the smallest proportion of these came from the Levant (7% - one out of 14 individuals). The African sample was more of a ‘mixed bag’. None of the individuals from Die Kelders or Klaises River Mouth classified as Neandertal, while four out of five of the individuals from Equus Cave did. Moreover, 6 out of 13 (46%) of the Northern African individuals were classified as Neandertal. An inspection of the individual specimens that classified as Neandertals revealed that in most cases it is the predominance of primitive features, rather than derived Neandertal traits, that is driving the classification. We conclude (1) by the time the earliest *H. sapiens* dispersed from Africa they had already attained a more-or-less ‘modern’ dental pattern; (2) in the past, as is the case today, Late Pleistocene Africans were not a homogeneous group, some retained primitive dental traits in higher proportions than others. Furthermore, we acknowledge that while our method is an excellent tool for discriminating between Upper Paleolithic *H. sapiens* and Neandertals, it may not be appropriate for testing Neandertal – *H. sapiens* admixture because all traits (primitive and derived) are weighed equally. Acknowledgements: Funding for this research was provided by the LSB Leaky Foundation, the National Science Foundation and the Max Planck Society.

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Poster Presentation Number 94, Sa (17:00-19:00)

## Pere Alberch’s phenotypic morphospace adapts to language ontogeny: Network analyses reveal typical and atypical phenotypes

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The results of a longitudinal study are presented, supporting the suitability of the conception of a phenotypic morphospace for linguistic phenotypes. These results support the idea of integrating Pere Alberch’s phenotypic morphospace into the study of cognition. Alberch phenotypic morphospace (PM) is a benchmark in the evolutionary and developmental theory of species (Alberch 1989). PM is valid for the study of both ontogeny and phylogeny (without assuming that “ontogeny recapitulates phylogeny”). In spite of its age, Alberch’s model has still a place within modern evo-devo accounts (West-Eberhard 2003). PM helps to understand variation within and between species, and why proves of both continuity and discontinuity are continuously found. According to Alberch, the PM integrates both kinds of development. Balari & Lorenzo have recently integrated the PM hypothesis for the study of morphology into the phylogenetic study of linguistic phenotypes. Linguistic phenotypes differentiate each other due to qualitative differences of their Computational Systems (Balari & Lorenzo 2008, 2013). For the moment, Balari & Lorenzo’s proposal cannot be tested due to evident problems (there are no other members of the subtribe *Hominina* to be tested). However, the suitability of PM could be proven by studies on ontogeny. We have studied the development of syntax longitudinally, covering one year of the child’s life (Barceló-Coblijn et al. 2012). Now we expand the study including (1) more languages and (2) clinical cases (Specific Language Impairment or SLI and Down syndrome). Several corpora of different first languages (e.g. Catalan, Dutch, German, English or Spanish) have been syntactically analyzed “by hand” (at least, 17 corpora per language). Each analyzed corpus has then been represented by means of a network, showing the syntactic relationships the words maintain with each other. These were compared to networks extracted from clinical cases. Our results show that humans typically follow the same developmental pattern during language ontogeny: - The pattern reflects two regimes of growth (linear and nonlinear), with sharp transitions between the three attested stages. - Each stage correlates with a different type of network: tree-like network, scale-free network and small-world network. These are well known networks, each of them with a different topology. - The results also point out the deviation in linguistic development in atypical, clinical cases, showing a different network. The results suggest that SLI and Down cases are “deviations” and not frozen stages. In sum, we have obtained a first morphospace for typical/atypical language development in ontogeny. This helps us to better understand the dilemma posited by the apparent continuity/discontinuity in great apes. *Homo sapiens*’ (typical/atypical) development of language, as part of their cognition, has evolved to rapidly reach a powerful computational phenotype. The computational phenotype of current *Homo sapiens* and its complexity is indicated by small-world networks. Acknowledgements: This research was supported by DGICYT Projects FFI2009-13416-C02-01 and FFI2010-20759 (Spanish Ministry of Economy and Competitiveness)

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Podium Presentation: Session 6, Fr (16:20)

## Interacting Cognitive Subsystems: a theoretical mental architecture for interpreting evidence in the archaeological record concerning cognitive evolution

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According to Barnard et al., (2007), mental capability arises from interactions among ‘subsystems’ of mind. This has implications for the interpretation of evidence concerning cognitive evolution. In this framework, a basic mammal has just four subsystems (three sensory and one multimodal subsystem in which emotions guide action selection). Through a mechanism analogous to cell division and specialization, additional subsystems evolved, each enabling augmented mental and behavioural capabilities. Successive augmentations occurred in a logical and cumulative process across the hominin line of descent. Advanced manipulatory skills provided a platform for the differentiation of a spatial-praxic subsystem in the common ancestor of living great apes, giving a six-subsystem mind capable of generative tool use in the LCA. This pattern was then mirrored in the auditory-vocal domain. Differentiated vocalization in early hominins (seven-subsystems) formed a platform for the emergence of an eight subsystem mind in archaic species of Homo specialized for processing verbal morphology. These minds would have supported generative language with clear implications for communication and instruction. Co-presence of computation with verbal and spatial-praxic representations enabled meanings to differentiate – what is spoken, seen, heard or felt in the body have underlying referents and properties in common and a ninth subsystem emerged specialized to process those specific meanings, namely propositions. The “mother” multimodal subsystem that controlled action on the basis of emotion still functioned with its capability now massively augmented because it could also benefit from being able to generalize over its propositional knowledge. A nine-subsystem mind can be wise as well as clever. Three subsystems were thus added between the LCA and our modern minds. Each kind of mind had a well-defined package of properties that can support theoretically principled inferences about what to expect in the archaeological record. No homunculus or “central executive” is required (Barnard, 2010). Rather, control emerges out of interactions among subsystems: the more subsystems there are, the more the mind can do at one and the same time. A nine-subsystem mind has all that it takes to walk, talk, imagine a visual image, and think about ideas at the same time. With fewer resources, precursor minds could do less at one at the same time and lacked abstract ideas. The theoretical analysis implies that we need to re-frame lists of features to look for in the record, that often give prominence to evidence for ritual or symbolically significant objects (e.g. McBrearty & Brooks, 2000). Rather we should be looking for evidence that reflects the intellectual “glass ceilings” imposed by six-, seven-, and eight-subsystem precursor minds while only a nine-subsystem mind should leave traces of both innovation and use of abstract ideas. Further, if we look for features such as ritual burials, we may miss or assign lower importance to key evidence for innovation and abstraction in behavioural domains more central to survival of the fittest such as tool making and use (e.g. compound adhesives, heat treatment?); differentiated use of medicinal substances (ochre?); food treatment (Toxins? Alcohol?) numerosity and labeling to differentiate aspects of possession (beads, ostrich shells?).

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Poster Presentation Number 31, Fr (18:00-20:00)

## A new method for assessing hominoid clavicle curvatures: functional, ontogenetic and phylogenetic implications

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Background: Hominoids possess particularly mobile shoulder joints compared to most other primates. The clavicle plays a central role in this mobility because it maintains a fixed distance between the glenoid fossa of the scapula and the sternum, ensuring that relative movement between these structures is arcuate. This is thought to be particularly crucial for great apes to profit from a complex 3D arboreal environment. More importantly, the clavicle is an important shoulder joint stabilizer because it acts as compression-resistant ‘strut’ during weight bearing and pulling. However, despite playing a central role in shoulder joint mobility in hominoids, the clavicle’s complex anatomy has made it a particularly challenging bone to analyse, and for this reason has remained seldom studied in a comparative context. The emergence of novel 3D methods in recent years has prompted renewed interest in clavicle morphology, particularly in the medical field, with studies proposing a number of protocols for analysing clavicular shape. Aims: In this study, we propose a new and more streamlined 3D protocol for analysing clavicle curvatures. This protocol is devised as an alternative to forcing the clavicle into 2D planes (cranial and anterior), and thus yields two curvature measurements (distal and proximal), rather than the four measurements produced with the more traditional 2D methods (proximal superior, proximal anterior, distal superior, and distal anterior). The aim is to provide a simple and reproducible 3D protocol for assessing clavicular curvatures that can be applied across species. Methods: Clavicular curvatures are estimated by fitting two polylines (proximal and distal) through four homologous landmarks on the anterior surface of the clavicle using Geomagic 12.1. The two polylines are fitted such that they represent two arches of a circle, and their curvatures measured (in mm) as a function of the circle’s radius (curvature = 1/radius). Measurements were collected on ontogenetic series of hominoid specimens (*Hylobates lar*, *Pongo pygmaeus*, *Gorilla gorilla*, *Pan paniscus*, *Pan troglodytes* and *Homo sapiens*). Gompertz growth curves were fitted to the distributions using the package ‘grofit’ in R. Regular PGLS regressions of curvatures against 40 shoulder variables of the humerus, scapula and clavicle were also performed. Pairwise t-tests and ANOVAs were employed to test for differences in proximal and distal clavicle angles within and between species. Results: Gompertz models indicate that the curvatures of the clavicle are more curved at birth and gradually flatten out with growth, reaching adult values well before the clavicle ceases to grow. PGLS regressions indicate that the proximal curvature significantly correlates with clavicle length and clavicle thickness (reflecting size) while the distal curvature significantly correlates with humeral torsion, and the angulation of the glenoid fossa relative to the spine of the scapula (reflecting the orientation of the glenohumeral joint). Pairwise t-tests show that the distal end of the clavicle is significantly more curved than the proximal end (p<0.05, at 95% confidence interval). ANOVAs show overall significant differences between species (p<0.001). Acknowledgements: Prof. Christopher Dean, Dr. Wendy Dirks, Angela Gill, Malcolm, Dr. Hugo Cardoso, Dr. Marcia Ponce de León, Michael Hiermeier, Dr. Robert Kruszynski, Dr. Roberto Portela Míguez and the Fundação para a Ciência e a Tecnologia (Grant number SFRH / BD / 60349 / 2009).



Poster Presentation Number 30, Fr (18:00-20:00)

### A preliminary assessment of the thoracic remains of the El Sidrón Neandertals (Asturias, Spain)

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The El Sidrón site (Asturias, Spain), dated to approximately 49 kyrs BP, has produced the most important collection of Iberian Neandertals. More than 2400 fossil cranial and postcranial remains have been recovered so far. These have been attributed to at least thirteen individuals including seven adults, three adolescents, two juveniles and one infant (Rosas et al. 2006; 2012). This paper presents first results on our research on the thoracic skeleton of the El Sidrón Neandertals, and in particular, the ribs. The skeletal thorax is important in human evolution in several respects: it participates as the kinematic part in the ventilatory function of the respiratory system, it connects morpho-functionally the cranium with the post-cranium, and the upper and lower parts of the thorax are central structures related to the ontogeny and evolution of body shape (Bastir 2008, Bastir et al., 2013). The current sample of the El Sidrón costal skeletal remains contains about 245 fossils. Their degree of preservation ranges from fully preserved and undistorted ribs to highly fragmented remains. Also, a lower thorax has been recovered, which is still in anatomical connection at the costo-vertebral articulations although with some taphonomic distortion. The aim of this paper is to present first results of our ongoing work on the remains of the thoracic skeleton and its bearing on the Neandertal ribcage morphology, its growth, and implications for body shape. We measured 20 3D-landmarks and sliding semilandmarks per rib on surface-scans of original El Sidrón fossils and performed geometric morphometrics to investigate size and shape variation. Data were compared with other Neandertal fossils as well as with an ontogenetic sample of twenty-eight recent modern humans ranging from newborn to adults of both sexes (Bastir et al. 2013). Shape data were analysed by principal components and partial least squares analyses to explore growth and adult allometric variation as well as patterns of morphological covariation. Our results suggest no size differences between Neandertals and modern humans among the 1st ribs of adults. However, in terms of shape the El Sidrón 1st ribs are a systematically more elongated in antero-posterior direction and less curved than those of modern humans. The morphology of the first rib is informative because partial least squares analysis in modern humans suggests a very tight correlation ( $R=0.85$ ,  $p<0.001$ ) between the shape of the first rib and the shape of the remaining rib-cage. Assuming similar relations in Neanderthals we hypothesise therefore that the upper thorax of the El Sidrón Neandertals is particularly extended in an antero-posterior direction. Differences in the rib geometry are likely also related to differences in the configuration of the costo-vertebral articulations. In this respect, our results fit with previous observations (Franciscus and Churchill 2002; Gómez-Olivencia et al. 2009). The divergent orientations of ontogenetic shape trajectories in a comparative growth analysis suggest that these morphological differences are expressed later during postnatal ontogeny.

Acknowledgements: We thank the El Sidrón Excavation team, Philippe Mennecier and Antoine Balzeau. Research is funded by CGL 2012-37279 and CGL 2012-36682 (Spanish Ministry of Economy and Competition), and The Leakey Foundation.

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Poster Presentation Number 59, Fr (18:00-20:00)

### Systems of adaptation during the Middle to Upper Palaeolithic transition in Eastern Europe – the examples of Crimea and the Middle-Don Region

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The present study is based on the empirical investigation of LMP and EUP assemblages of Crimea and the Kostenki area. The Crimean Peninsula and the Kostenki region represent two complementary settings during the Middle to Upper Palaeolithic transition. Crimea shows a long survival of Middle Palaeolithic industries until 33/32.000 cal. BP. Furthermore, Crimea exhibits evidence for the coexistence of late Middle Palaeolithic industries associated with fossil remains of Neanderthals (Crimean Micoquian) and Early Upper Palaeolithic remains attested by interstratifications at Buran-Kaya III and possible Middle Palaeolithic palimpsests within the Aurignacian sequence of Siuren 1. In contrast to that, the Kostenki region (Mid-Don region) has long been seen as uninhabited by Middle Palaeolithic groups during OIS 3 and first colonized by Upper Palaeolithic groups, according to radiocarbon dates prior to 40.000 cal. BP. The Middle to Upper Palaeolithic transition in Eastern Europe between the Crimean Peninsula in the South and the Central Russian Plain in the North is marked by the occurrence of two different adaptive systems. While the first one comprises tool-sets which are based on the bladelets, blades and bone points and the second one features symmetrical bifacial foliates which are produced in a bi-convex manner and lacks lamellar microliths and bone points. These adaptive systems comprise different techno-complexes: the first one includes the Aurignacian and the initial Upper Palaeolithic industries of Kostenki 14 (layers IVa till IVb) and Kostenki 17 (layer II/ "Spitsynskaya"), and the second contains assemblages of the Streletskaya industry and the related transitional assemblages of Kostenki 12, layer III (Mid-Don) and Buran-Kaya III, layer C (Crimea). According to absolute data and stratigraphic markers the bladelet and blade based initial Upper Palaeolithic assemblages of Kostenki 14/IVb1-2 and Kostenki 17/II (Mid-Don) occur earlier than the assemblages based on the production of foliates and bifacial tools, such as Kostenki 12/III (Mid-Don) and Buran-Kaya III/C (Crimea). The latter assemblages show elements which might be linked to a Micoquian tradition, while the former are more or less void of any Middle Palaeolithic elements. Due to this observation, the occurrence of foliate assemblages are interpreted as a reaction of regional Middle Palaeolithic groups to incoming early Upper Palaeolithic groups and as an in situ transformation of the material culture in the course of economic adaptations. All those adaptive innovations, centred in the today Russian Plain, are accompanied by the latest Middle Palaeolithic occurrences in Crimea. Thus, a complex scenario for the Middle to Upper Palaeolithic transformation has to be considered, including dietary competition, processes of cultural transformation and the replacement of Middle Palaeolithic groups by occurring Early Upper Palaeolithic groups. Moreover, a cultural and genetical exchange between Middle and Upper Palaeolithic groups is possible. These processes lead to the final abandonment of the Middle Palaeolithic mode of life, and its replacement by Upper Palaeolithic economical systems.

Acknowledgements: I would like to express my gratitude to the following persons, which gave me the possibility to study assemblages and samples of the sites Siuren 1 & Buran-Kaya III (Crimea) and Kostenki 6, Kostenki 12, Kostenki 14 & Kostenki 17 (Russia): V. P. Chabai, Y. E. Demidenko, A. A. Sinitsyn, M. W. Anikovich & N. I. Platonova. Also I like thank my supervisor J. Richter, the German Science Foundation and the CRC 806 ("Our way to Europe") for the funding of my journeys.

Poster Presentation Number 112, Sa (17:00-19:00)

## A microCT-based longitudinal study of the dental developmental pattern in the Neandertal child from Pech de l’Azé, France

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The possibility and nature of differences between the Neandertals and modern humans in the timing and patterning of dental maturation are still debated (e.g., Macchiarelli et al., 2006; Smith et al., 2010). Studies of dental developmental patterning in fossil taxa and past populations are usually based on cross-sectional data (e.g., Tompkins, 1996; Bayle et al., 2009; but see Dean et al., 1993). Thanks to the high-resolution microCT record of its maxillae, we derived longitudinal data for patterning of dental mineralization in the Neandertal child from Pech de l’Azé. We then compared its successive sequences to a sample of European living children. The Pech de l’Azé child remains were discovered in 1909 by L. Capitan and D. Peyrony in Carsac (Dordogne) in a Mousterian of Acheulean Tradition layer probably corresponding to OIS 3 (Maureille and Soressi, 2000). The specimen is represented by an almost complete cranium and the right side of the mandible (Patte, 1957). The age-at-death of the child is estimated to ca. 2-2.5 years (Patte, 1957). In 2011, the maxillae of Pech de l’Azé was imaged by X-ray microtomography at the AST-RX platform (equipment v|tome|xL240, GE Inspection Technologies SCS Phoenix|X-ray) according to the following parameters: 150 kV voltage, 220 µA current, 3000 projections over 360°. The final volume rendering was reconstructed at an isotropic voxel size of 29.74 µm. The high-resolution virtual record permitted the virtual extraction of the germs of the permanent incisors, canines, third premolars, and first molars preserved in the maxillae. The exceptional quality of the record also allowed the detection of several thicker incremental markers in the enamel of all the permanent teeth (pronounced internal lines corresponding to the position of the developing enamel that relates to a stressor experienced during development). Notably, we counted two accentuated lines in the I1s, I2s, and canines, one in the P3s, and three in the M1s. By cross-matching the accentuated lines, we derived four mineralization sequences representing four stress events distributed from the birth to the death of the child. By using a Bayesian approach, we then compared the successive sequences shown by Pech de l’Azé to a CT-based sample of 75 European living children aged 1-4 years. Results of the Bayesian analysis show that three of the four sequences have high probabilities to be found in our extant sample, while one sequence is very unlikely. Indeed, a relative advancement of the M1 and/or a relative delay of the incisors is observed between the second and the third stress events, suggesting a higher developmental rate in the molar and/or a lower one in the incisors than in the extant children during this stage of the development (between ca. 8-20 months in our extant sample).

Acknowledgements: For the micro-CT scanning procedure, we thank the AST-RX platform (Accès Scientifique à la Tomographie à Rayons X), UMS 2700 ”Outils et méthodes de la systématique intégrative”, CNRS-MNHN, Paris, France (<http://ums2700.mnhn.fr/ast-rx/presentation>). We are also indebted to A. Froment (Département Hommes, Natures, Sociétés) and P. Mennecier (Département des collections), MNHN, for allowing us to study the Pech de l’Azé maxillae. Thanks to the University Hospital Pellegrin (Bordeaux), and Necker (Paris) for access to CT-scans of living children.

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Poster Presentation Number 43, Fr (18:00-20:00)

## The Neanderthal patella: topographic bone distribution and inner structural organization

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The mammalian knee is an ”alarmingly complex joint” (Lovejoy, 2007: 326). It functionally represents a key-site where body weight is transferred to the ground and the locomotor-related stresses generated by the ground reaction are dissipated. Comparative analyses of the tibial plateau inner structure revealed an intimate relationship in extant primates between site-specific bone thickness variation and locomotion-related functional loads (Mazurier et al., 2010; Beaudet et al., 2012). However, within a distinct ”anthropic pattern”, expressed by a thicker cortical shell at the medial condyle associated to a strengthening of the cancellous network, some differences have been reported between the extant human and the Neanderthal conditions, the latter being characterized by a thicker articular plateau (at both medial and lateral condyles) and thicker sub-epiphyseal struts (Mazurier et al., 2010; Volpato et al., 2012). The patella, which is included in the knee capsule and actively takes part into the complex biomechanical dynamics at this joint, should record similar structural variation. However, while investigated in a clinical perspective (e.g., Toumi et al., 2006), its inner architecture is still unreported in fossil humans. We used X-ray microtomography to detail the structure of nine adult Neanderthal patellae from the early OIS 5e Croatian site of Krapina (spec. Pa.1., Pa.3., Pa.5. to Pa.9., and Pa.14.; Radović et al., 1988) and the OIS 4 partial skeleton Regourdou 1, France (Piveteau, 1959). Acquisitions were performed at the ICTP Multidisciplinary Laboratory of Trieste (isotropic voxel size of 31.58 µm) and at the ESRF ID 17 beamline of Grenoble (45.5x45.5x45.7 µm). The modern human condition is represented by 42 specimens from 22 adult individuals of both sexes selected from the archaeological sites of Geili (Sudan) and Velia (Italy). Our preliminary 2-3D virtual analyses show that the cortico-trabecular complex, i.e. the most dense zone including the cortical shell and the adjoining portions of the supporting trabecular network, is relatively and absolutely thicker in Neanderthals, where it is associated to a higher number of interconnected plate-like structures. In all cases investigated so far, the nonarticular surface is relatively thicker. However, while in Neanderthals the structural contrast between the medial and lateral facets is marked and the thickest complex lies beneath the latter, there is no distinct pattern in the modern patellae. Finally, in terms of textural properties, the cancellous network immediately below the cortico-trabecular complex globally shows a less heterogeneous pattern in Neanderthals compared to the topographic variation recorded in the modern specimens. Acknowledgements: V. Merlin-Anglade, F. Couturas and G. Marchesseau for access to Regourdou 1; L. Bondioli and A. Coppa for access to comparative material in their care. C. Zanolli for special support during acquisitions at the ICTP. L. Bondioli, J. Braga, P. O’Higgins (support to M.C.), L. Puymeraul and C. Zanolli for discussion and scientific collaboration.

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Poster Presentation Number 22, Fr (18:00-20:00)

Foramen magnum orientation and the cervical lordosis

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As the critical intersection of the locomotor, airway passage, neural and masticatory systems, the cranial base is a frequently consulted source for insight into the evolution of the human head in phylogenetic and functional–adaptive contexts. Due to the complexity of the structures involved very few authors have explored the relationship between cranial base morphology and cervical spine posture (Solow and Sandham, 2002). We hypothesis, that the existence of such a relationship would shed light on the understanding of bipedality and head posture evolution in our genus. Objectives: To explore the relationship between the orientation of the foramen magnum in the sagittal plane to the cervical lordosis angle. Materials and Methods: A total of 85 lateral cervical radiographs of healthy adult modern human individuals (20 to 50 years old) were examined. All subjects were standing comfortably with knees straight and arms resting on the side of the body. The subjects were asked to stand straight with a forward gaze. Measurements: on each radiograph the following angles were measured: the angle between the foramen magnum and the Frankfurt horizontal plane (FM – FH); Cervical lordosis between the foramen magnum and C7 (FM-C7); and upper cervical lordosis between FM-C3. Results: our preliminary results show a close correlation between foramen magnum orientation (FM – FH) and upper cervical lordosis FM-C3 (r=0.73) and only moderate correlation between foramen magnum orientation (FM – FH) and cervical lordosis FM –C7 (r =0.46). Discussion: In modern humans foramen magnum orientation is closely related to cervical lordosis (FM-C7) and especially to its upper part (FM-C3). This relationship might open a new window to understand the evolution of bipedality and head posture in our genus. Specifically, it would give us a good idea about how the head was held on the cervical vertebral column in extinct hominins.

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Podium Presentation: Session 9, Sa (13:20)

The Atapuerca evidences in the debate about the (dis) continuity of the European settlement during the Early Pleistocene

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The problem of the hominin (dis) continuity of the settlement of Europe during the Early Pleistocene is an important matter of discussion, which has been approached in the last decade from different points of view. The Gran Dolina (TD) and Sima del Elefante (TE) cave sites in the Sierra de Atapuerca, (Spain) include large and quasi-continuous stratigraphic sequences that stretch back from at least 1.2 million years ago (Ma) to the Matuyama/Brunhes boundary. The archaeological and paleontological record from these sites can help to test different hypotheses about the character of the human settlement in this region and period. A fragmentary human mandible, dated to to about 1.2 million years ago, was recovered from the TE9 level form the TE cave site. Furthermore, the TD6 level has yielded a large collection of human fossil remains attributed to *Homo antecessor*. According to different geochronological methods, as well as to paleomagnetic and biostratigraphical analyses, these hominins belong to an age range of 0.96 to 0.80 Ma. Unfortunately, the comparison of these two hypodigms is not enough to conclude whether *H. antecessor* had deep roots in the European Early Pleistocene. A set of derived features of *H. antecessor* shared with both the Neanderthal lineage and modern humans suggests that this species is related, and not far, from the most recent common ancestor (MRCA) of *H. neanderthalensis* and *H. sapiens*. Having into account these observations, if we assume that there was a lineal biological relationship between the TE9 and TD6 hominins, we should reconsider many of the conclusions achieved in previous paleontological and genetic studies. In addition, we would be obliged to build a highly complicated paleogeographical scenario for the origin of the MRCA. Although continuity in the settlement of Europe during the entire late Early Pleistocene is not discarded (e.g. in refuge areas), it seems that this Western extreme of Eurasia, and the Iberian Peninsula in particular, was occupied by at least two different hominin populations.

Poster Presentation Number 111, Sa (17:00-19:00)

## Microtomographic-based structural analysis of the immature Neanderthal mandible from Archi, Southern Italy

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Archi 1 is an immature Neanderthal mandible discovered in 1970 during road works on the hill of San Francesco d'Archi, near Reggio Calabria, in southern Italy (Ascenzi and Segre, 1971). The specimen, found in a fluvatile-lacustrine layer in association with abundant vertebrate fauna, is attributed to OIS 4 or early OIS 3 (Mallegni and Trinkaus, 1997). The mandible, consisting of the complete corpus and the beginning of the anterior ramal margin lateral crest, expresses distinct Neanderthal features, including a well-developed torus lateralis superior and torus transversus inferior, a weak development of the trigonum mentale, and anterior alveolar flattening. The in situ four deciduous molars and the left deciduous canine are fully-erupted, while the deciduous incisors and right deciduous canine were lost post-mortem. Based on its most recent radiographic analysis, suggesting the presence in their crypts of 12 developing permanent crowns (I1-M1), Archi 1 is estimated to represent a ca. 3 years old individual (Mallegni and Trinkaus, 1997). In order to investigate its inner structural morphology, to comparatively characterize its crowns in terms of endostructural organization and dental tissue proportions, to assess its dental maturational status with respect to the condition shown by other immature Neanderthals and to tentatively refine its age at death, in 2012 Archi 1 has been imaged using X-ray microtomography at the ICTP of Trieste (Tuniz et al., 2013) according to the following parameters: 120 kV voltage, 80 µA current, 2400 projections over 360°. The final volume rendering was reconstructed using DigiXCT in 16-bit format, at an isotropic voxel size of 25 µm. The high-resolution virtual investigation of this specimen reveals excellent preservation conditions of its inner structure, the dense cancellous network only showing limited fine-grained sediment infilling confined around the basal area. On coronal sections, the relatively thick cortical bone reaches 2.5 mm at the level of the dm1. Compared to the morphology of the mid-trigonid crest usually expressed in Neanderthals at the enamel-dentine junction (e.g., Macchiarelli et al., 2006), here the dm2 shows a distinct cusp-like structure set at the centre of this feature. In terms of tooth tissue proportions, Archi 1's endostructural morphology fits the Neanderthal condition characterized by relatively thin enamel deposited over absolutely larger volumes of coronal dentine, and the deciduous molar pulp cavity typically displays the derived taurodontic condition. According to our high-resolution 2-3D analyses, the development of both P4s is not yet initiated in this individual. We calculated the Bayesian probabilities that the maturational sequences of its deciduous and permanent dentitions are found within the variation represented by a large extant human reference sample (229 individuals aged 1-5 years). As seen in the OIS 5 Italian specimen from Molare (Tuniz et al., 2012), as well as in other Neanderthal children (Bayle et al., 2009), Archi 1's developmental sequence is characterized by a relative maturational delay of the anterior teeth associated to a relative advancement of the deciduous and permanent molars. The Bayesian analysis suggests an age at death for this individual between 2.4 and 3.5 years.

Acknowledgements: Soprintendenza per i Beni Archeologici della Calabria for granting access to the fossil specimen, Istituto Italiano di Paleontologia Umana, ICTP/Elettra, Nespos Society. EXACT Project funded by the Regione Friuli-Venezia Giulia.

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Poster Presentation Number 127, Sa (17:00-19:00)

## Kill-butchery events in the Late Upper Palaeolithic sites in Divnogor'ye (Central Russia)

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Divnogor'ye village is located on the right bank of the Tikhaya Sosna River, approximately 3 km from its confluence with the Don River (50°56'; 39°17'). There are two Palaeolithic sites and several areas of knapped stone concentrations found here. Divnogor'ye 1 is a short-term occupation area, possibly a seasonal camp site. The site contains a thin cultural layer, which includes lithic material (1500 items from a 53 m<sup>2</sup> excavation), pieces of red ochre and faunal remains. The stone assemblage displays features of the Eastern Epigravettian techno-complex and contains truncated burins and points, end-scrapers and backed bladelets. Remains of wild horses dominate in the faunal assemblage, while a small number of reindeer bones were also recovered. As a rule, mammal remains are found in disarticulated position, but sometimes groups of articulated bones are found. Elements of the axial skeleton are very rare. There are three radiocarbon dates made on horse bones: 12 050 ± 170 14C BP (Le-8649); 13 380 ± 220 14C BP (Le-8648) and 13 430 ± 130 14C BP (AA-). The latter two dates seem to be more representative of the actual age of the settlement. The bone bed at the site of Divnogor'ye 9 (2.5 km to northeast from Divnogor'ye 1) is located in the central part of an old ravine. The site contains six or seven levels containing horse bones, separated by sterile layers. Radiocarbon dates obtained on a number of horse bones from the various cultural levels indicate that human visits to the site occurred between 13 150 ± 200 14C BP (Le-8136; Level 1) and 14 430 ± 160 14C BP (AA-90655; Level 6). Two paleosol layers which cap the bone levels are important geochronological markers. The lower paleosol, associated with the Bölling warming, has been dated to about 12 kya on charcoal. The levels contain dense concentrations of articulated horse bones. In some cases the bone beds yielded almost complete skeletons of individual horses. The minimum number of individual horses represented by the combined faunal material from all cultural levels is 59. More than 80 knapped stone artifacts were also recovered from the various cultural layers. Typologically the artifacts are similar to those recovered from the Divnogor'ye 1 site, although the percentage of tools from Divnogor'ye 9 is higher (10% and 38% respectively). Several areas of horse costal cartilage have thin parallel cut-marks indicating that stone tools were used during the butchering process at level 6 of the site. Thus, Divnogor'ye 9 is a systematic horse hunting site (kill-site) occupied mainly in the spring/summer. Divnogor'ye 1 may have been a short-term campsite which facilitated nearby seasonal hunts, where horse carcass parts were brought for butchering and cooking from the Divnogor'ye 9 bone bed. Despite some questions concerning, for example, the hunting system, the existence of several bone levels indicates a successful hunting strategy and its long-term employment during the period 14.5-13 14C kya.

Grants: Presidium RAS; RGNF-13-01-18038.



Poster Presentation Number 24, Fr (18:00-20:00)

## A global study shows that population history is a better predictor of the shape of the human os coxae than climate

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Human populations living in high-latitude regions tend to have wider pelves than populations from tropical regions. This pattern has been explained as thermoregulatory adaptation, whereby a wider pelvic girdle would reduce the surface-to-volume ratio of the body and help body heat retention in cold environments, while a narrow pelvis would facilitate heat dissipation in hot tropical regions. A similar rationale has been used to explain differences in pelvic breadth in other hominin species, although the rarity of well-preserved fossil pelvic remains limits the dependability of such interpretations. There is, however, a serious theoretical problem in testing the effect of hypothetical selective factors without taking into account the neutral pattern of variation due to population history. Neutral processes such as genetic drift and gene flow have been shown to explain a high proportion of cranial variation in modern populations. Moreover, it has recently been shown that pelvic shape diversity reflects the neutral signature of the modern human expansion out of Africa in a similar way to the cranium. Here we test the hypothesis that climatic adaptation affected the human pelvis, taking into account the underlying affinity pattern due to population history. The shape and size of the os coxae was recorded with 27 3D landmarks in 1,494 individuals, 922 males and 572 females, representing 30 male and 23 female populations from five continents and a wide variety of climatic conditions. We tested for the effect of both neutral population history (i.e. using geographic distance as a proxy for genetic affinity due to historical short- and long-range migrations and gene flow) and climatic adaptation on population differences in the size and shape of the os coxae. The results show a substantial effect of population history, which explains over 30% of population differences in pelvic shape in males and females. Beyond this neutral pattern of variation, climate appears to have a significant, albeit more limited, effect on both the size and shape of the os coxae. Differences in temperature are significant predictors of differences in pelvic shape in males, with minimum and maximum temperature explaining about 10% and 4% of between-populations pelvic variation. Only a weak (2.6%) correlation between differences in maximum temperature and pelvic differences was found in females, once the neutral population history pattern had been included in the model. Climate also appears to affect the size of the os coxae, which tends to decrease with increasing temperature and precipitation in males, in accordance with previous hypotheses. The results of this study confirm that neutral processes have a substantial effect on human phenotypic variation, for the os coxae in a similar way as for the cranium. Previous studies may have, therefore, overestimated the effect of climatic adaptation on the pelvis by not taking into account the underlying neutral pattern of variation. Climate appears to affect both the size and the shape of the os coxae – at least in males – but its effects are much more limited than expected, and inferior to those attributable to population history.

Acknowledgements: We are grateful to Benjamin Auerbach, Brendon Billings, Michael Black, Jerome Cybulski, Gisselle Garcia-Pack, Lyman M. Jellema, Natasha Johnson, Maureen Klemp, Osamu Kondo, Robert Kruszynski, Pasuk Mahakkanukrauh, Giorgio Manzi, Philippe Menecier, Marta Mirazon Lahr, Janet Monge, David Morris, Masaharu Motokawa, Ogeto Mwebi, Tori Randall, Ana Luisa Santos, Maria Teschler-Nicola, Tim White, and Monica Zavattaro for allowing access to the collections and for general assistance. We wish to thank Brian Campbell for the original drawings of the os coxae.

Podium Presentation: Session 4, Fr (14:00)

## The signature of a modern human exit out of Africa?: Middle Palaeolithic occupation in the Thar Desert during the Upper Pleistocene

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The Thar Desert marks the transition from the Saharo-Arabian deserts to the Oriental biogeographical zone and is therefore an important location in understanding hominin occupation and dispersal during the Upper Pleistocene. Excavations in the 1980's at the site of 16R Dune yielded the regions first chronometrically dated Palaeolithic assemblages, indicating the presence of Lower, Middle and Upper Palaeolithic horizons. However, a synthesis of recent evidence from of 16R Dune indicates the Upper Palaeolithic assemblage, originally dated by radiocarbon to 26ka, matches technological descriptions of the South Asian Middle Palaeolithic, and this occupation is bracketed by OSL ages of 80 and 40ka. New survey and excavation has been undertaken in the Thar Desert to refine our understanding of the Palaeolithic occupation of this key region and its importance for the study of modern human dispersals. Excavations at the site of Katoati have yielded the earliest securely dated Middle Palaeolithic site in South Asia, dating to MIS 5c, as well as further occupations in MIS 5a and the MIS 4-3 boundary. Technological continuity is observed between the three main assemblages, which occur in contexts indicative of enhanced humidity. Distinctive point technologies identified in both MIS 5 and MIS 4-3 boundary horizons are comparable with artefacts observed in Middle Palaeolithic assemblages in South Asia, Arabia and Middle Stone Age sites in the Sahara. The evidence from the Thar Desert is consistent with arguments for the dispersal of *Homo sapiens* populations from Africa across southern Asia using Middle Palaeolithic technologies.

Poster Presentation Number 91, Sa (17:00-19:00)

How the brain got language-ready

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Paleoneurology has established that certain characteristics, such as the globularization of the brain and the enlargement of the parietal lobes can be considered derived features observed uniquely in anatomically modern *H. sapiens*. At the same time, comparative psychology has established that humans are particularly good – much better than other species – at unifying and combining units that belong to distinct conceptual modules/core knowledge systems. Evidence suggests that language is critical in achieving this cross-modular conceptual patterns. Departing from the emphasis on cortical regions in neurolinguistics, I argue, building on work on findings concerning attention and working memory, that the linguistic role of the thalamus is needed to understand this function of language. Although the thalamus has been implicated in the context of many human-specific traits like intelligence of consciousness, its role in language has not been fully exploited. Yet, there are several reasons to be optimistic regarding the cognitive relevance of this brain structure. First, at the raw anatomical level, the thalamus acts as a necessary relay center to connect many brain structures that have already been implicated in research on language: the cortical areas with the basal ganglia and with the cerebellum. Second, the literature on FOXP2 and its interactome has often mentioned the thalamus as an important expression site of the genes involved. Third, despite the cortical focus of many imaging studies and the technical difficulties in getting recordings from the thalamus, this brain structure’s role has been highlighted in neurolinguistic studies. Finally, outside of language proper, the thalamus has routinely been assigned a key role in controlling attention, regulating oscillations generated in the cortex, etc. – functions that, though not specific to language, must surely also be part of a comprehensive neural characterization of language. Given its central location and pivotal relay function, the thalamus may have benefited from the *sapiens*-specific globular brain environment, giving rise to our species’ distinct cognitive profile. I explore this possibility by using data from various sources: (i) what we know about modern language and its implementation in the brain, (ii) what we know at the genetic level concerning the development of the brain and the thalamus in particular, and (iii) what we can gather from recent findings in paleogenetics.

Poster Presentation Number 133, Sa (17:00-19:00)

Simple Prepared Cores in Britain

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From around 300,000 BP onwards hominins in Europe, late *H. heidelbergensis* and/or early Neanderthals, started producing flakes in a more systematic way. This core working technique, known as Levallois or Prepared Core Technology (PCT), has long been of interest to researchers however, the origins of this technique are still highly debated. Fully developed Levallois reduction sequences seem to have their roots in a lesser studied technique referred to as either ‘proto’ Levallois, ‘reduced’ Levallois or more recently as Simple Prepared Core (SPC) technology. This poster presents research from the first comprehensive study comparing these techniques with a uniform methodology, bridging data from different sites in Britain. Future work will include comparisons with data from France and Belgium. One of the aims of this research is to identify if these different terms are merely different names for what is technically the same reduction strategy. In order to do this, all mentions of these core working techniques are currently being investigated. The reduction strategies of these cores are compared through a detailed attribute analysis to see if a common technological definition can be applied. Currently 478 cores from 6 British sites have been examined. Results, thus far, demonstrate identical reduction techniques at all sites allowing for the construction of a new overarching technological definition of SPC technology. Preliminary results would suggest an *in situ* development for SPC and the origins of Levallois from the Acheulean. This in turn potentially suggests independent complex hominin behavioural innovations rather than a single contiguous “tradition” as previously thought.

Acknowledgements: AHRC, Lawrence Arthur Burgess Studentship, Dr John McNabb and Dr William Davies



Poster Presentation Number 108, Sa (17:00-19:00)

## Dentine growth patterns in human fossil teeth assessed by high resolution Magnetic Resonance micro-imaging

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Microstructural studies of fossil teeth have led to the detailed reconstruction of how tooth tissues grew in hominids, thus elucidating critical evolutionary relationships and developmental constraints (e.g., Dean 2006, 2010; Macchiarelli et al 2006; Smith and Tafforeau, 2008). Microstructural increments of dentine and enamel have been used to quantify the daily secretion rates, the periodicity of long- and short- period lines, the extension rates, and the crown and root formation times of teeth. Daily cross-striations and long-period Retzius lines, in the enamel, and daily von Ebner and long-period Andresen lines, in the dentine, are usually visualized using invasive histological methods, but microanatomical data from fossil teeth have also been obtained non-destructively, by means of phase-contrast X-ray synchrotron microtomography (Tafforeau and Smith, 2008; Smith et al., 2010). However, some concerns have recently been raised about the possible destructive effects of high-energy synchrotron radiation on the organic content of the fossil tissues (Richards et al., 2012). Magnetic Resonance Imaging has found its main application in the investigation of soft tissues; however, Magnetic Resonance Micro-Imaging ( $\mu$ MRI) techniques are able to retrieve high-resolution information about the density, the mean diameter, and the distribution of microfeatures in porous systems. Indeed, when the pores of a porous system, like dentine, are filled with liquid, that contains protons, it is in principle possible to obtain indirect information about some of the structural characteristics of this porous material, from the signal of the liquid entrapped in microstructures. We developed a new  $\mu$ MRI analytical approach to explore the possibility of noninvasive assessment of growth-related dentine microstructures in subfossil and fossil teeth. More specifically, besides some recent reference specimens,  $\mu$ MRI was used to visualize the dentine microanatomy in isolated human incisors and canines from Neolithic Niger (graveyard of Arlit), the Gravettian site of Finocchietto, Italy, and the Neanderthal site of Abri Bourgeois-Delaunay, France. Lastly, we investigated the erectus-like late Early Pleistocene incisor (UA 369) from Uadi Aalad, Eritrean Danakil. All specimens were first imaged by either the  $\mu$ MRI system operating at 9.4T and located in the physics Department of Rome, the  $\mu$ CT systems at the SYRMEP beamline of the Elettra Synchrotron Laboratory, Trieste (UA 369), the ID 17 beamline of the European Synchrotron Radiation Facility, Grenoble (the Neanderthal specimens BD19 and BD21), or at the Centre de Microtomographie of the Univ. of Poitiers (all remaining specimens). Finally, the Neolithic permanent canine from Niger was sectioned for histological analysis. The results show that  $\mu$ MRI allows the identification and quantification of dentine microanatomical features, such as the Andresen lines and the dentine tubules, at a resolution power at least comparable with routine histological methods. This analytical approach thus provides unique opportunities to investigate the subtle structural organization of the mineralized tissues and to quantify patterns of dentine growth in fossil taxa through the high-resolution imaging of microfeatures that are usually not identifiable in standard microtomographic records. However, additional methodological work is still needed to test the effects of a variety of taphonomic and diagenetic factors that might potentially disturb the signal.

Acknowledgements: P Bayle (Univ. Bordeaux 1), A Mazurier (Centre de Microtomographie, Univ. de Poitiers), D Dreossi and F Zanini (Elettra-Sincrotrone Trieste S.C.p.A.), PF Rossi (Sezione di Antropologia, Museo Nazionale Preistorico Etnografico "L. Pigorini", Rome) for scientific collaboration. Y. Libsekal (National Museum of Eritrea) and JF Tournepiche (Musée d'Angoulême) for granting access to fossil specimens in their care. The Nespos Society for support.

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Poster Presentation Number 23, Fr (18:00-20:00)

## Evolution of the human hip joint in relation to our permanent bipedal gait and posture: 3D functional and comparative approaches

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In humans, the hip joint occupies a central place in the locomotor system, as it plays an important role in body support and the transmission of the forces between the trunk and lower limbs. The study of the three-dimensional biomechanics of this joint has important implications for documenting the morphological changes associated with the acquisition of a habitual bipedal gait in humans. In this study, variation in the three-dimensional orientations of both the acetabulum and the femoral neck in adult humans was quantified, and patterns of covariation between these two orientations were analysed in order to evaluate the degree of morphological integration at the hip joint. First, we demonstrated a large variation of the three-dimensional orientation of the femoral neck. A significant difference in the femoral neck orientation between sexes was detected ( $p < 0.001$ ), and our results show a significant decrease of the anteversion of the femoral neck with age ( $p = 0.03$ ). Second, the three-dimensional orientation of the acetabulum shows less variation than was observed for the femoral neck. A significant difference in the acetabular orientation between sexes was detected ( $p = 0.004$ ), and a significant increase of the angle of anteversion with age was observed ( $p < 0.001$ ). Finally, no significant patterns of covariation between the three-dimensional orientation of the femoral neck and the orientation of the acetabulum were observed. In addition, the mean orientations of the two opposing articulating components demonstrated a poor congruity. We suggest that this absence of covariation and this poor congruity may be partly due to the phylogenetic history of the human species. Although natural selection optimizes performance of the human hip joint in function of locomotion, the adaptation is also dependent on, first, the constraints of the inherited structure and, second, the trade-off with other functions. In order to better understand the evolutionary framework and the effect of the locomotor behavior on the hip morphology, a comparative study of the joint was performed in Hominoïds (*Homo*, *Pan*, *Gorilla* and *Pongo*). Comparison of the relationships between the three-dimensional orientation of the acetabulum and the orientation of the femoral neck on the hominoid sample demonstrated that the best congruence of the joint is always obtained in quadrupedal posture regardless the habitual locomotor behavior used by the different genders or species. A total congruence of the hip joint in quadrupedal posture appears natural in the genera *Gorilla* and *Pan* as they spend an important part of their time in this posture. However, this congruence of the human hip joint in a quadrupedal posture on an inclined plane, rather than in a bipedal posture, is surprising further suggesting that the shape of the human hip joint is constrained by its quadrupedal ancestry.

Podium Presentation: Session 8, Sa (11:00)

### The role of mollusc exploitation in Levantine Upper Palaeolithic subsistence: zooarchaeological, radiometric, and isotopic investigations on Ksâr' Akil (Lebanon)

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Shellfish are a rich source of nutrients not readily available in terrestrial foods and their habitual consumption probably made the diets of Palaeolithic hunter-gatherers more balanced. It has been hypothesized that, in general, diversification of exploited foods increases the intake of essential nutrients. Advantageous dietary choices should result in healthier populations, shorter inter-birth intervals, which, in turn, may result in population expansion (e.g. Hockett & Haws 2003, 2009). These combined factors could have been part of the reason for the success of early modern populations dispersing into Eurasia between 50 and 40 ka BP. Here we present new data on the shell assemblage from Ksâr' Akil (Lebanon), a key archaeological site with a 23 m long sequence, covering long time span from the Middle Palaeolithic to the Epi-Palaeolithic (Ewing 1947). Shells of marine molluscs occur from the Initial Upper Palaeolithic (>44 kyr cal BP) up to the Epi-Palaeolithic. Our study shows that at Ksâr' Akil molluscs were a source of food (e.g. *Patella caerulea*, *Patella rustica*, *Osilinus turbinatus* and possibly *Helix pachia*) but that the shells of some species were also used as tools (e.g. *Glycymeris* sp.) and ornaments (e.g. *Nassarius gibbosulus*, *Columbella rustica*). Here we focus on the taxa exploited for food, which are all rocky shore intertidal taxa and the shells of which taphonomically differ from the rest of the assemblage. We have documented the frequent intentional removal of the apices of *O. turbinatus* to facilitate flesh extraction, notches on the periphery of limpet shells congruent with forced extraction from the rocks, and occasional burning. We also undertook AMS radiocarbon dating on shells of *O. turbinatus* to refine the chronology of the site and of the periods when shellfish were exploited. The radiocarbon dates suggest that modern humans collected marine molluscs for dietary purposes throughout the Upper Palaeolithic occupation at Ksâr' Akil, from at least 44 kyr cal BP until <30 kyr cal BP. Furthermore, we conducted oxygen isotope analysis on *O. turbinatus* shells to reconstruct the seasonality of collection. Our preliminary results suggest that during most occupational phases, marine molluscs were exploited in every season, albeit mainly in the colder period of the year (i.e. winter/spring). Our investigations indicate that although molluscs represented a minor source of protein, they were a stable source of essential nutrients otherwise rare or absent in the terrestrial animals or plants that constituted the bulk of the diet of the Upper Palaeolithic occupants of Ksâr' Akil. Acknowledgements: This research was funded by the Max-Planck-Society.

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Poster Presentation Number 130, Sa (17:00-19:00)

### Having the stomach for it: a contribution to Neanderthal diets?

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Due to the central position of diet in determining ecology and behaviour, much research has been devoted to uncovering Neanderthal subsistence strategies. This has included indirect studies inferring diet from habitat reconstruction, ethnographic analogy, or faunal assemblages, and direct methods such as dental wear and isotope analyses. Recently studies of dental calculus have provided another rich source of dietary evidence with much potential. One of the most interesting results to come out of calculus analyses so far is the suggestion that Neanderthals may have been eating distasteful and non-nutritionally valuable plants for medical reasons. Here we consider this argument and the benefits of calculus analysis in the context of the current state of Neanderthal dietary research, and offer an alternative hypothesis for the occurrence of plants in Neanderthal calculus based on the modern human ethnographic literature. We suggest that an alternative source of plant remains in Neanderthal calculus is the consumption of herbivore stomach contents (chyme). This practice has been historically documented for non-agricultural modern human groups in a wide variety of habitats, but it is best known in those inhabiting the high latitudes, where a lack of vegetable foods makes chyme a valuable source of vitamins and carbohydrates. Given the cold environment that many Neanderthals inhabited, we suggest that secondary consumption of plant foods via prey offal would have been equally crucial. We are not suggesting that Neanderthals would not have eaten plant foods, or discounting the possibility of Neanderthal self-medication, however, we suggest that given the evidence for widespread consumption of stomach contents in human groups this behaviour should be taken into account as a possible source of plant foods, including 'medicinal' ones, in the fossil record.

Poster Presentation Number 2, Fr (18:00-20:00)

## Biomechanical aspects of facial ontogeny in *Macaca fascicularis* as revealed by Finite Element modelling

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Interpretation of differences in craniofacial form among fossil hominins rests on understanding developmental transformations; how these relate to evolutionary modifications. Many recent studies of primates have shown that a significant proportion of the differences among adult facial skeletons of different species are already established by birth, with subsequent, approximately, linear postnatal ontogenetic shape trajectories until adolescence (Cobb and O’Higgins, 2004; Mitteroecker et al., 2004; Singleton et al., 2010). Further differences in shape emerge through relative truncation or extension of ontogenetic trajectories. The functional matrix hypothesis (Moss & Salentijn., 1969 a,b) posits strains as orchestrating and integrating craniofacial growth in size and development in shape, through their effects on surface remodelling, and bony deposition at sutures. Does the finding of consistency of facial ontogenetic shape trajectories from morphometrics mean that bone strains in the facial skeleton are also consistent in distribution and magnitude at different ages? In the present study we explore cranial mechanical performance under masticatory loading, comparing an adult and a juvenile *Macaca fascicularis*. Finite Element (FE) models of these crania were built and their performance during 100N bites was compared in terms of local strains and strain contour maps. During three different simulated unilateral bites, the strain contour maps are very similar within both models, when compared to differences among bites within the same model. Peak strain magnitudes in the adult during each bite are smaller than in the juvenile, as might be expected given the difference in size. As such, relative but not absolute strain magnitudes among facial regions remain approximately constant between models. This relative invariance with age in strain distributions is consistent with the approximate linearity of facial ontogenetic trajectories noted in morphometric studies. As such these findings correspond with expectations from the functional matrix hypothesis. This study has examined only two individuals but it points the way for future research, using larger samples, to examine the links between strains, growth and development of craniofacial form. In turn the knowledge gained from such studies will be relevant to explaining the transformations in hominin craniofacial morphology during evolution.

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Poster Presentation Number 113, Sa (17:00-19:00)

## New Dental Remains From the Middle Paleolithic Layers of the Chagyrskaya Cave, Altai Mountains

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Mousterian habitation horizons associated with Neanderthals were discovered in Okladnikov cave in northwestern Altai in Siberia. The presence of Neanderthals in the Altai was convincingly supported by the results of DNA sequencing (Krause et al., 2007). In 2007 S.V. Markin discovered Middle Paleolithic habitation horizons at another site – Chagyrskaya. In 2008–2009 the lithics from that cave were shown to be similar to those from Okladnikov Cave (Derevianko, Markin, 2011). Among the first dental remains from Chagyrskaya there was a specimen that we identified as a lower deciduous canine crown (Buzhilova, 2011). While being relatively gracile, it resembles Neanderthal deciduous canines in shape. In the same year, B.T. Viola (2011), who studied two permanent teeth from Chagyrskaya, attributed them to Neanderthals. Later, a preliminary analysis of a partial mandible with the right corpus and a canine, two premolars, and molars was published (Viola et al., 2012). It was possible to detect anterior fossae and midtrigonid crests on molars, and metaconids and crests on premolars – features typical of Neanderthals according Bailey (2002, 2005). For today human remains from Chagyrskaya represent several individuals. The total number of fragments includes some 25 skeletal fragments representing one or several adults, two fragments representing immature individual(s), two deciduous teeth, ten isolated permanent teeth, a left maxillary fragment with two molars and a partial mandible with the right corpus and five teeth. The minimal number of individuals was evaluated on the basis of the robusticity and the teeth wear. The preliminary examination revealed a numerical predominance of the left side among the postcranial fragments found in 2011. Fragments of right postcranial bones were discovered in 2012. Possibly they all represent one and the same adult individual. Therefore at least two immature individuals and three young adults are present in the sample from Chagyrskaya. Deciduous teeth: Deciduous two canines are rather well preserved and suitable for study. They are probably from one and the same child. The teeth link the Chagyrskaya child with European Neanderthals. Permanent teeth: Except the mandible, other dental remains include three lower and two upper incisors, and canine. Unfortunately their poor preservation prevents us from assessing their taxonomic affinities. The preserved roots are short and robust. Their length places these individuals between Neanderthals and Upper Paleolithic humans (Bailey, 2005). The crowns are nearly entirely worn away. One incisor displays a lingual cusp, which is rather frequent in Neanderthals (Bailey, 2002). The canine is robust. Because of the poor preservation of crown only VLD of the tooth were analyzed. With regard to VLD the canine is close to the European Neanderthal average. The root length of the first mandibular premolar falls within the variation ranges of both European Neanderthals and Upper Paleolithic humans. The MDD of P3 linking the former with European Neanderthals. The second premolars P4 is closest to Neanderthal teeth. The root length of the right and left M2 approaches maximal values in European Neanderthals, suggesting that the individual(s) were Neanderthals. Thus new fossils from Chagyrskaya reveal mostly a Neanderthal trait combination.

Acknowledgements: I am thankful to A.P. Derevianko M.V. Shunkov, and S.V. Markin for the permission to study Neanderthal dental remains from the Altaian caves. My sincere gratitude is due to T.A. Chikisheva, who conducted a preliminary analysis of teeth from recent excavations. I am thankful to B.Viola for the collaboration in the study. Supported by RFBR grant no. 13-06-12035.

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Poster Presentation Number 131, Sa (17:00-19:00)

## When carnivores attacked Neanderthals... Past and present forensic evidences

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Among the evolution of primate behaviour, morphology and even social structure, predation is assumed as a fundamental influence (Cheney and Wrangham, 1987). In this sense, predation deterrence has been pointed as an element with a high sociobiological impact on the origin of human condition (Fay et al., 1995) and had an enormous potential to study human behavioural changes (Brain, 1981). Although carnivore attacks on hominids have been inferred since early periods of human evolution, we focus on Neanderthals due to the high interaction that can be evidenced during the Late Pleistocene between this human group and large carnivores. This high degree of interaction has different forms such as dependency (scavenging), confrontation (carnivore hunting), competition for caves and exploitation of common preys. All situations generated mutual pressures that could have ended in violent encounters between Neanderthals and carnivores. The study of direct confrontation between hominids and large carnivores is something difficult to evidence, especially if only paleoanthropological or archaeological remains are studied. In the present contribution we intent to approach to this violent interaction by using new methodologies such as extant forensic evidences. The objective is to infer Neanderthal-carnivore direct confrontation during the Pleistocene, which is important to understand behavioural changes through human evolution. The implication of this specific interaction with carnivores is evaluated as a potential base to recover human behaviour and social organization patterns. The observation of current carnivore attacks has proven its potential (Ambarli and Bilgin, 2008; Rasool et al., 2010). This interaction can be reflected in skeletal permanent pathologies and bone damages. Some of these bone modifications could have been the result of serious wounds generated during a dangerous encounter with different carnivore species. To observe which pathologies and bone modifications are produced in such encounters and thereby recognise them in the archaeopaleontological record, we studied well documented forensic cases of nowadays attacks. In the present poster, we compare our forensic survey on human-carnivore extant dangerous encounters, with various fossil human remains from the Iberian Peninsula. Our results support the hypothesis that Neanderthals could have been potentially involved in dangerous encounters with large carnivores during Pleistocene. Direct interaction between *Homo neanderthalensis* and carnivores such as ursids, felids or canids has significant implications in the explanation of Neanderthal behaviour and social organization patterns. In this sense, by analyzing such direct interaction, issues related to ecosystem adaptation and pressures, sexual labour division or differences and similarities with other *Homo* forms such *H. sapiens* can be approached.

Acknowledgements: We would like to express our gratitude to R. Vallender (Canadian Wildlife Service), V. Santucci (National Park Service, USA), J. Jordá (UNED), A. Sanchis (MPV) and C. Díez (UBU) for their facilities so this research could be developed. Many thanks to the following institutions: Museo Arqueológico Provincial de Huesca; Museo de Burgos and Museu de Prehistòria de València. This research received the financial support of a research grant from the Ministerio de Economía y Competitividad (HAR2010-19957). Edgard Camarós is a FI and BE pre-doctoral research fellow from the AGAUR (Generalitat de Catalunya).

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Poster Presentation Number 88, Sa (17:00-19:00)

## The Parietal Lobe and Human/Neanderthal Behavioral Differences

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Recent morphological cranial analyses suggest that anatomically modern *homo sapiens* (AMHS) and Neanderthal brains may be different in important ways, despite being very similar in overall size. Neanderthals appear to exhibit smaller temporal lobes and narrower prefrontal lobes than do AMHS, as well as relatively smaller cerebellum. Furthermore, AMHS show pronounced parietal bossing in the skull while Neanderthals do not. Such differences are evident in infancy, along with findings that skull shape difference between the two species at birth. Here I draw on recent findings from human neuroscience to discuss the potential behavioral implications of such putative brain differences, especially that of the parietal lobe. The parietal lobe has long been associated with somatosensory integration, suggesting potential differences in bodily awareness between Neanderthals and AMHS. Moreover, recent finding indicate that it is the temporo-parietal junction (TPJ) that integrates bodily information with cognition into a sense of self and a corresponding self/other distinction. The TPJ is also critical in the development of cognitive perspective taking. Finally, recent results indicate parietal-frontal connections in humans that are not present in chimpanzees and macaques. On the basis of these results, I suggest differences in the size and connectivity of the parietal lobe may have led to demonstrable differences in the cognitive, social and social behavior of Neanderthals and AMHS. Recent archeological findings have narrowed the distinction between many aspects of AMHS and Neanderthal subsistence behavior. However, the relative lack of artistic production attributed to Neanderthals points to a substantive cognitive difference between AMHS and Neanderthals. Differences in self-representation between the two species would have important implications for social behavior. Without full blown mental representation of others, Neanderthals would have relied more on empathetic emotional connections to maintain local group cohesion, and may have been likely to see other groups as foes. AMHS, on the other hand, would have been able to form a wider and more flexible array of relationships with non-group members, through the use of representational categories in addition to embodied emotion. Direct evidence for developmental differences between Neanderthal and AMHS in the parietal lobe and its connections with the frontal lobes may well be difficult to obtain. However, the timing of life history markers, such as weaning, skull growth and dental maturation may provide important evidence about cognitive and behavioral maturation in Neanderthals. The development of self-representation in living humans appears to occur around the age of weaning, when the first molars initiate development. Full blown theory of mind is associated with the onset of middle childhood, a period defined by the end of brain growth and the eruption of the first molar. Closer attention to life history markers in Neandertals and their relationships to one another may help to understanding if, in addition to the documented differences in shape, the overall timing of brain maturation is shortened in Neanderthals relative to AMHS allowing less time for enculturation during childhood.

Poster Presentation Number 47, Fr (18:00-20:00)

## Wildfire and A Landscape of Fear: A new approach to examining the initial uptake of fire by plio-pleistocene hominins

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The nature of the evolutionary drivers for the initial uptake of fire-use strategies and behavioural adaptations by Plio-Pleistocene hominins remains a hotly contested topic. Preliminary data from this Landscape of Fear (LOF) analysis provides an exciting new dimension to this subject area. It has been known for some time that foragers live in a landscape of ‘fear’. How external factors and environments alter levels of fear can have major repercussions on foraging strategies. A growing body of literature shows that: i) The costs of predation can be big and comprise the forager’s largest foraging cost; and ii) Seemingly small changes in habitat can lead to large changes in the risk of predation. Vigilance is one way to manage ‘fear’ and plays a key role in primate foraging strategies. Vigilance can reduce an organism’s predation risk but also has a price (e.g. reduced feeding rates). Each forager must invest sufficient resources (i.e. time not foraging) in vigilance to negate predation risk. In general, vigilance should increase with a forager’s expected encounter rate with predators. In higher primates slow growth rates and long per generation times do not allow for the underestimation of the risk of predation, as on an individual and species level the costs of predation are too high. However, especially for ‘K’ strategists, overestimating the chances of predation will result in a loss of fitness as too many resources are invested in vigilance; therefore investing the correct amount of resources in vigilance must be a key part of any hominin foraging strategy. This is particularly true for early *Homo* as archaeological data shows a trend of increasing parental investment over time. Any way to effectively minimise investments in vigilance without increasing risks of predation will provide significant benefits. In this poster the results from experimental archaeological field research undertaken in the United Kingdom and South Africa over the past 2 years is presented integrated with new data extracted from extant hominin populations that together, in a LOF analysis, can be seen to ‘open a new front’ in this ongoing debate.

Acknowledgements: Prof. John Gowlett from the University of Liverpool for support and advice, and the AHRC (Arts and Humanities Research Council) for financial support for my PhD.

Poster Presentation Number 70, Fr (18:00-20:00)

## The first petrographic determination of *grain de mil* flint from the Aquitaine Basin of South-western France: a new key to understanding Palaeolithic social organisation

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The particularly rich Palaeolithic record of the Aquitaine Basin and its well-documented lithic raw materials, including high-quality sources in the Bergerac region (Dordogne), have led to the proposal of various models of raw material provisioning territories and management strategies. This is especially the case for the Upper Palaeolithic of the region. In terms of this *Bergeracois* flint, an east-west circulation pattern was initially documented in the northern Aquitaine Basin (Demars, 1982), followed more recently by evidence for transfers across the entire region (Bordes et al., 2005). Another type of high-quality flint known as *grain de mil* has been documented from numerous Middle and Upper Palaeolithic sites across the Aquitaine Basin during the last thirty years (Simonnet, 1985). Several sources of this material have been identified in the north-west Aquitaine Basin near Jonzac (Charente-Maritime) and attributed to supposed Conacian or Santonian (Upper Cretaceous) deposits (Bordes, 2002; Simonnet, 2007). Although these geological formations are present along the entire north Aquitaine carbonate platform, it remains uncertain if the *grain de mil* flint has a unique north-west origin linked to a specific Coniacian or Santonian facies from Charente-Maritime, or if an identical type can be found along with other Upper Cretaceous flints to the south-west in the Dordogne. Here we present preliminary results of a comparative petrographic study based on surveys of over forty raw material sources in both the Charente-Maritime and Dordogne combined with analyses of flint samples at middle to high-powered magnification (grain percentage, sphericity and roundness, micropaleontological data) in order to determine criteria for distinguishing flint from the two regions. Not only have several such criteria already been identified, but two different flint types gathered under the name *grain de mil* in the Charente-Maritime have also been discerned: flint from Jonzac and flint from Pons-Saintes. Based on these observations, we present a set of criteria for recognising these types of *grain de mil* flint from archeological contexts. This methodology has already proved successful in a recent analysis of raw material from the Early Aurignacian open-air site of Régismont-le-Haut (Hérault) where the presence of *grain de mil* flint from Jonzac indicates transport distances of nearly 400km. Flint from Bergerac, also present at Régismont-le-Haut, presents comparable qualities and dimensions as Jonzac flint, but the *grain de mil* sources are located some 100km further to the north-west on the northern side of the Dordogne, Isle and Dronne Rivers. The simultaneous use of these two important raw materials provides new insights for understanding how and why different raw materials circulated, and in doing so, enhance current models of raw material economies and territories in the Aquitaine Basin.

Acknowledgements: I would like to thank Jean-Guillaume Bordes for his direction of my doctoral research of which this study forms a part and François Bon for having granted me access to the material from Régismont-le-Haut. I am also grateful to PACEA (<i>De la Préhistoire à l’Actuel: Culture, Environnement et Anthropologie</i>) laboratory, the <i>Ecole Doctorale Sciences et Environnement</i>, and the University of Bordeaux 1 for financial support as well as the Regional Archaeology Services of the Poitou-Charentes and Aquitaine for financing the geological surveys.

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Poster Presentation Number 153, Sa (17:00-19:00)

## The Neanderthal behaviors from a spatio-temporal perspective: an interdisciplinary approach to interpret the archaeological assemblages

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The reconstruction of human behavior is the main goal of Palaeolithic Archaeology. To interpret the archaeological assemblages and the activities developed, homogeneous and high resolution corpus of information are needed, especially to place them in time and space. The way to achieve this aim is using a variety of precise analytical methodologies from an interdisciplinary point of view. The objective of this presentation is to reconstruct the Neanderthals subsistence behaviors from a spatio-temporal perspective. The work is focused on obtaining more detailed and precise data that allow to study differentiated individual events of activities (ethnographic time scale) (Bailey 2007, Vaquero 2008, Carbonell (ed.) 2012) developed at the domestic activity areas (Vaquero and Pastó 2001). For this purpose we propose to combine different disciplines that are usually considered separately: zooarchaeology, taphonomy, tooth wear analysis, lithic technology, raw material units, fauna and lithics refits, archaeostratigraphy and intra site spatial patterning. The selected archaeological sample comes from level O of the Abric Romaní site (Barcelona, Spain) dated around 55 ka. The fauna and lithics remain belong to the domestic activity area called O10 (25 m<sup>2</sup>). This area was identified through the archeostratigraphic and spatial analysis. - Taphonomic analysis shows that Neanderthals were the main agent in the modification and the displacing of archaeological remains. - Faunal and lithic refits suggest synchronicity between many remains inside the activity area O10, and also between some remains from this area and other activity areas (connection refitting line of more than 10 m). However the archaeostratigraphic analysis shows a certain diachrony inside the area O10. The upper layer is dominated by lithic remains while the lower layer is dominated by small calcined bone fragments. The separation between these two layers can be distinguished in the center of the accumulation (where the combustion areas are located), but not in the surrounding zones. - Zooarchaeology proposes that animal resources were obtained mainly for food purposes (presence of cutmarks, diagnostic elements of anthropogenic bone breakage, etc.). Nevertheless, the record from the lower layer of the area O10 suggest a specialized use of this space, related to the use of fire. Thus, it is possible that the area was used as a cleaning zone or/and that bones were used as fuel complementing wood resource. - Lithic technological and refitting analysis indicates three kinds of connections lines: production-sequence, breakage and retouch refits, that show the technological activities developed at this area. The vertical distribution of the connection lines between refits and conjoins points shows a very clear dynamic: they follow the slope of the spatial patterning of the material assemblage. In the other hand the direction of refitting indicates intentional movements that performed by Neanderthals groups in the rockshelter. Combining the data provided by the different methodologies allow to identify and characterize domestic areas that correspond to specific events of human activity, identifying the temporal dynamics in the formation of the archaeological assemblage. Because this study focuses only on a single activity area, some proposed disciplines (tooth wear analysis) have failed to fulfil all their potential. Further studies, including all the activity areas identified at level O (12 areas in total), will provide sufficient sample to develop new analysis and therefore to obtain higher resolution data on the human occupation in the Abric Romaní 55 ka ago.

Acknowledgements: Excavations at the Abric Romaní are carried out with the support of the Departament de Cultura de la Generalitat de Catalunya, Ajuntament de Capellades, Oficina Patrimoni Cultural-Diputació de Barcelona, Tallers Gràfics Romanyà-Valls, Bercontrés-Centre de Gestió Medioambiental SL, and Constructora de CalafSAU. The Generalitat de Catalunya provides financial support to the Research Group in Quaternary Human Autoecology (2005SGR-00702). Special thanks are for the Abric Romaní field team that 2012 commemorated their 30 years of excavation on the site. This research project HAR 2010-19957/HIST received the financial support of the Ministerio de Economía y Competitividad (MINECO). M.G. Chacón has been supported by a postdoctoral grant from the Juan de la Cierva Subprogram (JCI-2010-07863, MINECO). M.J. Gabucio was beneficiary of an FI Grant from the Generalitat de Catalunya and financed by the European Social Fund from January 2010 to January 2013.

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Poster Presentation Number 39, Fr (18:00-20:00)

## Virtual biomechanical analysis of the lower limbs of a Neandertal

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The aim of the study was to create and biomechanically analyse a three-dimensional (3D) musculo-skeletal reconstruction of the lower limbs of the Spy II Neandertal. Missing bones or bone parts were mainly reconstructed by mirroring the bones of Spy II. Other bones were reconstructed using Neandertal specimens scaled to the size of Spy II using an original developed scaling method. Computed Tomography (CT) scans of bones were analysed to create 3D bone models from medical imaging data. Standardised anatomical landmarks (ALs) were palpated on well-defined bony landmarks. ALs were then used for spatial scaling transformations between bones using a validated registration method which tracked the dispersal of ALs following the various geometrical transformations in which models were processed. Major muscle insertion and origin site ALs were palpated based on the complete dissection of an anatomically modern human to determine correct muscle attachment sites although were defined according to the morphology of the reconstructed Neandertal model. Muscle attachments ALs were used to simulate the muscle's line of action. Wrapping surfaces in the form of parametric objects were used to define certain muscle paths. Motion analysis systems including stereophotogrammetry (Vicon) and markerless cameras (Microsoft Kinect) were used to capture human movements from volunteers. The same set of standardised ALs were created on human volunteers as on the reconstructed Spy II Neandertal model. The Neandertal model was fused via the AL data set to the obtained kinematic data and used to calculate range of movement in the knee and hip joint and major muscle moment arms. In contrast to static models, which have a single value for moment arms, this method enabled moment arms to be analysed simultaneously with joint angles. Biomechanical analysis was performed in the open source musculo-skeletal software package called 'lhpFusionBox' which was developed at the University of Brussels. The software was originally developed for biomechanical analysis of modern day humans in clinics although has recently been adapted for the study of fossil hominid locomotion. The results seem to demonstrate that Neandertal bone morphology, joint orientation and movements were similar to anatomically modern humans. In contrast, moment arms were greater than anatomically modern humans due to the robusticity of Neandertals and this may have enabled a greater mechanical advantage.

Acknowledgements: We thank Gilles Berillion , Isabelle Crevecœur and Hélène Rougier for their work on the re-analysis of the Spy II material. We thank Bruno Bonnechère for his assistance with kinematic modelling. We also thank Mr. Hakim Bajou for his technical assistance and the team at the Radiology Department of the ULB Erasme Hospital for scanning the fossil material. CT scans from the Spy fossils are available on request from the Nespos database (<http://www.nespos.org/>).



Podium Presentation: Session 12, Sa (15:00)

## Accessing hominin cognition: a case study in the British Lower to Middle Palaeolithic

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Exploring the link between material culture production, hominin cognition, behavioural complexity and the development of language form some of the central tenants of Palaeolithic archaeological discourse. This paper aims to bring these components together by utilising a new theoretical perspective regarding hominin identity construction and the use of material culture in the story of language development – the identity model. The identity model proposes that in order for material culture to be imbued with symbolic social meaning, not only is a theory of mind (or second-order intentionality) essential, but it also must be superseded by a third-order of intentionality at a minimum. This premise will be examined using data pertaining to handaxe manufacture from the British Lower and Middle Palaeolithic in an effort to shed new light upon the cognitive landscape of ancient hominins. Within Palaeolithic studies, standardisation in tool manufacture has long been seen to indicate a sense of cultural affinity and a relatively high degree of cognitive complexity within Pleistocene hominins. Furthermore, it has been assumed that the instances of artefact standardisation, and specifically handaxe symmetry, must increase through time. However, the presence of standardisation within Lower to Middle Palaeolithic assemblages has never really been satisfactorily quantified. The aim of this paper shall be to consider the presence of symmetry present within bifaces from the British Lower to Middle Palaeolithic in order to assess the cognitive potential of Pleistocene hominins in relation to the Social Brain Hypothesis (SBH) as evidenced through the behavioural record. The method of analysis follows McNabb et al (2004) with a total sample of some 2680 handaxes. It is proposed that although hominins paid attention to form within manufacturing processes, on the whole they may not have realised the full potential of such a gaze to consciously off-load social interactions and culturally meaningful signals onto the material culture with which they interacted.

Acknowledgements: This paper was based on my Ph.D thesis supported by a full grant as part of the British Academy Centenary Project ‘From Lucy to language: the archaeology of the social brain’ and I will be eternally grateful for the time, intellectual consideration and financial support graciously given by the project and it’s three directors, Clive Gamble, Robin Dunbar and John Gowlett. I would also like to thank Francis Wenban-Smith and Rob Hosfield for many interesting and engaging discussions relating to the study of handaxes during the course of my PhD and beyond. Special mention should also go to John McNabb and William Davies whose unceasing guidance through my thesis proved more valuable than I can possibly say.

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Poster Presentation Number 96, Sa (17:00-19:00)

## The Pontnewydd Pleistocene hominin remains and their morphological affinities

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The Pontnewydd Pleistocene hominin remains and their morphological affinities - Tim Compton & Chris Stringer Pontnewydd Cave is in the Elwy Valley of North Wales. It was excavated by a team led by Stephen Aldhouse-Green between 1978 and 1995. Pleistocene deposits containing archaeological material consist of two debris flows - Upper and Lower Breccia. The Lower Breccia, containing the hominin remains, is capped by a stalagmitic floor that has been dated at 225 ka using uranium series dating, and burnt flint artefacts within the Lower Breccia have been dated at 197 ka using thermoluminescence dating. The associated fauna is consistent with an MIS 7 age, and direct ESR dates mostly fall in the range 200-260 ka. The 17 hominin teeth (plus a tooth fragment) discovered in the Lower Breccia and associated deposits represent a minimum of five individuals with age estimates, based on late Neanderthal development criteria, as follows – an 8.5 year old, a nine year old, an 11–11.5 year old, a young adult (14–16 years) and a mature adult. Based on tooth sizes, the individual with an estimated age of nine years (with two teeth) is possibly female and the remaining individuals possibly male. The maximum possible number of individuals represented is sixteen; nine juveniles/adolescents and seven adults. Two teeth were found in position in a maxillary fragment, the remainder being isolated finds. All posterior permanent teeth are represented other than upper third premolar, and most only have slight wear. The crown areas of the two smaller (possibly female) teeth are small compared with the mean crown areas of teeth from the major early Neanderthal site of Krapina in Croatia. The crown areas of the remaining teeth are large compared with most European later Middle Pleistocene teeth and similar to the mean values of Krapina. The crown indices of the Pontnewydd teeth fit better with later Middle Pleistocene material (including the site of Atapuerca-SH in Spain) and Krapina teeth than with earlier specimens. Certain morphological traits in the Pontnewydd teeth show clear Neanderthal affinities that in most cases relate the teeth to those from Atapuerca-SH, whilst differentiating them from earlier Middle Pleistocene European hominins (Arago, Mauer, Petralona, Visogliano). 1 Lower lateral incisor • Marked lingual inclination of the buccal surface. 2 Lower third premolar • Tip of buccal cusp placed lingually • buccal cingulum absent • multiple lingual cusps present. 3 Lower fourth premolar • Mesiobuccal swelling absent • distinct mesiolingual flattening. 4 Upper molars • Relative size and distally swollen shape of first molar hypocone intermediate between earlier Middle Pleistocene hominins and later Neanderthals • hypocones smaller than grade 3.5 found on third molars • cusp 5s smaller than grade 4 present. 5 Lower molars • Anterior foveae all larger than grade 1 • mid trigonid crests present on first and second molars • protostylids above grade 1 present. Further details from Compton & Stringer 2012.

**References:** Compton, T. & Stringer, C. (2012). The human remains. In (S. Aldhouse-Green, R. Peterson, & E. Walker, Eds) *Neanderthals in Wales: Pontnewydd and the Elwy Valley Caves*, pp. 118-230. Oxford: Oxbow Books.

Podium Presentation: Session 10, Sa (13:20)

## Bifacial technology at Sibudu and its implications for our understanding of the Still Bay

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The Still Bay phase of the southern African MSA has often been viewed as being limited to a narrow period around 70-75 ka BP. Much current research on the southern African MSA addresses the nature and tempo of cultural change and considers the implications that the Still Bay has for our understanding of the emergence of advanced patterns of cultural behavior. Ongoing excavations by the University of Tübingen at Sibudu in KwaZulu Natal Province of South Africa have exposed a number of new stratigraphic horizons at the base of the sequence from the deep sounding. The results of our most recent fieldwork show that bifacial technology and numerous Still Bay points are found in the lowest stratigraphic units at the site. These layers underlie what has previously been described as Still Bay and “pre-Still Bay” deposits. The newly excavated strata are not yet dated, but they must significantly predate the age of 77 ka BP attributed to deposits near the base of Lyn Wadley’s excavation at Sibudu. In this paper we characterize the nature of the bifacial technology of the site. This work suggests that Still Bay bifacial technology is not limited to a narrow chronofacies but instead is part of a behavioral repertoire that has a longer history than previously assumed. The deposits containing bifacial tools and shaping flakes from their manufacture include multiple strata and reflect a degree of functional variability. From our point of view, the stratigraphic context of bifacial technology during the MSA, as documented at Sibudu, is more complex than has often been argued in the past. This work erodes the notion that Still Bay technology and tools are restricted to a narrow chronological phase of the southern African MSA.

Poster Presentation Number 81, Sa (17:00-19:00)

## Fetal development of the modern human chin: The 3D shape variation is bounded to spatial arrangement of the hyoid bone, the tongue and suprahyoid muscles

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The inverted T-relief shape of the modern human chin (Schwartz and Tattersall, 2000), appears during fetal development (Schwartz and Tattersall, 2000; Coquerelle et al. 2010). Nevertheless, the craniofacial context and factors linked with symphyseal shape during chin development are unclear. During postnatal life, the symphyseal shape changes are highly correlated with the spatial arrangement of the back of the vocal tract, the hyoid bone, the tongue, and the suprahyoid muscles. Using geometric morphometric methods, we test whether the prenatal appearance of the inverted-T shape relief of the labial surface is bounded to the same factors. The sample consists of 3D reconstructed jaw-basicranium-cervical skeletons from 23 high-resolution MRI scanned human fetuses, which range in age from 12 gestational weeks (gw) to term, and 3 CT-scanned neonates prior to 1 month of age. On each specimen, we digitized 679 semi-landmarks including the tongue and geniohyoid muscle insertions at the lingual side of the symphyseal fibroblastic midline as well as the tongue outline. We converted the coordinates to shape-variables by Procrustes superimposition to analyze the average ontogenetic shape changes associated with the inverted T-relief. Our results show that from the 12th to 14th gw the mandibular shape changes dramatically when the head flexes towards the throat and the lateral basicranium grows centripetally. The pharynx, the hyoid bone and the basal tongue become superiorly more deeply enclosed within the oral cavity. At the same time, the symphysis changes from convex anteriorly to vertical as its height increases at the area of the muscle insertions. The basal part of the fibroblastic midline becomes even more prominent relative to the parasagittal bony structures. From the 14th to 17th gw, the basal part of the symphysis projects forwards simultaneously with the posterior inclination of the hyoid bone and the flattening of the tongue. From the 17th to 20th gw, the basilar part of the symphysis relocates underneath the alveolar region, which is very bulged near the canine, simultaneously with the backward and downward positioning of the muscle insertions that follow the descent of the hyoid bone and the base of the tongue down the throat. The mental fossae deepen; the vertical and inferior symphyseal margins sharpen forming the real ridges outlining the inverted T-relief. From the 20th gw to birth, the symphyseal shape does not change substantially. Our results confirm that the development of the inverted T-relief is bound to the space at the back of the vocal tract and the arrangement of the tongue and suprahyoid muscles. The earlier symphyseal shape changes including the fibroblastic midline are similar to those observed in infants after birth. This provides further evidence that the postnatal prominence of the mental region is not particularly related to mastication or speech but is an adaptation to spatial adjustments and constraints. Funding: Fyssen Fondation (to MC); CGL 2012-37279 (to MB; Spanish Ministry of Economy and Competition), Cátedra Dental Implants and Biomaterials SA (to JCPF).

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Poster Presentation Number 114, Sa (17:00-19:00)

## Evolutionary History And Biological Diversity Of *Homo Sapiens* In Southeast Asia: Contour Shape Analysis Of Modern Human Upper Molars

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The evolutionary history and the pattern of biological diversity of modern humans in Southeast Asia has long been regarded as resulting of two major migrations waves. In this hypothesis it is generally considered that a first wave of migration (generally referred as “Australo-Melanesians”) reached Australia around 60000 BP while the second wave (often referred as “Mongoloids”) is correlated to a demic diffusion of the Neolithic from a Southeast China homeland which started around mid-Holocene. Alternative models take into consideration (i) only a single primary wave of migration followed by various local evolutionary processes or (ii) multiple population migrations in Southeast Asia since the Upper Pleistocene (often highlighting the importance of environmental factors -especially eustatism - for the dynamic of expansions). However, the situation seems to be more complex if we take into account the proposition emanating from recent genetic results of a certain amount of interbreeding between “Denisovans” and the ancestors of some Australasian modern human populations. Size and shape of human teeth have a high degree of heritability, and the comparative analysis of the 2D crown contour shape of modern human permanent molars combines the advantages of: (i) a large sampling of archaeological specimens and (ii) the use of methods which allow detecting and quantifying low intraspecific morphological variations. The present study includes 1537 molars of modern humans from Mainland and Island Southeast Asia, Australia and Melanesia. This includes 661 archaeological specimens from various chrono-cultural periods spanning from the Upper Pleistocene to the sub-actual time periods. The quantification of crown contour shapes is performed by Elliptic Fourier Analyses. Principal component analyses and discriminant analyses are used to investigate patterns of morphological variation, while phenograms depict the phenetic affinities between the different groups. Design matrices modelling the main hypotheses of settlement (by integrating geographic and chronological distances between predefined human groups) are also elaborated and tested against morphometric distances. The results confirm the complexity of the evolutionary history of modern humans in Southeast Asia. The morphological variability observed in the sample is not compatible with models based on two major migration waves, nor with those taking into account only local evolutionary processes. The scenario privileged by our results favours several important population movements since the Upper Pleistocene. The frequency, extension and genetic impact of the different waves were apparently strongly influenced by eustatic variations. Cultural innovations and diffusions are potentially important factors as well, as shown for example by the morphological changes which are significantly correlated with the spread of Neolithic in continental Southeast Asia. Local evolutionary processes played also a major role as evidenced by the significant correlation between geography and morphological variation at a broad scale. Our results also bring very interesting perspectives concerning the detection of the signature of a possible Denisovan admixture in the phenotype of modern human populations. Indeed, past and recent modern human groups which are hypothetically sharing Denisovan ancestry have closer phenetic affinities with each other than with other populations.

Acknowledgements: We also acknowledge SYNTHESYS, IUSS-Ferrara 1391 and the UMR 7194, Department of Prehistory of the Muséum national d'Histoire naturelle for the financial supports.

Poster Presentation Number 147, Sa (17:00-19:00)

## Behavioural ecology, social carnivores and Neanderthal spatial behaviour

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The spatial behaviour of Neanderthals has been characterised as limited in area but with a high frequency of movements when compared to modern humans (Féblot-Augustins 1999, MacDonald et al. 2009). This pattern corresponds to high residential mobility as characterised by Binford (1980). However, foraging models based in behavioural ecology predict that the opposite pattern is more efficient where resources are variable in time and space. Neanderthals successfully inhabited a variety of environments but extended their range into both northern and eastern Europe where subsistence resources would have been highly variable in their availability. In these areas a pattern of long distance moves of low frequency should be expected. Rather than suggesting Neanderthals were not as efficient in their foraging strategies as modern human, it is argued here that a clearer picture emerges when our framework for interpreting mobility is challenged. Extant hunter-gatherers are often used as an analogue to understand mobility patterns and are sometimes contrasted with other animals, but this dichotomy neglects important similarities and is often based on simplistic characterisations. Focussing on the subsistence challenges faced by Neanderthals, the mobility patterns of large social carnivores in seasonal environments are analysed. The spatial behaviour identified supports the general patterns predicted by foraging theory. However, contrary to assumptions, social carnivores rarely follow migratory prey and even in highly seasonal environments are often tethered to places or areas. In a similar manner to human hunter-gatherers, long-distance movements are often avoided in favour of fallback foods and a more logistical strategy. Whilst humans are not limited by the immobility of multiple young to the same degree as some carnivores, they experience a spatial tether due to a similar investment in place. Investment may be to secure resources, including shelter, or to coordinate the exploitation of multiple resources. These differences can alter mobility patterns in a predictable way, as well as influence whether a specific site as opposed to an area becomes a tether and is reused. Using this detailed analysis of spatial behaviour a specific pattern of movement is predicted for Neanderthals in the Late Pleistocene ‘mammoth steppe’. An understanding of why and how spatial strategies vary in other animals is argued to provide a wider integrative framework to interpret archaeological data than is currently used, without the need to invoke human-specific capacities.

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Poster Presentation Number 86, Sa (17:00-19:00)

## Turning on the 'radiator': numerical modeling analyses to test an old and elusive theory

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It is well known among biologists that brains are expensive organs that require large amounts of energy for their development, maintenance and function (Mink et al., 1981). Moreover, as a large proportion of the cerebral energy budget is lost as heat, metabolic heat production is also a basic energetic feature characterizing nervous systems (Bertolizio et al., 2011). Considering that slight brain temperature variations may compromise cerebral structure and function, the ability of an organism to efficiently remove the excess of heat produced by its neural tissue seems to have played an important role in the evolutionary history of any species. In this context, heat removal from the brain is mainly performed by the vascular system, although other factors may also be relevant in this regard. In this context, it has been hypothesized that brain size evolution in the genus *Homo* was possible in part due to the coevolution of a more complex and efficient vascular network. The so called 'Radiator theory' (Falk, 1990) proposes a brain cooling mechanism which is based on the collateral circulation of blood flow between the outside of the skull and the endocranial cavity through perfusion of the emissary, diploic and meningeal vessels, as well as the venous sinuses. It is worth noting that the meningeal and diploic vascular systems are significantly more developed and ramified in modern humans than in other fossil hominids or great apes (Bruner et al., 2005; HersHKovitz et al., 1999). These autapomorphic traits are independent of size variation, suggesting that some physiological adjustments may be also related to non-allometric changes in brain shape. However, in vivo quantitative studies on brain temperature and its regulation are rather scarce and, when available, they provide contradictory and inconclusive results to test these hypotheses. In the present study we used a numerical modeling approach (Bruner et al., 2011; 2012) in order to investigate how cerebral geometric changes (ie. size and shape) may influence the endocranial heat dissipation patterns in modern humans and fossil hominids. Quantitative comparisons between taxa were performed using traditional multivariate techniques and functional data analyses (FDA; Ramsay and Silverman, 2005), while mapping of the thermal loads allowed us to localize these differences directly on the endocranial surface. We quantified and compared thermal loads in different hominids beyond estimations based on size alone, and considering the whole form to evidence the effect of brain size variation. While heat dissipation patterns in fossil species seem to share a common allometric trajectory, we found that, at similar cranial capacities, modern humans display higher thermal loads. After visual inspection of the thermic maps, these non-allometric differences were localized at the level of the cranial base as well as on the parietal lobe surface, regions that have been repeatedly associated with endocranial globularity in modern humans. Implications of these findings and its relation to the radiator theory are discussed accordingly.

Acknowledgements: We thank the staff from EVAN society, NESPOS, Italian Institute of Human Paleontology (Rome) and Foro Italico University from Rome for access to the material under their care. This study was funded by the Spanish Ministry of Science and Innovation (Grant Number: CGL2009-12703-C03-01/02/03), Junta de Castilla y León (Grant Number: GR-249), Gutiérrez Manrique Foundation (Programa Jóvenes Excelentes 2012), and the Italian Institute of Anthropology.

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Poster Presentation Number 148, Sa (17:00-19:00)

## Had Neanderthals a modern behaviour? Hominid-carnivore experimental approach

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Interactions between hominids and carnivores are well documented during the Pleistocene. Along human evolution, carnivores have played an important role and even some scholars talk about a co-evolutionary process between the genus *Homo* and large carnivores (Brantingham, 1998). It is well known that during the Middle and Late Palaeolithic, Neanderthals have shared alternately with carnivores the use of caves to inhabit, hunted common preys in the same habitats, and generated other mutual pressures that have influenced human behaviour or difficult its archaeological study. The aim of our experimental project with extant large carnivores such as bears, hyenas, lions and wolves at the Cabárceno Nature Park (Santander, Cantabrian Spain), is to recreate potential Pleistocene scenarios of interaction between hominids and carnivores to develop a methodology to later study Palaeolithic archaeological contexts. To do so, three different experiments where developed. One of them consisted in the performance of a complex fire structure with a hearth related assemblage (lithic artefacts). The other one consisted to observe how bone remains with cut-marks were modified by carnivores, paying special attention to marks superposition (bite mark over cutmarks). The last experiment consisted in the recreation of well defined and spatially structured inhumations to analyze how carnivores modified them. At the moment, experimental results are giving important information to afford the study of complex anthropic spatial organisation and the systematic use of fire (Camarós et al., 2013), scavenging or hunting strategies (primary or secondary access to animal resource), or the isolation of a modern cognition related to inhumation rituals. As experiments developed prove, the interaction between hominids and carnivores has a lot to do in the study of the evolution of human behaviour from the Middle to the Upper Palaeolithic. Acknowledgements: We would like to thank Cabárceno Nature Park and Park's staff for their facilities. This research received the financial support of a research grant from the Ministerio de Economía y Competitividad (HAR2010-19957). Edgard Camarós is a FI and BE pre-doctoral research fellow from the AGAUR (Generalitat de Catalunya).

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Poster Presentation Number 144, Sa (17:00-19:00)

## Understanding Late Middle Palaeolithic Neandertal Landscape-use during Short-Term Occupations in Britain using the pixel difference method and GIS

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The goal of this research was to study a “snapshot” of Neandertal (Middle Palaeolithic) landscape-use and mobility within Britain during Marine Isotope Stage three (MIS3) (c. 60-30ka BP) under short lived climatic conditions at the extent of their Northern range. Following a creation of a definitive gazetteer of all relevant sites and find-spots, a new method for analysing the 2D shape similarity of handaxes was used. Using a single numerical value obtained from the pixel counts of non-overlapping regions of overlaid handaxe silhouettes, the difference in shape between two handaxes can be described. Displaying these values with cluster analysis shows that British Late Middle Palaeolithic (c. MIS3) handaxes are highly variable. However there are examples that exhibit an almost identical 2D shape to one another as well as recurring ”styles”. Using dated examples, definable degrees of similarity are available for the typological dating of British Late Middle Palaeolithic handaxes, including examples of the so-called “bout coupé” which are frequently found without any context. Using a GIS, find-spots can be plotted showing regularity of distribution and regional patterns. This may cautiously permit the visualisation of the movements of Neandertal groups or even individuals in the landscape, allowing understanding of mobility and settlement patterning. Location attribute analysis of find-spots using Shuttle Radar Topography Mission data was less successful but was still able to show a tendency for handaxes to be found close to rivers both vertically and horizontally, regardless of method of discovery suggesting their use as route ways and living environment of Neandertals.

Poster Presentation Number 32, Fr (18:00-20:00)

## The integration of the lower limb diaphyses with body shape: Whole-limb assessment of human variation with implications for the interpretation of Neanderthal behaviour

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Neanderthal fossils are frequently interpreted as possessing a cold-adapted physique, of high body mass, short stature, and relatively wide body breadths. This unique physique, relative to most comparative anatomically modern human populations, presents a challenge to the interpretation of behaviour from the skeleton. It is important to understand and control for the influence of both body size and body shape (relative body breadth) upon the limbs, in order to interpret biomechanical variation. Building upon two recent studies that have assessed Pleistocene lower limb morphology comparatively (Trinkaus & Ruff, 2012; Shaw & Stock, 2013), this paper examines 3D surface scans of 160 femora and 134 tibiae of recent human individuals encompassing a breadth of modern human Holocene variability in both mobility and physique. The influence of body mass and body breadth on the cross-sectional morphology at 1% intervals along the diaphyses of the femur and tibia are examined to investigate relationships between body shape and the mechanical architecture of the lower limb diaphyses. The influence of body mass upon the limb is greatest towards the proximal end of the femoral diaphysis – accounting for more than 80% of all variation in cross-sectional properties at 75% of femur length. The influence of body breadth on the periosteal geometry of the lower limb is strongest in the proximal segment (50-75%) of the femur diaphysis, consistent with biomechanical expectations. Additional influences are also detected towards the distal ends of each of the femur and tibia that may indicate physiological constraint to joint morphology. From these results it is predicted that the best indicators of activity (i.e. sites free from the confounding effects of body shape) may be preserved in the mid- to mid-distal region of the tibial diaphysis. Two predictions arising from this analysis were then tested against published data available for Neanderthal fossils: 1. That the Neanderthal profiles (from proximal to distal) in limb rigidity variables will follow those observed in high latitude human populations, and 2. That high mobility in the Pleistocene ought to be reflected in the mid-to-mid-distal region of the tibia. Neanderthal cross-sectional biomechanical properties (at 5 locations for each bone) were compared to mean profile plots for six human populations derived from 3D surface scans (and having adjusted for the influence of presence/absence of quantification of the medullary cavity in data collection). Whilst Neanderthals display robustness throughout the lower limb, consistent with their physical build (body size and body shape), they are differentiable from the recent human populations at key locations within the limb. In particular, Neanderthals display very high anteroposterior strengthening (Ix) of the mid-tibial diaphysis (35-65%) in line with expectations for extremely high levels of habitual mobility or movement over rugged terrain. Acknowledgements: Funding for this research was provided by Natural Environment Research Council, UK.

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Podium Presentation, Session 10, Sa (14:00)

## Searching for consistencies in Châtelperronian pigment use

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A key question in human evolution is when in prehistory human cultures similar to ours emerged and to what extent we share ‘modern’ cultural traits and cognition with anatomically archaic populations such as Neanderthals. In Europe the evidence supporting the hypothesis that Neanderthals developed cultural adaptations comparable to those associated with later Upper Palaeolithic come from on a handful of sites attributed to the Châtelperronian and Uluzzian technocomplexes. Paucity of meaningful evidence jeopardizes attempts to identify consistencies leading to a consensual scenario. A way to overcome this problem is to enlarge the sample of studied sites and conduct more indepth analysis of relevant archaeological material. Such an approach has been scarcely applied to the cultural components considered relevant in the debate on the emergence of ‘modernity’. This lack of research notably concerns mineral pigments, which play a growing role in this debate (Henshilwood et al., 2002; Wadley et al., 2009). Pigment use is well documented at only one site, the Grotte-du-Renne at Arcy-sur-Cure, where about 18 kg of red, black and yellow pigment were recovered by A. Leroi-Gourhan in Châtelperronian levels (Salomon, 2009; Caron, 2011). Our aim is to present a review of available data on pigment use in the Châtelperronian, and provide new data based on a detailed analysis of material from well documented sites. Literature mining reveals that at least ten other Châtelperronian sites have yielded pigmental material. At two of these sites, Grotte des Fées and Saint-Césaire, the cultural attribution of lumps of pigments found in Châtelperronian levels is uncertain due to the mixed nature of the archaeological assemblages. At six other sites the use of pigmental material by Châtelperronians is warranted. We submitted the fragments of pigment from three of these sites, Roc-de-Combe (Lot), Le Basté and Bidart (Pyrénées Atlantiques), comprising more than 40 pieces, to a microscopic, elemental and mineralogical analysis using multifocus and SEM microscopy, EDS, XRF, Raman and  $\mu$ XRD. Results highlight the use, at Roc de Combe, of a great variety of red and black iron and manganese oxide rich rocks. Almost pure iron oxides were instead used at Le Basté and Bidart. A third of the pieces from Roc-de-Combe and one piece from Bidart and Le Basté bear traces of modification in the form of facets produced by grinding and percussion marks. Our results demonstrate that the Grotte du Renne is not an isolated case and that a consistent use of pigments occurs at Châtelperronian sites located in the Southwestern portion of the known Châtelperronian distribution, which is distant from the purported area of contact with Protoaurignacian and Early Aurignacian sites from Germany, Austria and England under the assumption that the latter were contemporaneous with the former. Observed differences between sites in raw material and amount of pigment may reflect availability, exchange, site function, regional traditions or a combination of these factors. We will discuss these hypotheses by contrasting data on the nature and properties of selected raw materials, processing techniques, and geography of pigment use.

Acknowledgements: This research is supported by a grant from the European Research Council (FP7/2007/2013, TRACSYM-BOLS 249587)

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Poster Presentation Number 152, Sa (17:00-19:00)

## The Disappearance of the Neanderthals: An analysis through demographic parameters modeling

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The Neanderthals are a well-known middle Pleistocene population, which was autochthonous and flourished in Europe during MOIS 6, 5, 4. During the later part of MOIS 3, in the late Pleistocene, Europe was also populated by modern humans originating from Africa and, soon after their arrival, the Neanderthal population completely disappeared in Europe. Despite numerous investigations, the debate concerning their demise is still unresolved. It may be that prior to the arrival of modern humans in Europe the major climate changes during MOIS 3, causing a large “turnover” of natural resources, already had a major impact on the Neanderthal population. This may have led to a reduction in the size of the Neanderthal population due to changes in demographic parameters (fertility and/ or mortality), to extensive population fragmentation inducing local extinctions and, thus, to demographic weakening of Neanderthals. The aim of this study is to present the demographic parameters (size, age repartition, survival and fertility rates) of the Neanderthal population during the last 10 000 years of their existence (from 40 000 BP to 30 000 BP) that, regardless of the presence of another competitor (*Homo sapiens*), may have had a major impact on their disappearance. We hypothesize that during this period of time the population size diminished to the point of reaching the critical value of 5000 individuals. This is the size that is considered as a ‘minimum viable population’ (MVP) in ecology studies (Shaffer, 1981; Lacava and Hughes, 1984). The method used to test the demographic characteristics of the Neanderthal population is the modeling approach. This method permits us to understand complex systems by working on a simplified model of these systems. Thus, this process involves the choice of certain parameters and variables which, even if they are simplified, are nonetheless controlled in such a way that they are capable of representing the system as a whole. Our basic model consists of a population of 70,000 individuals (Bocquet Appel and Degioanni, 2013) divided into three age groups: pre-reproductive (60% of the population), reproductive (35%) and post-reproductive (5%). In this model, a stable population over time, without size changes, is reached when women’s rate of reproduction is of 1.71, and the survival class rate is 0.58333 (pre-reproductive to reproductive) and 0.142857 (reproductive to post-reproductive). Our model indicates that a very small variation in fertility or in survival rate would be sufficient for the Neanderthals to gradually reach MVP over a period of 10,000 years, where the generation time-span is 25 or 20 years. For example, in regard to fertility, our findings indicate that to bring about a downward turn in population, a reduction over time in the number of daughters per woman from 1.71 to 1.69 and, in regard to survival rates of pre-reproductive class, from 0.58333 to 0.58300 is sufficient. This basic model can be made more complex if we take into account the population subdivisions (Fabre et al, 2009; Dalen et al, 2011) and test the effects of climate change on the demographic characteristics of the Neanderthal population.

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Podium Presentation: Session 7, Sa (9:00)

## Châtelperronian bone tools from the Grotte du Renne, Arcy-sur-Cure

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The interpretation of the bone tools found in the Châtelperronian levels of the Grotte du Renne, Arcy-sur-Cure, is controversial. Their presence in those levels has been interpreted as the result of independent Neandertal innovation, as reflecting Neandertal trade or scavenging from abandoned contemporary Aurignacian sites, as an intrusion from overlying Protoaurignacian levels or, more recently, as the consequence of the fact that the Châtelperronian makers of those tools may well have been Modern Humans. However, in light of recent radiometric ages from the site, stratigraphic and spatial distributions of bone tools, personal ornaments, pigment fragments, pigment processing tools, human remains and diagnostic Châtelperronian, Protoaurignacian, and Mousterian artefacts, as well as to the presence of byproducts of bone tool manufacture, all indicate that the site’s levels have not been reworked and that Châtelperronian Neandertals were the makers and the users of the bone tools found in the Grotte du Renne Châtelperronian levels. The conclusion that these bone tools were made by Neandertals does not solve the contentious problem of whether this technology was independently invented by them prior to the arrival of modern humans in Western Europe or was in some way adopted or re-elaborated as a result of close contact with or long distance influence of the latter. In this respect the Grotte the Renne bone tools represent a cogent paradox. While playing a major role in a key anthropological debate they have never been fully described. The aim of our presentation is to provide results of the first exhaustive taphonomic, archaeozoological, technological, morphometric and functional analysis of the Châtelperronian bone and ivory artefacts from this key site. Of the 194 artefacts, 102 are made of mammal bone, 81 of ivory and 11 of bird bone. Results reveal previously unrecognized consistencies among which the most notable is the discovery of dimensionally discrete categories of ivory spear points. We will discuss the significance of these artifacts to the debate on the Middle-Upper Palaeolithic transition, and on a broader level, to the debate concerning the origin of human cultures comparable to ours.

Acknowledgements: This reserch is supported by a grant from the European Research Council (FP7/2007/2013, TRACSYM-BOLS 249587)

Poster Presentation Number 29, Fr (18:00-20:00)

## New researches on the ”Altamura man”: morphology of the scapular glenoid cavity of a Neanderthal skeleton

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It is well known that in 1993 an archaic (i.e., non modern) human skeleton was discovered inside the Lamalunga karstic system, near Altamura in Apulia, Italy. Although the conditions of preservation of this massive adult male are exceptional, so that each element of the skeleton should be virtually preserved, the specimen has remained so far inaccessible to study. It is incorporated within calcite concretions of various thickness, which prevent from any direct intervention hiding the genuine morphology of bones and teeth. After a long period of ”standby”, in 2009 a new scientific endeavour (appointed by the Direzione Regionale per i Beni Culturali e Paesaggistici della Puglia, in collaboration with the Soprintendenza per i Beni Archeologici della Puglia and assisted by speleologists of the Centro Altamurano Ricerche Speleologiche) performed a survey in the cave with the aim to physically remove a skeletal fragment to be used for high-quality investigations (aDNA extraction and absolute datings). The fossil piece removed from the cave in sterile condition is represented by the articular portion of the right scapula, including the glenoid cavity, the neck, both the roots of the acromion and the coracoid process. This communication is aimed at evaluating the morphology of this portion of the scapula extracted from the Lamalunga cave. The specimen was subjected to medical tomography with a resolution of 0.25 mm and an increment of 0.65 mm; then, the digital high-resolution stereolithography (slicing 0.17 mm) was analyzed with ordinary morphometric methods, using as variables the length (GAL), the breadth (GAB) and depth (GFD) of the glenoid cavity; eventually, we performed a 2D geometric morphometrics analysis of the outline of the glenoid cavity, using 60 landmarks and semilandmarks, treated according to the methodology described in Di Vincenzo and colleagues (2012). Overall, the results of these morphometric analyses show that the scapula portion from Altamura – as regards both metric (GAB/GAL ratio and GFD) and geometric (shape) variables – falls within or in continuity with the variability of *Homo neanderthalensis*, in accordance with general observations on the morphology of the skeleton still in situ. However, phenetic relationships obtained from the Euclidean distances of the Procrustes’s coordinates of the glenoid outline apparently intercept a phylogenetic signal: the scapula from Altamura is interposed between the early Neanderthals from Krapina and those of more derived Neanderthals.

**References:**Di Vincenzo, F., Churchill, S.E., Manzi, G., 2012. The Vindija Neanderthal scapular glenoid fossa: comparative shape analysis suggests evo-devo changes among Neanderthals. J. Hum. Evol., 62, 274—285

Poster Presentation Number 52, Fr (18:00-20:00)

## Developing a chronostratigraphic framework for human cultural change spanning the North African Middle Stone Age through to the Neolithic using Single Grain OSL: the example of Rhafas (NE Morocco)

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The long, stratified archaeological site of Rhafas, in northeastern Morocco, provides valuable information about the timing of cultural changes in the Palaeolithic of northwest Africa. The location of this region is highly significant with respect to human evolution and migrations out of Africa, yet the timing and nature of Palaeolithic behaviour and dispersals remain poorly understood. Recent studies have highlighted the strategic importance of northern Africa in the cultural transition between the Middle Stone Age (MSA) and Late Stone Age (LSA), and in particular the need for accurately defined chronologies (Jacobs et al. 2011, 2012; Humphrey et al 2012; Richter et al. 2010). However, there are relatively few stratified archaeological sites in this region that offer the potential for the development of chronologies spanning multiple Palaeolithic technocomplexes. The precise dating of these sites would substantially improve our knowledge about the antiquity of these technocomplexes, at site, regional and continental scales. Single grain optically stimulated luminescence (OSL) dating methods provide reliable constraints on the timing of technocomplexes by directly dating sediment deposition within archaeological sites, with the upper limits of dating substantially greater than that allowed by radiocarbon. In this study we present a complete chronology from the stratified inland cave site of Rhafas. This site is of particular significance due to its preservation of Iberomaurusian and North African MSA including Aterian occupation horizons. The site is situated near the city of Oujda, approximately 900 meters above sea level and was first excavated to a depth of 4.5 m in the 1980/90s by Wengler (1993, 1997). The stratigraphic profile inside the cave comprises 71 individual layers, of which 39 are associated with MSA. New excavations from 2007 were initiated to apply an interdisciplinary approach incorporating archaeological, geochronological, geological and sedimentological methods, including luminescence dating. We have redefined the cave stratigraphy and opened a new excavation pit in front of the cave entrance, which has yielded layers containing North African LSA and MSA. Our results indicate that the sequence spans from MSA occupation phases dating to more than 100 ka, an Aterian layer less than 70 ka old, through to the Neolithic. In this study we apply high frequency, single grain OSL dating to each of the stratigraphic sections at Rhafas, and a wadi terrace profile nearby, with the aim of producing a complete chronology for the cave site. We place our results in the context of previously dated archaeological sites and Quaternary palaeoenvironmental change across northwestern Africa. Our chronology for the Rhafas cave site provides additional data on the timing of transitions between the Palaeolithic technocomplexes. We also introduce the challenges confronting luminescence dating at this site, and discuss the geochemical analyses which have led to an improvement of the reliability of the resulting OSL chronology.

**References:** Jacobs, Z., Meyer, M.C., Roberts, R.G., Aldeias, V., Dibble, H., El Hajraoui, M.A., 2011. Single-grain OSL dating at La Grotte des Contrebandiers ('Smugglers Cave') Morocco: improved age constraints for the Middle Palaeolithic levels. *J. Archaeol. Sci.* 38, 3631-3643. Jacobs, Z., Roberts, R.G., Nespoulet, R., El Hajraoui, M.A., Debénath, A., 2012. Single-grain OSL chronologies for Middle Palaeolithic deposits at El Mnasra and El Harhoura 2, Morocco: Implications for Late Pleistocene human-environmental interactions along the Atlantic coast of northwest Africa. *J. Hum. Evol.* 62, 377-394. Humphrey, L., Bello, S. M., Turner, E., Bouzouggar, A., Barton, N., 2012. Iberomaurusian funerary behaviour: Evidence from Grotte des Pigeons, Taforalt, Morocco. *J. Hum. Evol.* 62, 261-273. Richter, D., Moser, J., Nami, M., Eiwanger, J., Mikdad, A., 2010. New chronometric data from Ifri n'Ammar (Morocco) and the chronostratigraphy of the Middle Palaeolithic in the Western Maghreb. *J. Hum. Evol.* 59, 672-679. Wengler L., 1993. Formations quaternaires et cultures préhistoriques au Maroc oriental. Thèse de Doctorat d'État à l'Université Bordeaux I. Wengler L., 1997. La transition du Moustérien à l'Atérien. *L'Anthropologie* 101 (3), 448-481.

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

## Did *Homo erectus* consume a Pelorovis herd at BK (Bed II, Olduvai Gorge)?

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In the 1950s, Leakey unearthed a large concentration of Pelorovis remains at BK amounting to 24 individuals. His interpretation was that hominins were successful in driving a whole herd into a marshy area by a river where they were trapped in the mud and killed. During the subsequent era of the scavenging paradigm, this interpretation was disregarded. Renewed excavations at the site, which started in 2006, have unveiled a wealth of evidence of megafaunal exploitation by hominins at the site. This recent taphonomic work has provided evidence that megafaunal remains (belonging to Sivatherium and Pelorovis) were repeatedly exploited by hominins (in some cases, thoroughly). This stands in contrast with other classical Paleolithic sites, where large concentrations of faunal remains have been found associated with stone tools, but proved to have independent depositional histories (e.g., Torralba and Ambrona). Here, the taphonomic analysis of Leakey's Pelorovis herd (from Level V in the on-going excavation) will be presented and it will be shown that the site presents a complex taphonomic history, which involves independent and time-averaged deposition of individual Pelorovis carcasses, with a combination of cases in which some individuals died without either hominin or carnivore modification and other individuals show conspicuous damage showing hominin exploitation. This interpretation is limited by the incompleteness of the Leakey's collection, since no long bone shafts were collected. A comparison of this collection with a recent collection from the same level shows important discordances in skeletal part profiles due to selective collection of Leakey's assemblage, and also that the hominin signals of carcass exploitation are more conspicuous on long bone shaft portions. Natural processes of deaths of Pelorovis are contemplated and comparisons with modern bonebeds of bovids in similar low-energy environments are carried out to balance interpretations on whether Pelorovis carcasses were introduced partially to the site, on whether they were naturally deposited there and biased by post-depositional processes or by a combination of all these factors. The role played by meat-eating will be discussed vis-a-vis recent cost signaling interpretations that tend to oppose the subsistential value of animal protein in the evolution of *Homo erectus*.

Podium Presentation: Session 4, Fr (15:20)

## Direct radiocarbon dating of the earliest Upper Palaeolithic ornaments in Europe and the Levant

Katerina Douka<sup>1</sup>, Robert E.M. Hedges<sup>1</sup>, Thomas F.G. Higham<sup>1</sup>

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Establishing a reliable chronological framework to describe the timing, migration routes and cultural affiliation of the earliest anatomically and behaviorally modern humans arriving in Europe and southwest Asia is important to understanding the earliest Upper Palaeolithic but has proven hugely challenging to achieve. This is due to the often-poor organic preservation of dateable samples, and the difficulties in radiocarbon dating near to the limit of the method. One of the main archaeological correlates for the presence of modern humans along the northern Mediterranean Rim, one of the two putative migration paths into Europe, is the sudden appearance of beads made of deliberately-perforated marine shells. These are thought to represent body ornaments and reflect symbolic behaviour. Since 2006, a large number of such shell beads has been studied and dated at the Oxford Radiocarbon Accelerator Unit using advanced AMS radiocarbon dating. This was the largest study of its kind to attempt direct dating of Palaeolithic ornaments. A robust, novel methodological approach was developed and applied to 100 beads from 14 sites covering the entire stretch of the northern Mediterranean rim, from Lebanon to Spain. Archaeologically, the material was associated with different technocomplexes: Initial Upper Palaeolithic, Uluzzian, Protoaurignacian, Aurignacian and Ahmarian. The interpretation of the results within a Bayesian modelling framework provide important insights which include the identification of the oldest beads in Europe so far, confirming their association with modern human fossils, and the prime importance of some regions in understanding the onset of the earliest Upper Palaeolithic of Europe. In turn, the new results reveal aspects of the timing of the Middle to Upper Palaeolithic transition along the northern Mediterranean. A further interesting aspect revealed by this work is the typological similarities of the earliest European beads with the oldest ornaments from African record.

Poster Presentation Number 53, Fr (18:00-20:00)

## Two Waves of Paleolithic Settlers Migrations to North West Beringia in Pleistocene End (End of Karginsky Interstadial)

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Settlement of Siberia by Paleolithic Man began 900 Ka from opening up of Southern Mountain Belt of Siberia. Big cooling 33-30 Ka was next in Turn ecological catastrophe. Demographic supersaturation occurred in this Belt. All resources were extended and necessary of Man settling to North was springing up. The most be settled part of Mountain Belt on West adjoined West Siberian plain and Middle Siberian highland to East. Man was adapted to live in small ecological niches of mountains, where during unfavorable stages can be search favorable niches. Plains were monotonously unfavorable. That is why Man began to extend its hunting area in direction of highland. Migrations movement streamed along rivers that flow from South to North. Movement skipped plains. Way of 1st wave is marked by sites Afontova Gora V, Ust-Kova on Angara, than along Lena river up to Central Ykut plain, turn Aldan (Ikhine I etc), than round Kolyma plain to Chukotka, where they left abt 30 Ka Orlovka II site in North of West and Kymyneykey site in North of East Chukotka. In Aldan basin migration slowly down. Its reason could be glaciation of Verkhoyansk and Chersky ranges. During this delay “technical re-equipment” happened of migrations. Orlovka II and Kymyney artefacts are clear Aldan. 2nd wave migration was abt 29-28 Ka during final karginsky (middle: würm, wisconsin) warming, when paleoclimate along all northern outskirts of Asia was like to recent or more warm (Drozdov and Laukhin, 2010). Migrants of 2nd wave went to Yana mouth and left here site. Artifacts of this site don’t have Aldanian traditions, but are very close to Yeniseisk. There were little of favorable niches to North of South Mountain Belt; and their demographic capacity were nor big.

Acknowledgements: Work was supported by grant N0 9 of integration project SB RAS-FEB RAS and FBR grants No 11-05-01173a and 13-05-00854a

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Poster Presentation Number 154, Sa (17:00-19:00)

Interpretation of the Neandertal Record through Cloninger’s Bio-Cognitive Model

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This paper investigates the range of Neandertal cognitive abilities based on their archaeological activities *vis a vis* Cloninger’s (Cloninger & Kedia, 2011) bio-cognitive model of temperaments and traits, primarily based on empirical genetic research of the behavioral sequelae of the chemical neurotransmitter systems, norepinephrine, dopamine, and serotonin. Three of Cloninger’s temperament-based traits (i.e., genetic) are Harm Avoidance (mediated by norepinephrine), Novelty Seeking (dopamine), and Reward Dependence (serotonin). He also found genetic evidence for the temperament, Persistence, and evidence for three character traits, Self-Directedness, Cooperativeness, and Self-Transcendence. Neandertals are extinct hominids who shared a common ancestor with modern humans approximately 500,000 years ago. Genetic studies demonstrate that modern non-African humans possess 1% to 4% Neandertal DNA, indicating recent (i.e., 100,000 years ago) but limited interbreeding (Green et al., 2010). There is some anthropological evidence that Neandertal’s hunting strategies were consistent with being low in the temperament of Harm Avoidance, as numerous studies have indicated a preponderance of Neandertal head, neck, and shoulder injuries (e.g., Berger & Trinkaus, 1995) similar to modern rodeo cowboy injuries, indicative of dangerous and close hunting strategies. Evidence that Neandertals were low in the temperament of Novelty Seeking is partly based on Neandertal living sites that consisted of small areas accommodating few individuals- roughly ten or so (e.g., Wynn & Coolidge, 2012). Based on other evidence that Neandertals lived in small groups and foraged in small home ranges has led this behavior to be called the “Neandertal niche” (Hoffecker & Cleghorn, 2000). Most Neandertal sites have a range of about 45 square miles while raw material foraging over 20 kilometers were considered unusual trips (Wynn & Coolidge). Neandertal hunters foraged according to season and revisited camps they knew would provide fauna based on year before success. Further evidence for the absence of Novelty Seeking behavior comes from their adherence to essentially the same range of tools for their entire existence. It has been argued that Neandertal’s 40,000-year-old tools are “almost indistinguishable from [their] 200,000-year- old tools” (Wynn & Coolidge, p.56). Although Neandertal hafting was impressive technologically (e.g., Boeda et al., 1998), it has been argued that such innovation was relatively rare in Neandertal technology (Wynn & Coolidge). Finally, there is evidence for Neandertals to also be low on the temperament of Reward Dependence. Low scores on Reward Dependence illustrate a sense of practicality, pragmatism, unsentimentality, determination, tough-mindedness, and aloofness from others (Kose, 2003). It may be argued that Neandertal cannibalism found in the skeletal evidence in Krapina and the Gran Dolina cave, suggests that the Neandertals may have been eating others for sustenance (e.g., Patou-Mathis, 2000). However, there may be advantages of being low on Reward Dependence, as pragmatism, being unsentimental, and tough-minded may aid survival under harsh conditions. Its disadvantage is that Neandertals’ xenophobic nature (Wynn & Coolidge, 2012) may have not only inhibited trading with others but also may have limited their acquisition of knowledge and innovation from others. Finally, the present paper will evaluate Neandertal behavior on Cloninger’s other remaining temperaments and traits.

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Poster Presentation Number 137, Sa (17:00-19:00)

New results for palaeoenvironment and vegetation change from Wonderwerk Cave, South Africa

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In contrast to eastern Africa, southern Africa’s interior lacks long records that reflect past environmental shifts for the Pleistocene and even the Holocene. Yet resulting shifts in conditions, especially vegetation, would clearly have impacted the distribution of resources for hominins through this period. Wonderwerk Cave is the only site in the interior to preserve a well-dated sequence of human occupation spanning two million years (Chazan et al. 2012, 2008). However, information on the palaeoenvironmental sequence is sparse following earlier pioneering work in the early 1980s at the site (van Zinderen Bakker, 1982, Avery 1981, Thackeray 1983). Other than a more recent speleothem record (Brook et al. 2010), no other palaeoenvironmental data has been published from the more recent archaeological investigations. We report new data from stable carbon and oxygen isotopes of ostrich eggshell as well as pollen and phytolith analysis in excavation Area 1 to provide a more detailed and sequential (albeit discontinuous) picture of past and vegetation changes. Combining these proxies we explored shifts in plant types, the proportions of C3 and C4 plants, growing conditions and moisture availability. The results show significant shifts in the sequence, especially between the Oldowan and the start of the Acheulean levels, as well as at the beginning of the Holocene, where shifts in both plant composition and humidity are unexpectedly diverse and fluctuating. The observed changes are compared to other, less detailed records from southern Africa and interpreted in terms of larger orbital scale climate cycles affecting the sub-continent.

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Poster Presentation Number 110, Sa (17:00-19:00)

Unique within his group: High incidence of chipping enamel may reflect a specialized behavior in the El Sidrón neandertal group

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Chippings are irregular *ante mortem* fractures affecting the enamel or both the enamel and dentin, produced due to shock or pressure produced as a result of the use of teeth as tools or due to hard particles ingested with the food. The location of this feature in the dental crown serves to distinguish between the two etiologies, considering those in the occlusal surface of the tooth and in the posterior dentition more likely related to chewing tasks, and those that are on the incisal edge on the anterior dentition as related with non-masticatory activities (Gould, 1968; Molnar, 1972; Belcastro et al., 2004; Scott and Winn, 2011; among others). In this study we examine the distribution of chippings on the anterior dentition of eleven Neandertals from El Sidrón cave (Rosas et al., 2012), focusing on the number of chipped teeth per individual as well as its number and location on the tooth. Chipping enamel size has been recorded following the 1 to 3-stage scale proposed by Belcastro et al., (2004). When there is no chipping enamel it is recorded as “0”, and when it was not possible to record, due to the presence of dental calculus or calcrete, it was recorded as “9”. We also recorded location of the affected areas (mesial, distal, distolingual...). As for the El Sidrón sample all individuals are affected, and about one third of the anterior teeth show chippings with a slightly higher frequency in the maxillary dentition. Chipping appears on the incisal edge of teeth, principally on the labial side, but also it has been found on the mesial and distal sides of the incisal edge. Only El Sidrón Adult 2 has a high incidence of this trait, affecting all the incisal edge of his maxillary anterior teeth (more than three chippings have been recorded on the same tooth), forming an indentation or notching. On the contrary, on his mandibular teeth, the presence of chipping is scarce. Chippings are at stages 1 and 2 (small, affecting only the dental enamel) on the whole anterior dentition. The distribution of this non-masticatory dental wear in this individual seems to be analogous to that described for primitive populations of Australian Aborigines (Gould, 1968), who used their teeth to correct or re-sharper the stone tool cutting edge. It is possible that the origin of these marks on the Neandertal population from El Sidrón have a similar etiology, and among the group, El Sidrón Adult 2 seems to have developed a distinctive behaviour when comparing with his group members. The pattern of distribution of this trait together with the presence of bitumen in the dental calculus of Adult 2 (Hardy et al., 2012), suggests a task’s specialization in this Neandertal group and thus a particular partitioning of labor in this fossil species. Acknowledgements: This work was supported by Consejería de Cultura del Principado de Asturias, Grant sponsor: Convenio Universidad de Oviedo-CSIC, Grant number: 060501040023. Paleobiological aspects of this study have been funding by MINECO of Spain, Grant number: CGL2012-36682.

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Podium Presentation: Session 9, Sa (13:00)

New ESR datings of Acheulian levels at Atapuerca Dolina and Galería Sites and their position in the European prehistoric context

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The Sierra of Atapuerca, Northern Spain, has yielded many prehistoric and palaeontologic data documenting the human history in Eurasia during the last million years. The stratigraphical sequences of three major sites, Gran Dolina, Galería and Sima del Elefante, cover almost the entire period of the Pleistocene from the oldest Hominin bearing levels of Western Europe dated to 1.1 to 1.3 Ma at Elefante (Carbonell et al., 2008) to c.a. 0.2 Ma on the top of the Galería archaeological sequence (Falguères et al., in press). The upper levels of Dolina and the entire sequence of Galería have provided a rich Acheulian assemblage documenting the earliest stage of the second human settlement of south-western Europe. Recent results obtained by combined ESR/U-series dating on 20 herbivorous teeth from different levels at the Galería site allow a chronological comparison with upper levels of Dolina site. For these levels, several data were obtained using independent methods (TL, ESR/U-series, TIMS) yielding a more accurate idea on the chronology for the first Acheulian levels in these major sites of Middle Pleistocene. The obtained ages range between 300 and 500 ka and are contemporaneous with the lower part of Arago (France) and Visogliano (Italy) stratigraphical sequences. They succeed from one hand to La Noira site (France) in which Acheulian tools have been identified at more than 650 ka (Moncel et al., ESHE 2013) and in the other hand to Mauer (Germany), Pakefield (England) and Isernia la Pineta (Italy) sites recently dated to 600 ka or more and which do not contain Acheulian artefacts.

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Poster Presentation Number 55, Fr (18:00-20:00)

Shilo-Shumilov Low and Beginning of Sociosphere Forming

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From low geoecosystemic evolution of biosphere (Shilo-Shumilov low) there is investigation: ecosystems are turned in paragenetic entity with geosystems on which ecotopes and biotopes formed. Sociobiotic systems (civilizations etc) submit such low. With forming etnosphere economic evolution of society can not to extend such level, which conformity to potential this ecosystem; economic development of society can not better what than which allows to it his own natural environment and ability effective to adapt oneself to it (Shilo and Shumilov, 2004). In light of stages of forming sociosphere of Earth are representing interest. Ist spots (points ?) of sociosphere can not to emerge earlier that 1.8-1.5 Ma. Its disposed in Africa, SE Asia and, possibility, on Near East (?) including Caucasus. On South of Northern Hemisphere big areas of it arose in China, India, Pakistan. On North of Northern Hemisphere most ancient from big areas of sociosphere is Siberia during middle phases of Late Paleolithic, When tundra-steep giperzone was formed and Paleolithic population was forced in big collectives for hunting on mammoth fauna (Derevyanko et al., 2003). Finally Northern Hemisphere included in sociosphere in the Middle Ages, when it included Greenland. Last continent, which, possible, only including in sociosphere is Antarctida. Debatable of said don’t provide double. And also it is undoubtedly and what investigations in this direction is necessary for comprehension of humanity evolution.

Acknowledgements: Supported by grant No 9 of integration project SB RAS-FEB RAS and grant RFBR No 13-05-00854a

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Poster Presentation Number 3, Fr (18:00-20:00)

Patterns of craniofacial pneumatisation: the consequence of skull shape and functional loading?

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Variation in craniofacial pneumatisation within the hominins has previously been used for phylogenetic placement of fossil taxa and as indicators of behavioural and environmental adaptations such as cold stress. However, what drives sinus variability is still poorly understood. Macaques and mangabeys, two closely related taxa, provide an opportunity to investigate the relationship between functional loading, facial remodelling and the formation of the maxillary region. As juveniles, neither possesses a maxillary sinus however by adulthood macaques develop an internal sinus whereas mangabeys develop an external fossa. This study investigates how differences in cranial architecture between these taxa and subsequent bearing of stresses and strains might relate to maxillary sinus formation in *Macacca fascicularis* (macaques) but fossa formation in *Cercocebus atys* (mangabeys). Finite element models were produced for both species and hypothetical models created in which the maxillary region was experimentally modified by filling in the maxillary sinus or fossa. Models were loaded according to the regimen predicted by multibody dynamic analysis for a series of biting scenarios for each species, and facial strains computed. Using VoxFE, a custom made finite element analysis tool, the models were then adapted by either adding bone (voxels) to regions predicted to experience compressive strains or removing it from regions of low compressive or tensile strain. Results revealed that the distributions of low peak compressive strains in the modified “filled in” models reflected the positions of the maxillary fossae and sinuses in the original specimens. Via ‘adaptive remodelling’ hollow spaces were also formed in the correct maxillary region for each specimen. The results underline the significance of applied loads and the spatial relationships between the dentition, maxilla, nasal cavity and orbits in governing how loads are transmitted through the face. The findings suggest that the loading regimen and spatial relationships of facial structures may be critical cues in the development of the maxilla. Variability in size and shape of cranial pneumatisation in the fossils hominins may therefore be a consequence of differences in biomechanical loading and external cranial form.

Acknowledgements: This study was funded by the BBSRC grant numbers BBE0138051 and BBE014259, European Union Marie Curie Action 020601 (PALAEO), Leverhulme F/00224 and Marie Curie Research Training Network 19564 (EVAN).



Podium Presentation: Session 8, Sa (10:40)

## The potential for catastrophic impact of the Campanian Ignimbrite (CI) tephra on human evolution: new data from the Lower Danube loess steppe

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The Campanian Ignimbrite (CI) volcanic super-eruption was the most explosive in Europe in the last 200,000 years, and took place in the Phlegrean Fields near Naples, Italy. The event was superimposed on an extremely cold climatic phase known as Heinrich Event 4 (HE4), approximately 40,000 years ago. The volcanic winter most likely induced by the super-eruption, combined with the effects of the short-lived, extreme HE4 “ice age”, may have increased the severity of the climate across Europe, and possibly globally, as indicated by various terrestrial and marine paleoclimatic archives. The CI event is of particular interest to human evolution because its timing coincides with the arrival into Europe of anatomically modern humans, the demise of Neanderthals, and associated major changes in lithic technology. At this stage, however, we have very little idea how much the super-eruption and HE4 might have affected hominin populations, particularly those within the zone of ash fall – including the lower Danube basin, one of the proposed “gateways” for human migration into Europe. In this study we provide important new data from Eastern Europe which indicate that the magnitude of the CI super-eruption, and impact of associated far-travelled ash (tephra) deposits, may have been substantially greater than existing eruption models suggest. CI ashfall extends as far as the Russian Plain, Eastern Mediterranean and northern Africa, although there are very few studied tephra deposits beyond the western Balkans. Here we investigate an unexpectedly thick CI tephra deposit at Urluia in the southeast Romanian loess steppe, 1200 km from the super-eruption vent in Italy. Existing models suggest that the CI tephra thickness might reach a maximum 5-10 cm in Eastern Europe; the Urluia ash deposit is up to 100 cm thick. Additional, recently discovered Lower Danube sites also reveal substantially thicker than modelled CI ash beds. We establish the tephra using field observations, geochemistry and luminescence dating as a widespread primary deposit, which blanketed the topography both thickly and rapidly, with potentially catastrophic impacts on local ecosystems. Environmental magnetism suggests colder conditions following ash deposition, likely evidence of the harsh HE4 climate conditions possibly combined with the volcanic winter. We discuss how the rapid deposition of CI ash across the Romanian steppe may have constituted a health hazard for animals and humans inhabiting the region. We also speculate that the influence of the super-eruption and ashfall on climate may have influenced hominin populations and their ability to survive in a region strategic for human migration into Europe.

Acknowledgements: We thank Professor Jean-Jacques Hublin and Dr Shannon McPherron for their support of the Lower Danube Survey Project for Paleolithic Sites, under which this work was carried out. D. Veres acknowledges the support of CNCS-UEFISCDI. Thanks to Professor A. Barnea (University of Bucharest) and to Mariana Petrut (National Museum of History, Adamclisi) for logistical assistance. We wish to thank Steffi Albert for luminescence dating sample preparation, Hubert Schulze and Detlef Krausse from the Bayerisches GeoInstitut (Bayreuth, Germany) for assistance with the EPMA analyses, and Christine Lane (Oxford University) for guidance with the geochemical analyses.

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

## Second maxillary molars confirm a dimorphism of *Australopithecus* at Sterkfontein Member 4

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All hominid fossils from Sterkfontein Member 4 and Makapansgat are conventionally classified as *Australopithecus africanus* in spite of their great morphological diversity. Several authors described morphological evidence from the cranium, post-cranium and teeth that indicates the presence of at least two morphotypes within the *A. africanus* hypodigm (e.g., Clarke, 1988; Kimbel and White, 1988; Lockwood and Tobias, 2002; Moggi-Cecchi and Boccone, 2007; Zipfel and Berger, 2009). In particular, Clarke (e.g., 2013) has claimed that this hominid fossil record represents two distinct species, according to their craniofacial and dental traits: *A. africanus* and the more *Paranthropus*-like *A. prometheus*. This issue has not been resolved morphometrically. We assessed the morphological variability of the *Australopithecus* fossil record at Sterkfontein Member 4 through a Geometric Morphometric investigation of second maxillary molars (M<sup>2</sup>s, less worn than M<sup>1</sup>s and possessing a more regular morphology than M<sup>3</sup>s). We considered 47 teeth, 30 from South African *Australopithecus*, *Paranthropus* and early *Homo*, and 17 from European Neanderthals and recent modern humans. 3D models for data collection were produced by virtual segmentation of micro-CT scans. We used two different geometric morphometric approaches. A landmark based analysis of 3D landmarks from the occlusal surface and semilandmarks on the occlusal ridge curves for both the outer enamel surface (OES) and the enamel dentine junction (EDJ), and the analysis of cervical and crown outlines. In principal component plots, the landmark-based and crown outline analyses cluster *Homo* separately from australopithecines and distinguish Neanderthals from modern humans well. The corresponding thin-plate spline grids show that much of the discrimination owes to relative proportions of trigon and talon (the latter relatively larger than the trigon in australopithecines), and to the relative heights of cusps (lower in australopithecines). The cervical outlines are not as informative as the other features. Within the *Australopithecus* group are two distinct molar shape clusters based on the OES and EDJ. However, the correspondence with Clarke’ species attribution (1988, 2013, pers. comm.) is imperfect, since Sts 52, which Clarke and other scholars confidently attribute to *A. africanus*, clustered with *A. prometheus*. The EDJ seemed to provide a clearer separation between groups, but only 3 EDJs for *A. africanus* were available. In accordance with Clarke’s observations, *Paranthropus* and *A. prometheus* widely overlap in shape, but separate from *A. africanus* (except Sts 52!). When the information about size is brought back into the analysis, we observe a neater separation between recent modern humans and Neanderthals, while the effect is milder in the australopithecine sample. In conclusion, our findings confirm the presence of two different upper second molar morphotypes at Sterkfontein Member 4 (and Makapansgat). This morphological (and probably taxonomical) distinction should be taken into account in studies including hominid fossil material from Sterkfontein Member 4 and Makapansgat. At the same time, our results raise doubts regarding the taxonomic attribution of Sts52 to *A. africanus* (which has already been questioned by Kimbel and White (1988) for the morphological affinities of its lower face with *A. prometheus* specimens).

Acknowledgements: We thank NECSA (Nuclear Energy Corporation of South Africa), Pelindaba, South Africa, and Mr. Frikkie De Beer for providing us with the high resolution CT scans of the South African material and NESPOS (www.nespos.org) for the Neanderthal data. We thank Martin Dockner from the Vienna Micro-CT Lab for scanning the modern human specimens. We are deeply grateful to Professor R. J. Clarke for the very constructive discussions on the subject of our work. We thank Professor J. Moggi-Cecchi for promoting the beginning of this project. This research was supported by A.E.R.S. Dental Medicine Organisations GmbH, Vienna, Austria.

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Poster Presentation Number 26, Fr (18:00-20:00)

## The functional morphology of the seventh cervical vertebra in primates

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The seventh cervical vertebra forms the caudalmost segment of the cervical spine, which connects the head to the thorax and shoulder girdle. It bears the weight of the head (stability), and the muscles originating there attach to the head and to the scapula/shoulder girdle (mobility). Depending on the type of posture and locomotion, it is subject to diverse directions of forces. It therefore can be used to infer locomotion and posture. In this study, the seventh cervical vertebra was analyzed in *Macaca fascicularis* (n=15), *Hylobates lar* (n=14), *Pongo sp.* (n=11), *Gorilla gorilla* (n=20), *Pan troglodytes* (n=15) and *Homo sapiens* (n=26), as well as casts of *Australopithecus sediba* (MH1, UW88-09) and *Homo erectus* (KNM-WT 15000). Measurements were taken with a digital caliper according to Gommery (1995) and Martin and Saller (1957) together with additional measurements. To compare within and between species, angles and indices were used to correct for body size differences. The *spinous length index* (spinous process length /cranial body height) showed that *A. sediba* falls into the range of variation of great apes. Thus, the spinous process of *A. sediba* is significantly longer than the spinous process of macaques, gibbons or humans. This suggests a stronger nuchal musculature compared to modern humans, which might be related to climbing behavior and/or to the relatively larger viszerocranium of australopithecines. The posterior tubercle width relative to cranial body width may be used to infer quadrupedalism found in monkeys. It clearly separated macaques from all other species in our sample. The vertebral body surface area of orangutans and *Homo* was larger than in other species when compared to the facet joint area. At least in modern humans this might be connected to axial weight transmission. The rather small vertebral body surface area relative to facet joint area of *A. sediba* may reflect the different head balance of australopithecines (Dart, 1925). The position of the superior articular processes in relation to the vertebral body was assessed by the *center triangle* (the angle is formed when connecting the vertebral body center to the centers of the left and right superior articular processes). Macaques, chimpanzees and humans displayed a wide angle whereas orangutans and gorillas had the smallest angle. *H. erectus* fell above the human mean, *A. sediba* between the human and *Pongo/Gorilla* mean. The wider angle may be related to an emphasis on lateral rotation, a narrower angle to facilitated flexion-extension movements of the head. Further, the small angle in *Pongo/Gorilla* may be due to morphological constraints in the species with extreme ventro-dorsal vertebral dimensions. The lever arms of the cervical spine - transverse and spinous processes - seem most promising for inferring posture and locomotion as they are directly linked to movement. Nevertheless, genus level differences can also be observed when comparing other characteristics of the seventh vertebra such as the body surface area index and the center triangle. Our results show that they do not reflect phylogeny and thus may be of functional relevance.

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Poster Presentation Number 79, Sa (17:00-19:00)

## The impact of geographic variation and allometry on the postnatal development of modern human facial features

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Geographical differences in adult facial morphology have been identified in numerous studies (e.g., Howells, 1973; Hanihara, 1996), and it is becoming increasingly clear that many of these differences develop early in ontogeny. Influential work by Strand Viðarsdóttir et al. (2002) on the development of facial features has shown that regional differences are likely present at birth and that postnatal growth further enhances these features. Additionally, size-correlated shape differences (i.e., allometry) contribute to variation in modern human facial morphology; this is most explicitly expressed through sexual dimorphism (e.g., Rosas and Bastir, 2002). Such studies, however, have focused on large-scale differences in facial morphology by means of traditional (i.e., linear) and three-dimensional landmark and curve semilandmark geometric morphometrics. An inherent limitation to this method is its inability to quantify more subtle differences in facial morphology, such as the topography and orientation of the infraorbital plate. The goal of this study is to explore developmental and geographic variation in subtle facial features in a cross-sectional sample of four modern human groups spanning Africa, Europe and North America. To do so, we have created a landmark dataset consisting of curve and surface semilandmarks covering the entire face. Following Strand Viðarsdóttir et al. (2002) we test 1) at what point in ontogeny regional facial features develop; and 2) whether geographic groups share a common growth allometry, but at a finer scale. The sample comprises cross-sectional growth series from four populations. We digitized landmarks and semilandmarks on surface and computed tomography scans and analyzed the Procrustes shape coordinates using multivariate statistics. In order to explore the influence of size on facial features, static and ontogenetic allometric trajectories were calculated. Adult facial shape differences between males and females within each geographic group and across developmental stages were compared. Our results support previous studies that show that adult facial morphology can be discriminated by geographic group, and population-specific facial morphology develops early in ontogeny, before the eruption of the first permanent molar. Subtle differences in adult facial shape between geographic groups are also present in subadults, and these differences are generally maintained throughout development. Additionally, we show that there is a shared pattern of facial growth throughout development among the four geographic groups. Acknowledgements: We thank all of the curators who have so generously allowed us to scan the modern human material from the following institutions: American Museum of Natural History (New York), Iziko South African Museum (Cape Town), and the University of Cape Town. We also thank Pr. J.-L. Kahn from the Department of Anatomy, Medicine Faculty, Strasbourg for access to the osteological collection and Pr. F. Veillon from the Department of Radiology, Hautepierre Hospital, Strasbourg for access to the medical scanners; and Dr. Fred Grine for allowing us to use a collection of CT scans. This work was supported by the Marie Curie Actions grant MRTN-CT-2005-019564 “EVAN,” the Max Planck Society, NSF (0333415, 0513660 and 0851756), the L.S.B. Leakey Foundation, and Sigma Xi.

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Poster Presentation Number 16, Fr (18:00-20:00)

## A morphometric assessment of the *Australopithecus sediba* cranium (MH1) in relation to other Plio-Pleistocene African hominin crania

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Hominin remains discovered at the South African site Malapa and dated to 1.97 MA BP have been assigned to a new species, *Australopithecus sediba*, despite a number of more derived features. The purpose of this paper is to provide a morphometric re-assessment of the MH1 cranium in the context of other Plio-Pleistocene hominin crania, attributed to *Australopithecus*, *Paranthropus* or early *Homo*. 15 Craniometric dimensions from the MH1 cranium of *A. sediba* and from other Plio-Pleistocene specimens from South Africa and East Africa have been compiled from the literature. The specimens included in this analysis in addition to MH1 were: Sts 5 and Sts 71 (*Australopithecus africanus*); SK 48 (*Paranthropus robustus*), OH 5 KNM-ER 406, KNM-ER 732 (*Paranthropus boisei*); SK 847, KNM-ER 1470, 1813, 3733, 3883 (*Homo* sp.), OH 24 (*Homo habilis*). Three modern humans were also included. Using a technique described by Darroch & Mosimann (1985), we obtained log-shape ratios, which are scale-free (shape) variables, and computed Principal Component Analysis (PCA) and neighbor-joining trees (NJ). Based on the results from both the PCA and NJ, the morphometric affinities of the MH 1 cranium clearly lie more with *Homo* than with either *Australopithecus* or *Paranthropus*. This shape proximity appears largely driven by the relative dimensions of the bony nose.. A significant morphometric aspect of MH1 that puts it closer within the *Australopithecus* range is overall cranial size, which is relevant to previous assessments of it being of near-adult size. Given the absence of significant allometric effects, the cranium of MH1 appears to be most similar to an *Australopithecus*-sized early *Homo*, and thus sheds new light on the differential evolution of the hominin cranial and postcranial skeleton.

Poster Presentation Number 51, Fr (18:00-20:00)

## New data about the chronology of middle Pleistocene (MIS 5-3) Mousterian sites of southwest France: A multi-method (OSL, IRSL and TL) and multi-material (quartz, feldspars and flint) approach

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During the Middle Palaeolithic, between Marine Isotope Stages (MIS) 5 and 3, the major phases of paleoclimatic evolutions have shaped the landscape of Neanderthals. In southwest France, in particular, several areas of the Aquitaine basin seem to have been refuge areas for human and animal populations. One of the main features of this region is the great apparent heterogeneity of behaviours reflected within the archaeo-stratigraphic sequences. This heterogeneity is especially linked to the variability of technological systems adopted by prehistoric groups, differed through time according to their skills and traditions, but also as a response to varied subsistence strategies and related mobility patterns (Delagnes et al., 2011). However, during this period, absolute dating of reference archaeological sequences is still insufficient to precisely correlate paleoclimatic and archaeological data. It is often difficult, therefore, to estimate to what extent the change of animal species hunted and the lithic technology choices - in terms of material culture- are correlated with climatic and environmental fluctuations. In order to specify the context in which these cultural traditions have been developed among Neanderthals and have persisted in southwestern France, we have contributed to establish an absolute chronological framework for several majors sites (La Ferrassie, Roc de Marsal, Les Pradelles and Artenac) using luminescence dating methods. The interest of Thermoluminescence -TL- on heated flints is to provide chronological information directly related to anthropogenic activities. However, the success of this approach is conditioned by the availability of flints sufficiently heated to be datable. Conversely, the ubiquitous character of sedimentary quartz and feldspars allows to estimate the amount of time elapsed since the grains were last exposed to daylight whatever was the anthropogenic characteristics of the level to which they were associated. Thereby, the combination of TL and OSL/IRSL methods allows obtaining a robust and detailed chronological scenario (e.g. Guérin et al., 2012; Mercier et al., 2003; Mercier et al., 2007). In the present study, we will present a chronological scenario for the successive occupations of each site resulting from the combination of the radiometric dates obtained on these different supports (grains of quartz, feldspar extracted from sediment and heated flints) and from several methods of luminescence (TL and OSL/IRSL). We will discuss what emerges from this synthesis: new insights on Mousterian technological variations over time of four reference sites for the study of the Middle Paleolithic in southwest France.

Acknowledgements: The PhD research presented here is funded by the Aquitaine Region Council, through the program entitled “La radioluminescence des feldspaths: un nouvel outil de datation des gisements archéologiques et des séquence quaternaires d'Aquitaine”.

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Poster Presentation Number 103, Sa (17:00-19:00)

Cranial variation among fossil and modern humans in the Americas: some perspectives on the peopling of the New World

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The arrival of *Homo sapiens* in the New World remains the subject of extensive debate about the nature and timing of the settlement and subsequent population history. A key question regards the presence of at least two biologically distinct populations or of a continuous variation from the first migrants to Native Americans. At present, craniofacial variation in past and modern Amerindians has been attributed to the effect of at least two founder events, or alternatively to a single major migration followed by *in situ* differentiation and possibly late recurrent contacts among subarctic groups. Using three-dimensional geometric morphometric methods, our study aimed at: (i) detecting morphological differences that may indicate several migration waves; (ii) re-assessing morphological affinities of Kennewick Man (Early Holocene skeleton discovered near Kennewick, Washington); (iii) testing the correlation between our shape data and competing settlement hypotheses taking into account geography, chronology, and climate effects. Our sample is composed by Early and Late Holocene skulls from the Americas, Old World fossils, as well as a large sample of modern populations from Americas, Asia, Australo-Melanesia and Pacific Islands. 900 specimens were digitized by means of a surface scanner, and 39 landmarks were placed on each skull. After Procrustes superimposition, the shape coordinates were analyzed by means of standard multivariate statistics. Furthermore, shape variation was confronted to various settlement hypotheses using a Mantel matrix correlation approach. Our results corroborate cranial differences observed between earliest Paleoamericans and Native Americans and underscore distinctive morphology within Early and Late Holocene American skulls. Results also confirm the uniqueness of Kennewick Man, who shares relatively more affinities with Old World fossils and some Pacific Islanders than with any past and modern Amerindians. Morphological differences were also detected among Native Americans, in particular between subarctic and continental groups, supporting a more recent arrival in the Northern Extreme of the continent from Siberia. In addition, morphological differences between continental and geographically isolated groups suggest genetic isolation in some areas. In terms of settlement hypotheses, two models are supported by our data, and both require micro-evolutionary processes, such as isolation/late survival to account for the observed patterns of craniofacial variation.

Acknowledgements: This research was supported with funding from Synthesys (Synthesis of Systematic Resources, the European Union-founded Integrated Activities grant), la Société des Amis du Musée de l’Homme (Prix Leroi-Gourhan) and UMR 7206 CNRS, Muséum National d’Histoire Naturelle.

Poster Presentation Number 19, Fr (18:00-20:00)

A Quantitative Analysis of the Distal Tibia *Homo habilis*

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The locomotor affinities of early *Homo* remain controversial. Some researchers argue that postcranial remains from Olduvai Gorge and Koobi Fora assigned to *H. habilis* show all the hallmarks of modern striding bipeds. Others posit that *H. habilis* was more mosaic in its locomotor repertoire, sharing a number of more primitive features with the South African, *Australopithecus africanus*. This study presents additional information to my original research on the *Homo habilis* distal tibia, OH35, by adding data collected both from a Neanderthal and the new *Australopithecus sediba* fossil. Using modern geometric morphometric techniques on the distal tibiae of fossil hominins and a comparative extant sample, this study attempts to shed light on the gait of our earliest ancestors. Homologous landmarks were designed to accurately reflect the shape of the distal articular surface. Data were collected using a Microscribe digitiser and the landmarks were registered and analyzed using the software morphologika. The comparative extant sample consists of 107 humans, 27 gorillas, and 15 chimpanzees. The fossil hominin sample consists of AL 288-lar, OH 35, KNM-ER 1481, and KNM-KP29286A, UW88-21, and SPY 1. PCA of the registered data reveals very distinct separation between all extant species with no significant overlap between *Homo*, *Gorilla* and *Pan*. When the fossil sample was considered both AL 288-lar, KNM-KP29286A, UW88-21 and the SPY 1 distal tibia, fall well within the human sample, while OH 35 and KNM-ER 1481 consistently fell outside of it. This analysis indicates that in terms of the talar articulation of the tibia, the temporally earlier australopithecines share more shape similarities with fully bipedal modern humans and neanderthal than later species of hominin included in the genus *Homo*.

Acknowledgements: We would like to thank the staff of the Mammalogy department at the American Museum of Natural History for allowing us access to their collections, without which this project would not have been possible. Thank you also to Dr. Ian Tattersall, curator emeritus of the biological anthropology department, for his invaluable advise and assistance.

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Poster Presentation Number 99, Sa (17:00-19:00)

## Hyperostosis Frontalis Interna In A Neanderthal From Marillac (Charente, France)

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The site of Marillac (“Les Pradelles”) is situated on the right bank of the Ligonne river at Marillac-le-Franc (Charente, France). An important stratigraphic sequence has yielded a great deal of archaeological information (Quina Mousterian techno-complex) and numerous fragmented and incomplete Neandertal remains related to the MIS 4. The detailed study of one of the cranial fragments, Marillac 3, allowed to identify grade 2 (Barber, 1997) or B (Herskowitz et al., 1999) of *Hyperostosis frontalis interna*, remodelling and altering the internal table of the frontal bone. This pathology has been analysed macroscopically, and also with radiography and sections made with a microscanner. The development of the HFI is compared with the evidence published about Sangiran 3 (*Homo erectus*) two other Neanderthals (Forbes’ Quarry and Shanidar 5) and several past populations. Forbes’ Quarry seems to display more advanced HFI than either the Iraqi fossil or Marillac 3. The three Neanderthals may be considered mature individuals (≥40 years) and it seems likely that the aetiology of this pathology may be due to hormonal alterations, as has been suggested for extant populations.

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Poster Presentation Number 132, Sa (17:00-19:00)

## Palaeoeconomic Behaviour In Northern Iberia During The Late Glacial Maximum From A Zooarchaeological Perspective

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During the Last Glacial Maximum (LGM) European human groups had to cope with extreme environmental conditions and a progressive reduction in available hunting territories due to the advance of ice sheets. In this scenario, some southern regions, characterized by a milder climate and a heterogeneous topography that favoured ecological diversity, acted as refugia for plants, animals and human populations. The Cantabrian Coast, located in northern Iberia, was one of those refugia as has been proved by the increasing number of archaeological sites during the Solutrean (Straus 1992) and the aDNA evidence, which has confirmed that the repopulation of central and northern Europe during the Late Glacial, not only in the case of animals such as red deer or salmon (Sommer et al. 2008, Meiri et al. In press; Consuegra et al. 2002) but also for humans (Achilli et al. 2004) had its origins in this area. The Cantabrian Coast is then a well-suited region for studying the evolution of the strategy of subsistence carried out by human groups during this critical period, above all for identifying how the economic behaviour adapted to an unprecedented episode of demographic intensification within a less-productive than present ecological niche and, how it changed with the posterior depopulation that came with the progressive migration northwards. The rich and well-preserved available archaeological record existing in the region provides an excellent opportunity to do so. Consequently, here we analyse the archaeozoological data recovered from Gravetian, Solutrean and Magdalenian sites in the region in order to test whether the variations in human demography through time have a reflection in the adopted palaeoeconomic choices. The degree of hunting specialization, the age of the consumed individuals, the type of carcass transport, the extent of logistic mobility and the sort of butchering process are estimated and compared between these cultural periods. The results show that the more intense human presence during the LGM implies a higher pressure on natural resources, with diets that tend to be in general wider and less productive. This scenario progressively moved toward a larger specialisation on red deer and ibex during the Magdalenian. Within this general framework, the preliminary results of the unpublished Lower Magdalenian faunal assemblages from El Mirón Cave, located in Eastern Cantabria, are also presented and assessed. This is a key site in Cantabrian Upper Palaeolithic due to its rich, complete and well-dated sequence (Marín-Arroyo 2010). Those new data come to help understand the significant economic changes that took place at the end of the LGM in this relevant refugium.

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Poster Presentation Number 143, Sa (17:00-19:00)

### A GIS approach to the Paleolithic site of Pirro Nord, Apricena, Italy: from data management to spatial analysis through a Wiki documentation

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The Paleolithic site of Pirro Nord, Italy [1,2], represents together with others France and Spanish sites the first human occupation of Europe in early Pleistocene. The site is a partially destroyed fissure, part of a Quaternary karst system, and it is filled by clay and sandy sediments with a significant vertebrate assemblage from the Pirro Nord Faunal Unit, associated with lithic artifacts. Since 2008 systematic excavations have collected a significant amount of data and, among others, taphonomical studies on macro-vertebrate remains were conducted for a PhD research in 2011 [3] in order to understand the formation processes of the deposit. The main aim of this project is the development with Free Software of a Geographic Information System (GIS) for the management of data and for spatial analysis. It also includes a detailed documentation Wiki site where we record the project's phases involved in the creation, maintenance, use and long-term preservation of GIS-based digital resources. A Web-based recording system (PiNo) has been developed for data entry in a spatial database (PostgreSQL / PostGIS) directly from Total Station file and from field reports. Thanks to a set of open library we are able to connect several GIS software (R, GRASS) to the database for spatial and quantitative analysis. We have correlated taphonomical analysis with spatial analysis, in particular with fabric [4,5,6] and point process analysis, very useful in the interpretation of post-depositional processes through the determination of isotropy in the orientation pattern and of randomness or clustered pattern. Although issues in the analysis of point distributions caused by the effect that voids and the size of study area has on the detection and characterization of patterning; despite orientation of records is estimated during the excavation with approximation of 45°; the GIS prove to be an useful technology for the management, the manipulation and the analysis of data even in the extreme conditions of a karst intra-site set. The previous hypothesized model of inner channels where water flow reworks the sediments is not confirmed by the fabric analysis. Clearly uniform orientation pattern and randomness distribution are more probably correlated with rapid, chaotic and massive processes like debris-flow. For the future it could be useful to completely reconstruct the site in 3D for more deep spatial analysis.

Acknowledgements: Special thanks to Marta Arzarello (Ph.D.) and Cristina Bagnus (Ph.D.) for full and unconditional access to research data.

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Podium Presentation: Session 2, Fr (11:30)

### Paleoepigenetics: Reconstructing the DNA methylation maps of archaic hominins

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The fact that until recently our ancestors lived concomitantly with Neandertals and Denisovans but turned out to be the only group to survive, raises the question of whether this is a result of some unique human properties. Recent advances in ancient DNA sequencing yielded ancient hominin genomes at a quality that rivals that of modern humans. This opens up an unprecedented opportunity to use genomic information in studying recent human evolution. Genomic variations that lead to differences in the protein product of genes had been comprehensively studied, but led to no conclusive insights. It is widely accepted, though, that much of the phenotypic differences between species is attributed to changes in regulatory programs rather than to changes in protein sequence. The big challenge is, of course, to retrieve meaningful information on regulation from ancient DNA sequences. Here we present a novel method to reconstruct the complete DNA methylation map along ancient genomes, based on asymmetry between the deamination of methylated and unmethylated cytosines. We revealed close to 500 differentially methylated regions (DMRs) between the Denisovan and modern humans, and a similar number for the Neandertal. Over 200 of these are found within gene promoters, where methylation levels are known to be inversely correlated with expression levels. Around 200 DMRs are shared between Neandertals and Denisovans (i.e., modern human-specific). These DMRs are associated with brain function, limb development, muscles, lipid metabolism and the immune system. They are highly enriched with disease-associated genes, and tend to reside in regions that are under strong positive selection in modern humans. This work comprises the first DNA methylation map of an ancient genome, and provides the first insight to gene activity in archaic humans. Our method can be implicated on any future high-coverage ancient genome, and thus opens a window to a new field – paleo-epigenetics.



Poster Presentation Number 97, Sa (17:00-19:00)

### Additional human fossil remains from Regourdou (Montignac-sur-Vézère, Dordogne, France)

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The Regourdou site is situated in Montignac-sur-Vézère, Dordogne, France and was discovered in 1954 by R. Constant. The remains of two hominins have been found at the site (Vandermeersch and Trinkaus 1995). The first individual, Regourdou 1 (R1), excavated in 1957, is a partial skeleton that preserves all the anatomical regions of the postcranial skeleton and the mandible with all the teeth. R1 displays clear Neandertal taxonomical affinities (Piveteau, 1963-66; Vandermeersch and Trinkaus, 1995) and was found in an interment under tumulus IVA, at level IV. The existence of a second hominin at this site is inferred from the presence of two human calcanei from the right side, one of which was discovered in a different part of the site to the interment (Madelaine et al., 2008). The revision of the faunal remains from the site started in 2008, and in its first phase yielded 11 additional human fossils that pertain to the R1 skeleton (Madelaine et al., 2008). Since then, the ongoing revision of the faunal remains at the museum of the site, at the Musée National de Préhistoire at Les Eyzies and at the Musée d'Art et d'Archéologie du Périgord has resulted in the identification of around 50 additional human remains. These new human fossils include thoracic remains (vertebrae (Gómez-Olivencia et al., 2013), ribs, a fragment of sternum), hand and foot remains, and long limb fragments. Most of these fragments can be assigned to the R1 skeleton as some have been refitted onto the original R1 skeleton: they constitute antimeres of specimens already belonging to R1 or they show congruence in size and do not constitute duplicates of the skeletal remains of R1. The objective of this communication is to present these fossils and discuss their significance in the present knowledge of the Regourdou 1 individual from a paleobiological and taphonomical point of view, as well as how these new remains affect to the general knowledge of the site. From a paleobiological point of view, it has been possible to ascertain pathological lesions on the vertebrae, on one rib and on the femoral shafts. From a taphonomical point of view, the finding of the first cervical makes the R1 skeleton to further resemble Kebara 2 in terms of preservation of the thorax and reopens the debate of the absence of the cranium in this individual. Acknowledgements: Thanks to Michèle Constant for the lending of part of the collections from the site of Regourdou, to the Musée National de Préhistoire, its director J.-J. Cleyet-Merle and the rest of its staff; and to the Musée d'Art et d'Archéologie du Périgord and especially its curator V. Merlin-Anglade and F. Couturas for making this study possible. The CT scanning of the vertebrae and ribs of the R1 individual was performed at the AST-RX, Plateforme d'accès scientifique à la tomographie à rayons X du MNHN (UMS 2700 outils et méthodes de la systématique intégrative CNRS-MNHN) and has been possible thanks to the Leakey foundation and the generosity of G. Getty and C. Thomson. AGO has a Marie Curie-IEF research fellowship and is supported by the Spanish Ministerio de Economía y Competitividad (project CGL2012-38434-C03-01). This study has also received support from the project Transitions convention 20051403003AB from Région Aquitaine.

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Poster Presentation Number 140, Sa (17:00-19:00)

### MTA B or not to be, that is the question? On going work concerning unpublished lithic and faunal material from Le Moustier (Dordogne, France)

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After some two decades of intense interest in the emergence of the Upper Palaeolithic in Western Europe, recent research has begun to re-focus attention on the Final Middle Palaeolithic of the region. Once seemingly resolved, continued revisions of both lithic and faunal assemblages (e.g. Discamps 2011; Jaubert 2012 for a synthesis) have revealed new, sometimes unexpected aspects of the Mousterian succession in South-western France. It is now clear that the MTA is not the final Middle Palaeolithic manifestation in the region as it is either older than or overlain by single or multiple layers of Discoid-Denticulate industries (Jaubert 2012; Jaubert et al. 2011; Thiébaud 2009; Discamps et al. 2011) or other techno-complexes as at Le Moustier (Lower Shelter). This latter site has played a formative role in our conception of the final stages of the Middle Palaeolithic. Originally excavated by O. Hauser, followed by D. Peyrony in the early part of the 20th century, the upper layers of the site partly formed the basis for the original distinction of the MTA-A MTA-B 'transition' (e.g. Bordes 1953). Following Laville and Rigaud's straightening of the profiles left by Peyrony, J.-M. Geneste and J.-P. Chadelle carried out a test pit towards the back of the rock-shelter in 1982 to obtain dating samples (Valladas et al. 1986). Here we present preliminary results of our ongoing analysis of the unpublished lithic and faunal material from this small test pit. This material of known provenance and excavation conditions (e.g. level, sieve size, etc.) provides an ideal measure for evaluating any biases inherent in Peyrony's collection and hence its overall representativity (e.g. artefact types, density, etc.) of the original contents of each level. More importantly, this material can be securely correlated with the sub-levels identified by Laville & Rigaud (1973), therefore providing a means for tracing changes internal to each level. A techno-economic analysis of the material from level H, assigned to the MTA-B by F. Bordes, with special attention to the primary reduction strategy and taphonomy of the bifacial component, not only presents interesting points of comparison with chronologically similar assemblages, but might suggest an alternative industrial attribution. Detailed zooarchaeological analyses of faunal material associated with MTA assemblages remain relatively rare. The faunal material recovered by Geneste & Chadelle provides an opportunity for assessing the site's faunal composition and subsistence strategies which was previously impossible due to Peyrony's recovery methods. While the material from levels G (MTA-A) and J (Typical Mousterian) is less informative, the faunal signal from level H shows interesting internal developments. This coordinated re-evaluation of previously unavailable lithic and faunal data from Le Moustier clearly demonstrates the importance of revising material from old excavations with new perspectives, which in this instance, allows level H to be discussed in relation to other contemporaneous occupations, posing new questions as to the variability of the regional Late Middle Palaeolithic.

Acknowledgements: We are extremely grateful to Jean-Pierre Chadelle and Jean-Michel Geneste for confiding the material from their excavation to us for study. We would also like to thank Alain Turq, Jean-Phillipe Faivre, Jean-Guillaume Bordes and Jacques Jaubert for invaluable discussions. Financial support from UMR-5199 PACEA (CNRS/ University of Bordeaux 1) made this research possible.

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Poster Presentation Number 89, Sa (17:00-19:00)

Morphological description and comparison of the endocasts from Qafzeh (Israel)

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The study of brain morphometrics from ancient anatomically modern humans in the Levant can provide important insight into the emergence of behaviorally modern humans in Eurasia. We present a comprehensive study of Qafzeh 3, 6, 9 endocasts which are compared to the Skhul V endocast and bibliographic data from other individuals in the site. Physical or virtual endocasts of Upper Paleolithic hominins (Cro Magnon 1, 2 and 3, Predmost 3, 4, 9 and 10, Brno 3, Dolni Vestonice 1 and 2, Pataud 1) and 102 extant modern humans from diverse geographic origins (kept in the Museum National d’Histoire naturelle in Paris) are employed in the comparative analysis. Besides a complete description of the overall morphology (including sinusal and middle meningeal vascular imprints, sulcal and gyral impressions, etc.), estimation of cranial capacity and, classic metric brain measurements as well, are performed on the physical endocasts, on virtual models with dedicated software (ArteCore and Avizo) and on drawings for dimensions quantified in projections. 3D coordinates of landmarks for geometric morphometric analyses were registered with a microscribe. The individual variation illustrated by the most complete specimens (Qafzeh 6, 9 and Skhul V) is analyzed with regard to the data collected from other fossil and extant modern humans, in order to discuss the potential peculiarities documented by these most ancient *Homo sapiens*’ brains from the Levant. The results of this study illustrate intraspecific anatomical variations in the *Homo sapiens* brain, demonstrating its plasticity, since the appearance of our species.

Poster Presentation Number 102, Sa (17:00-19:00)

The Late Palaeolithic to Neolithic transition in Northwest Africa: Body size, mobility and habitual activity

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The shift from hunting and gathering to a food production economy resulted in one of the most profound bio-cultural transitions in human history. It caused a major change in the relationships humans have with the natural environment in which they live but also lead to changes in society: property ownership, hierarchy and social complexity (Diamond, 1999; Stock et al., 2011). Food production made it possible for humans to occupy a series of new, previously unoccupied niches. It also lead to a reduction in interbirth interval and subsequent population increase (Wells & Stock, 2007). Although domesticated and cultivated plants as well as animal husbandry appear by 5500 BP (Morales et al., 2013) in Northwest Africa the effect of this subsistence transition on the biology of these populations is poorly understood. It is commonly suggested that cultural diffusion from the early Near Eastern food production centres lead to the introduction of agriculture (Smith, 1998) and possibly coincided with population replacement. Dental traits, however, indicate population continuity from the Later Stone Age through the Neolithic in Northwest Africa (Irish, 2000) supporting instead the idea that there were multiple centres of agricultural origin (Hanotte et al., 2002). As far as we are aware, no studies have addressed the bioarchaeology of the transition to food production in Northwest Africa. Nevertheless, there is a large body of literature describing this transition in other parts of the world. In the Nile Valley, for example, a decline in body size early on was found with the onset of agriculture, followed by a recovery (Stock et al., 2011). An initial increase in linear enamel hypoplasia was also observed (Starling & Stock, 2007) which, taken together, suggest an period of population stress with the introduction of food production, followed by recovery. This stress could have been a reduction in the availability of food due to crop fails, reduction in food quality and an increased overall disease load from the easier spread of infectious diseases, and bacterial transfer in sedentary and larger populations (Cohen, 1989). This study covers the temporal span from the Iberomaurusian (20,000 BP – 8,000 BP) through the Neolithic (about 7,000BP – 3,000 BP) and examines stature, body size and indicators for habitual behaviour and mobility during the transition. A sample of 272 Iberomaurusians, 29 Capsian and 25 Neolithic individuals, show similar trends to those observed elsewhere. Results show no significant difference in stature or body size between the Iberomaurusian and Capsian, reflecting the continued use of a hunting and gathering lifestyle. The onset of the Neolithic shows a significant decrease in stature and body size, suggestive of population stress. Robusticity also reduces with the introduction of agriculture. In the Iberomaurusian there are differences in levels of robusticity in males and females suggesting different loading patterns, but sample sizes for sex-determined the Capsian and Neolithic individuals are small so apparent differences can only be considered indicative of changing patterns in the roles of males and females with the onset of agriculture.

Acknowledgments: Many thanks to Louise Humphrey for valuable discussion. I would also like to thank Professor De Lumley, Amelie Vialet, Philippe Mennecier, Mary Jackes, David Lubell, and INSAP, Rabat Morocco for access to collections. This work was funded by the Leverhulme Trust and the Calleva Foundation.

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Podium Presentation: Session 10, Sa (13:40)

Advances in the study of the Middle Palaeolithic of Arabia

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As a bridge between Africa and the rest of Eurasia, the Arabian Peninsula is of fundamental importance in our understanding of Middle and Upper Pleistocene hominin evolution, demography and dispersal. Dramatic environmental change in Arabia also makes it a pertinent place with which to study the relationship between humans and environments through time and the extent to which they could adapt to arid conditions. No pre-Holocene hominin fossils are known in Arabia, so the study of human evolution primarily rests on the analysis of lithic assemblages. In the last five years stratified and dated archaeological sites in Arabia have begun to be published, allowing the first robust comparisons both within Arabia and with surrounding regions. Here we report the results of the recent fieldwork of the Palaeodeserts Project, which has been conducting surveys and excavations in Saudi Arabia. We have conducted the first excavations of Middle Palaeolithic sites in Saudi Arabia, which have demonstrated high levels of technological diversity. Other results include the discovery of the oldest well-dated Palaeolithic site in Arabia (MIS 7). In this paper we present these recent findings and compare the character of lithic reduction at these sites using quantitative techniques to assemblages in surrounding regions of Africa and Asia. We argue that increasing evidence supports the hypothesis of Marine Isotope Stage 5 population dispersals from Africa into Arabia along terrestrial routes. This stands in contrast to some other models, which suggest that the dispersal of modern humans out of Africa occurred around 70-50 ka and followed a coastal route.

Acknowledgements: The Palaeodeserts Project is funded by the European Research Council (to MDP, 295719). Initial fieldwork was funded by the Leakey Foundation and National Geographic. We thank the Saudi Commission for Tourism and Antiquities for allowing us to conduct our research in Saudi Arabia.

Poster Presentation Number 105, Sa (17:00-19:00)

The Influence of Latitude and Island Ecology on Macaque Dental Morphology

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Macaques (genus *Macaca*, tribe *Papionini*, family *Cercopithecidae*) are one of the most successful and diverse primate radiations. With the largest geographical distribution of any non-human primate, spanning from North Africa to East Asia, these cercopithecoid monkeys have dispersed into a variety of ecological contexts. In this study we are investigating the role of geography and ecology, compared to phylogeny, in macaque evolutionary history. We do so by examining patterns of dental morphology in relation to various environmental parameters. Data were collected from the permanent dentition of 670 museum specimens of ten different *Macaca* species. Species included are *M. sylvanus* (N = 70), *M. silenus* (N = 50), *M. nemestrina* (N = 69), *M. nigra* (N = 71), *M. maura* (N = 56), *M. sinica* (N = 86), *M. radiata* (N = 80), *M. fascicularis* (N = 75), *M. mulatta* (N = 70) and *M. fuscata* (N = 46). These were selected on the basis of their geographical, habitat, phylogenetic, and size diversity. The resulting sample covers a wide geographical area (from North Africa to Japan) and includes species from continental and insular Asia that differ in habitat breadth and body size. Moreover, all four species groups (the *sylvanus*, *silenus*, *sinica*, and *fascicularis* groups) are represented in the sample, allowing for phylogenetic comparison. Dental metrics (tooth length, breadth and height) as well as a number of non-metric traits (e.g., level of expression of C6, C7 and C8) are analysed. We analysed the dental metrics and non-metrics in relation to a number of environmental and geographical variables, as well as phylogeny. We tested two hypotheses. 1) The range of intra-specific variation across macaques increases with latitude in the northern hemisphere. This links in with the latitudinal biodiversity gradient, a phenomenon that refers to a decrease in biodiversity with increasing northern latitudes while species' ecological niches broaden, a trend that may be reflected in dental morphology. 2) The level of morphological complexity in the form of supernumerary cusps and cingular remnants is lower in island species. As a result of increased genetic isolation dental morphology may become decreasingly variable and complex. The results of these analyses are discussed in the context of a broader study detailing the geographical and ecological correlates of macaque dental morphology, aimed at understanding the ecological factors underlying macaque dispersal and evolution. The widespread distribution and diversity of macaques makes them the ideal taxon for a comparative approach in which we may identify more general evolutionary mechanisms that drive the observed morphological patterns.



Podium Presentation: Session 2, Fr (11:50)

## Morphological integration of the bony labyrinth and the cranial base in modern humans and Neandertals

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The shape of the bony labyrinth varies even among closely related groups, such as modern humans and Neandertals (Hublin et al., 1996; Spoor et al., 2003). Among extant species morphological variation of the cochlea and semicircular canals have been linked to differences in sound perception and locomotor behaviour, respectively (Spoor & Zonneveld, 1998). However, shape differences among labyrinths have also been linked to differential development of the cranial base and brain (Jeffery & Spoor, 2004). It is therefore unclear to what extent the differences in semicircular canal shape between modern humans and Neandertals reflect functional differences of the vestibular system, or whether they are merely a by-product of morphological integration with the encasing petrous part of the temporal bone. Here we study the morphological integration of the shape of the human bony labyrinth and the shape of the cranial base. We use three-dimensional geometric morphometrics to analyse high-resolution computed tomographic scans based on landmarks and semilandmarks. We first quantify the morphological integration of semicircular canals and cochlea (Gunz et al., 2012) with the cranial base (Neubauer et al., 2009) within recent modern humans (N=21) using partial least squares (PLS) analysis (Bookstein et al., 2003). We then assess the bony labyrinths of a Neanderthal sample (N=10) in light of these PLS predictions. We find that within modern humans bony labyrinth shape co-varies with the shape of the cranial base. The strength of this association is moderate: for the first PLS axis (explaining 40% of the covariation) the correlation between the PLS scores of labyrinth and cranial base  $r=0.66$ , and the Escoufier coefficient (Escoufier, 1973)  $RV=0.26$ . Unexpectedly, we find that shape changes of the petrous portion of the temporal bone seem to have little impact on the spatial relationship between the functionally unrelated cochlea and semicircular canals. Along PLS 1 a relatively larger size of the posterior cranial fossa with a relatively wider cranial base and a thus more coronally oriented petrous bone is associated with a relative decrease in arc size of the posterior semicircular canal. Moreover, the lateral canal tilts upward. The main axis of morphological integration between the bony labyrinth and the cranial base within modern humans is consistent with the shape differences between modern humans and Neandertals, in particular the spatial relationship between the lateral and the posterior semicircular canal. However, morphological integration cannot account for all species differences observed in the bony labyrinth. It is therefore possible that some differences in the morphology of the vestibular system between modern humans and Neandertals might be functionally relevant.

Acknowledgements: We thank all curators of extant and fossil material for providing access to the material in their care.

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Podium Presentation: Session 4, Fr (14:20)

## New data on the radiocarbon chronology of the Stretleskayan at Kostenki (Voronezh, Central Russia)

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The Kostenki archaeological area, south of Voronezh (Don valley) provides some of the best documented open air sites related to Early Upper Palaeolithic assemblages in the Eastern European plain (Sinitsyn, 1996). Preserved on the second terrace of the Don, these sites are usually related to a reproducible Middle Pleniglacial pedo-sedimentary succession, encompassing two humic complexes, with in between loess-like deposits containing the Campanian Ignimbrite (CI) dated ca 34 ka uncal BP in Italy (Sinitsyn and Hoffecker, 2006). Our presentation will focus on the chronological background of the Stretleskayan assemblages encountered in the lower humic complex at Kostenki, which represent a major component of the Middle to Upper Palaeolithic transition in the Russian plain. It concerns cultural layer III at Kostenki 12 and cultural layer V at Kostenki I, respectively previously dated 36,280 ±360 and 34,900 ±350 BP in Groningen (Damblon et al., 1996). Recently, as a complement to a renewed pedo-sedimentary record of the Kostenki 1 section, two charcoal samples from cultural layer V, provided in the 1990s by N. Praslov, were cross-dated. Each homogenized charcoal sample has been split in two subsamples which were submitted for dating to Groningen with ABA (acid-base-acid) pretreatment and to Oxford with ABOx-SC (acid-base-oxidation-stepped combustion) pretreatment (Haesaerts et al., 2013). Remaining material of the charcoal sample from cultural layer III at Kostenki 12, previously dated 36,280 ±250 BP, was also submitted for dating to Oxford with ABOx-SC pretreatment. The results show that the two Groningen dates and the three Oxford dates are in good agreement and fit within a time interval of 1 millennium, but provide ages several millennia older than the ages obtained previously. Taking into account this new chronology, the appearance of the Stretleskayan at Kostenki will be compared with the chronological background of the Early Aurignacian, Szeletian and Bohunician occurrences in the Middle Danube sequence, also based on ABA and ABOx-SC cross-dating (Haesaerts et al., 2013).

Acknowledgements: The loess research in Kostienki is a contribution to the Sc-09 and MO/36/021 research projects of the Belgian Science Policy, with complementary funding from the INTAS 2000-879 research project. The Oxford dates were funded by the McDonald Institute for Archaeological Research (D M McDonald Grants and Awards Fund) and the NEMO-ADAP project (EU FP7 MC Career Integration Grant and Sir Isaac Newton Trust, University of Cambridge).

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Podium Presentation: Session 5, Fr (16:20)

# Omnivorous Neanderthals: New perspectives on diet and environmental knowledge from the Middle Palaeolithic

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The recent identification of two medicinal plants, yarrow and camomile, in the dental calculus of an individual from the Spanish site of El Sidrón (Hardy et al. 2012), together with identification of the bitter taste perception gene in this population, raises the issue of plant knowledge among Neanderthals. Both plants have little nutritional value and we believe they were ingested for medicinal purposes. The ability to taste, select and use non-toxic bitter tasting plants indicates a sophisticated understanding which fits into the continuum of acquired, essential knowledge that occurs very widely across the animal kingdom (Hardy et al. in press). Additionally, while it is established that Neanderthals ate substantial amounts of protein, they were not obligate carnivores therefore they also needed to consume carbohydrates in order to survive. We propose that Neanderthals had an extensive plant knowledge that included the ability to select and consume a range of edible plant foods in addition to selecting non-toxic bitter tasting plants as medicine. When viewed from the broad perspective of the emerging evidence for the extent of medicinal use of plants by animals and insects, and the knowledge of plants displayed by higher primates both as food and for purposes of self-medication, it would in fact be surprising if Neanderthals did not also share and apply this type of knowledge. This presentation will outline a context for Neanderthal plant use, drawing evidence from archaeological remains, physiological requirements and the broader context of plants as food and medicine as displayed by animals generally and higher primates in particular.

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Podium Presentation: Session 1, Fr (8:40)

## Searching for stone tools older than 2.6 Ma: how do we know what we are looking for?

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The manufacture and use of tools by hominids have been studied extensively by archaeologists and also recently by primatologists, all of whom appreciate the relevance of tool-use and tool-making in understanding the origins of technology and the evolution of human behavior. Over the last few decades, there has been growing consensus on the probability of hominin tool manufacture before the Oldowan technocultural complex at 2.6 Ma. The simplest and most widely accepted defining characteristics of the Oldowan are that its knappers had a basic understanding of the conchoidal fracture mechanics of stone and that they used it to effectively strike flakes off of cores, predominantly using the free-hand knapping technique. The earliest known artifacts from the sites of Gona (2.56 Ma) and Hadar ( $2.36 \pm 0.07$  Ma) in Ethiopia and Lokalalei 2C ( $2.34 \pm 0.05$  Ma) in Kenya already demonstrate hominin knappers' planning depth, spatial coordination, manual dexterity, and raw material selectivity. It has been acknowledged that percussion processes apart from knapping, such as pounding/battering activities, could have been more important in the earliest stages of stone tool use, possibly for processing plant foods. The publication of potentially cut marked bones from Dikika, Ethiopia, dated at 3.39 Ma, added to this speculation. Finally, it has been argued that artifacts made by hominins before 2.6 Ma might be of too low densities or made of perishable materials such that they have remained invisible, or that archaeologists haven't recognised such stone traces because they do not directly resemble known Oldowan lithics. How, when, and why did stone tool manufacture and use originate? Did the earliest stone knapping develop naturally from pre-existing bashing behaviors or did it develop more punctually and directly to flaking for cutting edges? What were the first stone tools used for? Recent archaeological discoveries made by the West Turkana Archaeological Project and initial results from a new experimental program are presented here showing that percussion processes apart from knapping, such as pounding/battering activities, could have been more important in the earliest stages of stone tool use.

**Acknowledgements:** We thank the office of the President of Kenya and the National Museums of Kenya for permission to conduct this research; the French Ministry of Foreign Affairs, the Fyssen Foundation, the National Geographic Society, the Rutgers University Research Council and Center for Human Evolutionary Studies for financial support; Total Kenya and the Turkana Basin Institute for logistical support and the GeoEye Foundation for a satellite imagery grant.

Podium Presentation: Session 1, Fr (8:20)

Stone tool use by wild monkeys: primate archaeological case studies from Thailand and Brazil

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Recent primatological models for the development of hominin stone tool use have tended to concentrate on chimpanzees (*Pan troglodytes*), the best-known tool-using primates [1,2]. However, stone tools are also used for pounding tasks by wild Old World and New World monkeys: respectively long-tailed macaques (*Macaca fascicularis aurea*) in Thailand and bearded capuchins (*Sapajus libidinosus*) in Brazil [3-5]. The geographic pattern of stone tool use for all three of these species suggests that each has independently converged on this behaviour [6], which means that analogy rather than homology needs to be invoked if they are to be considered relevant to hominin evolution. Here, I discuss ongoing field projects investigating stone tool use by both *M. f. aurea* and *S. libidinosus*, aimed at defining the archaeological signatures of monkey stone tool use. These projects fall under the umbrella of primate archaeology, an emerging research field that examines the material evidence for the evolution of tool use in primates outside the human lineage [7]. Initial results demonstrate that (i) different actions used by long-tailed macaques to process shellfish can be accurately identified by macroscopic use-wear patterns on stone tools; (ii) landscape-scale activities by bearded capuchin groups that process hard palm nuts can be reconstructed from stone anvil patterning; (iii) evidence for capuchin tool use is preserved in sub-surface deposits; and (iv) capuchin processing of cashew nuts results in the accumulation of stone tools at distinct sites, identifiable in the absence of direct observation. I compare aspects such as site formation, ecological context and stone selection across the two monkey species and chimpanzees, to help identify those features that are relevant to discussions of human evolution.

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Poster Presentation Number 50, Fr (18:00-20:00)

Extending the age range of the OSL method for dating Pleistocene sedimentary deposits using quartz grains

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The knowledge of the early stages of the Palaeolithic period suffers from a global lack of precise chronological data because of the scarcity of available material that could be dated by numerical methods. In this context, the development of sedimentary quartz dating is of great interest to establish a precise and detailed chronostratigraphical framework. Since the 90's, the Optically Stimulated Luminescence (OSL) dating method makes benefits of intensive methodological researches as well as technological advances, and is now widely used in geochronology (Wintle, 2008). However, this method, in his classical form, is restricted to samples whose age do not exceed the last 100.000 years. Going beyond this limit implies to use other types of luminescence signals which are able to accumulate larger dose during burial time. Recently, it was demonstrated that the luminescence signal obtained in using a violet stimulation could provide an alternative to this requirement (Jain, 2009). Following these first observations, we initiated a methodological study to test and develop this approach based on the Violet Stimulated Luminescence (VSL). This poster presentation aims at providing an overview of the potential of the VSL dating method. Some characteristics of the VSL signal are presented and discussed in order to highlight the applicability of this method. The results indicate a rapid bleaching of the signal what would make possible the dating of a large variability of sediment deposits. Moreover, the high saturation dose level and the physical characteristics of the source traps involved in the production of the VSL signal suggest that the method could be used for dating Early and Middle Pleistocene sediment samples. In light of these data, a dating protocol was established and comparisons between VSL and independent ages are presented.

Acknowledgements: This work was supported by the labex LaScArBx.

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Poster Presentation Number 38, Fr (18:00-20:00)

## Covariation between hands and feet: 3D geometric morphometrics applied to human proximal phalanges

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In human hands and feet, the first digit is longer and more robust compared to the lateral digits than in apes (Rolian et al., 2010; Rolian et al., 2009). These human traits may have coevolved in hands and feet due to a shared developmental pattern of these elements; evolutionary changes towards precision grip capabilities involving ray 1 in the genus *Homo* could, therefore, be a by-product of selective pressures on the big toe (Rolian et al., 2010). The present study focuses on the covariation of the shape of proximal finger and toe phalanges of adult modern humans (*Homo sapiens*) of various phenotypes to determine whether covariation is different in the first ray relative to the others. Fifty individuals from the Americas, Asia, Europe and Africa have been digitised using a NextEngine surface scanner and Geomagic. Landmarks were digitized on 3D surface models of the phalanges using Landmark. They were chosen to reflect general and functional shape of the proximal and distal articular surfaces and the tubercles. Subsequently, generalised Procrustes superimposition and two-block partial least squares analyses (2B-PLS) were conducted in MorphoJ on the Procrustes coordinates. Angles of the PLS vectors were computed for each ray in the hand and the foot and compared using principal coordinate analysis (PCoA). PCoA differentiates between the first ray and the middle three rays. An increase in overall robusticity is associated with a change in the shape of the distal articular surface, which is different in the first ray to the other rays. Additionally, as the medial and lateral basal tubercles in the foot phalanges become more prominent with increasing overall robusticity to a similar degree, the associated change in the hand phalanges is symmetrical for the first ray, but asymmetrical for the middle three rays, where the medial tubercle increases most in relative size. The difference in PCo scores between the first and the other rays indicates that the developmental integration between the thumb and the big toe may be different from that between the hand and foot phalanges of the other rays. This may be the evolutionary consequence of differential selection pressure on the big toe relative to the other toes related to the rise of bipedalism in the human lineage. Functionally, it may be hypothesised that a more symmetrical development of the tubercles with increasing robusticity in the first manual ray is associated with the need for high precision mobility, as rotation is being performed, for a large part, by the metacarpal. In the middle three rays, however, asymmetry is caused by a larger radially directed pull of the interossei involved with opposing these fingers to the thumb, as there is only limited metacarpal rotation. In the foot, on the other hand, all rays share a similar function (i.e., bearing of weight and locomotion) and the tubercles develop more symmetrically with increasing robusticity.

Acknowledgements: The authors are grateful to A. Froment, P. Menecier, A. Fort, V. Laborde and L. Huet for help with the specimens stored at the Mus  um national d'Histoire naturelle in Paris. We would also like to thank A. Gossez for digitising part of the sample used herein and G. Berillon for valuable advice. This research is funded by the Centre national de la Recherche scientifique through the labex BCDiv ("Diversit  s biologiques et culturelles: Origines, Evolution, Interactions, Devenir").

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Podium Presentation: Session 7, Sa (8:40)

## Radiocarbon dating the extinction of European Neanderthals

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To understand the disappearance of the Neanderthals, a reliable chronology is required. This has largely eluded science thus far; despite many radiocarbon determinations being obtained from sites dating to the Middle to Upper Palaeolithic transition, our knowledge of the timing of this is opaque. The western European archaeological record constitutes the best evidence there is for the prehistoric replacement of one species of human by another, so deciphering the signals of this transition assumes importance in understanding what happened. For example, exploring the dates of the disappearance of Neanderthals and the arrival of modern humans might help us to understand the possibilities for overlap between the two groups, and therefore whether there was any genetic or genetic exchange between the two populations. AMS dating material dating older than 30,000 BP is challenging, but work undertaken in Oxford over the last decade has improved the dating of material from this period. We have developed aspects of our pre-treatment chemistry, particularly the purification of bone collagen using ultrafiltration and in the dating of single amino acids from bone, as well quantifying our background limits and corrections. Within a large project funded by the NERC in the UK, we have been dating over 400 samples of bone, shell and charcoal from more than 50 key Palaeolithic sites in 10 countries. The main focus has been on sites with a succession of contexts containing lithic industries attributed to the Mousterian, Ch  telperronian (both seemingly associated with Neanderthals), Uluzzian (now thought to be anatomically modern humans (AMH)), Aurignacian and Gravettian (associated with AMHs). In this paper we will discuss the emerging chronology for the disappearance of the Neanderthals by presenting results from some of the key sites in France, Germany, Italy, Spain and Belgium. We use Bayesian modelling to derive posterior density estimates for the final disappearance data of Neanderthals in each geographic location we have studied and consider the results in a spatio-temporal model.

Poster Presentation Number 67, Fr (18:00-20:00)

## Al-Kharj 22, a Nubian Complex site in central Saudi Arabia

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Across both sides of the Red Sea archaeological sites exhibiting a specific type of Levallois reduction, entitled the Nubian Method, have been reported (Rose et al. 2011; Usik et al. 2012; Crassard and Hilbert 2013). In Northeast Africa and across central and southern Arabia, this reduction method was applied for the production of Nubian Points, which are preferential blanks with pre-determined elongated and convergent outlines. Distinct characteristics of this production method are: A) the preparation of the cores distal to medial guiding ridge by a combination of distal and centripetal removals administered from a specially prepared distal striking platform and; B) the predominantly triangular to sub-triangular outline of the cores themselves. The presence of the Nubian Levallois technology in North Africa and the Arabian Peninsula cannot be explained by simple technological convergence or recurrent autochthonous invention. Archaeological investigations conducted across Arabia indicate a considerable amount of technological and demographic permeability between Northeast Africa, the southern and central portions of the Peninsula from the MIS 5d (115 -105 ka. BP) onward. The point of entry for expansion is yet to be determined. The Southern Dispersal Rout, via the Bab al Mandeb, cannot be ruled out, neither can an incursion through the north of the Peninsula, over Sinai, be fully rejected given the premature state of research across northern Saudi Arabia. Here we discuss the implications of the newly discovered site of Al-Kharj 22 in central Arabia, an important point of reference for tracking the expansion of the Nubian Complex and Anatomically Modern Humans across Arabia. Based on technological analysis undertaken on samples from across Arabia we also suggest a revision of the original Nubian Levallois taxonomy, which was originally proposed by Guichard and Guichard (1965) and based strictly on core typology. Furthermore, possible expansion scenarios into and across the Arabian Peninsula are discussed.

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Podium Presentation: Session 6, Fr (17:40)

## Deciphering Patterns in the Archaeology of South Africa: The Neurovisual Resonance Theory

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It has been assumed that the accumulating archaeological finds from the Middle Stone Age in southern Africa, including the geometric patterns on various objects from Blombos and Diepkloof, provide evidence of symbolic intent and therefore modern human behaviour. These finds, some dating back to 100,000 years ago, have led to a reassessment of the probable timeline of the cognitive profile of *Homo sapiens*. However, the symbolic status of the patterns concerned continues to be debatable, not least because there are competing alternative explanations. Moreover, the patterns on the objects from the separate sites of Blombos and Diepkloof show distinct similarities with a progression from simpler lines to more complex motifs over a period of 25,000 years, and corresponding patterns have been found from other sites in southern Africa. This observation raises the question as to why these motifs are so similar over such an extended time span and from such disparate sites. A socio-cultural explanation would predict more variation in the patterns over time and between groups as a result of the different cultural imperatives obtaining. A further issue that needs to be explained concerns the reason why there was a preoccupation with abstract geometric shapes at such an early date rather than figurative representation, as the latter is obviously more meaningful due to its iconicity. Moreover, the fine motor control required for producing the Blombos and Diepkloof patterns suggests the individuals responsible were skilled enough to produce iconic figures. The aim of this paper is to show that the Blombos and Diepkloof patterns can be potentially explained by the Neurovisual Resonance Theory, which is a formal model based on how the early visual cortex processes visual information. This theory is based on the close interconnection between perception, the early visual cortex, the visuo-motor system, implicit awareness, and embodied processes. Important developments in neuroscience since 2000, when the theory was first outlined, will be presented that has provided verification of this theory. In particular, it has been established that neurons in early visual cortex are tuned to and detect basic aspects of form, or perceptual primitives, e.g., edges (lines), intersections (angles) etc., which conform to Gestalt principles of perceptual organization. As the South African motifs conform to the same Gestalt principles, and given the fact recent neuroscientific research confirms that the early visual cortex deals with sensory information in a similar way, a useful alternative approach towards helping to understanding the provenance of such “designs” is now possible. This presentation will therefore describe the relevance of the Neurovisual Resonance Theory to these issues by providing a detailed analysis of the dynamic interaction that takes place between perception, the early visual cortex, the visuo-motor system, and the earliest confirmed patterns from South African sites. Thus, it will be shown that, in view of the fact that a lower order “bottom-up” account is capable of accounting for the southern African motifs, a higher order symbolic explanation needs to be regarded with caution.

Poster Presentation Number 17, Fr (18:00-20:00)

The StW 99 femur and relative lower limb length of *Australopithecus africanus*

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1 - Tulane University · 2 - Duke University · 3 - University of West Bohemia · 4 - University of the Witwatersrand

StW 99 from Member 4 at Sterkfontein is the most complete presumed *Australopithecus africanus* femur found to date, but a reliable reconstructed length for this partial femur remains somewhat elusive. For example, McHenry and Berger (1998) used their estimate of femoral head diameter (38 mm) to predict StW 99’s femoral length using both human and nonhuman hominoid regression equations. The resulting femoral length estimates were 381.8 mm and 313.0 mm, respectively. Alternatively, Häusler (2001: 83) concluded that the median value for StW 99’s femoral length was 346 mm, with a “maximum feasible length of 350 mm and a minimum of 338 mm”. After a careful examination of the specimen, we consider these estimates as highly unlikely and propose a different approach to the length estimation in this specimen. We locate the specimen’s “femoral waist” (i.e., the mechanically weakest point along the shaft as defined by Friedl et al.[2009, 2013]) to serve as a proxy for midshaft, and then estimate femoral length using a least-squares regression of the distance from the center of the trochanteric fossa to actual midshaft for a sample of recent humans (n = 50). From this, we estimate the femur length of StW 99 to be 433.5 mm, with an associated 95% confidence interval spanning 417.3 – 449.8 mm. This is much longer than the femoral lengths predicted for the specimen by McHenry and Berger (1998) or Häusler (2001), but it is almost identical to two possible femoral lengths predicted for the large-bodied *Au. afarensis* specimen KSD-VP-1/1 (Haile-Selassie et al., 2010). Together, these two specimens suggest that lower limb elongation in the Hominini may be more ancient than previously thought, and are yet further evidence of mosaic locomotor evolution in the tribe. Acknowledgements: This project was supported in part by a New Technologies for Research of Contemporary and Past Societies Grant (Grant number: OPVK NOTES CZ.1.07/2.3.00/20.0135).

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Poster Presentation Number 42, Fr (18:00-20:00)

Neandertal adaptation to close-range hunting: metabolic cost of bent-hip bent-knee gait

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It is widely accepted that Neandertals hunted at close-range using stone-tipped spears for thrusting and/or short distance throwing. Such hunting strategy requires to get to pray noiselessly and unseen as close as possible. Bent-hip bent-knee (BHBK) walking seems to be eligible gait for close-range hunting since it decreases both loudness (by smoothing peaks of ground reaction force) and visibility (due to reduction of instant body height) of the hunter in comparison to normal erect walking. The Neandertal short lower limb and long knee extensor muscle moment arm may be especially advantageous for BHBK walking used in close-range hunting. In this study we aim to explore energetic aspects of BHBK walking in close-range hunting in Neandertals and Early Upper Paleolithic Europeans (EUP). We measured sagittal plane kinematics and instant body height of one male subject while walking in one of four different postures (normal erect posture and three degrees of BHBK posture) and analyzed the relationship between the instant body height and lower limb joint angles. We used locomotor posture modeling and inverse dynamics to estimate walking cost of Neandertals and EUP while BHBK walking. Our results suggest that assuming equal locomotor posture, Neandertals would had 3% higher walking cost and 6% lower instant body height than EUP while BHBK walking. To achieve the same instant body height as Neandertals, EUP would have to keep their hips and knees more flexed which would increase EUP walking cost 7% above that of Neandertals. Neandertal morphology thus seems to be more advantageous for close-range hunting than that of EUP allowing Neandertals to use less energy and/or keep lower instant body height while approaching the prey.



Podium Presentation: Session 7, Sa (9:20)

## The “transitional industries” and their makers

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The colonization of western Eurasia by modern humans between 50–40 ka cal BP is the best-documented example of replacement of one human group by another in the Pleistocene record. Assuming that pending issues can be resolved, it may allow us to investigate a replacement process in great detail and to assess the degree of chronological overlap of the two populations on a continental scale as well as their possible biological or cultural interactions. There is a rather solid consensus on the fact that, in Europe, late variants of Middle Paleolithic (MP) (Mousterian or Micoquian) industries were produced by Neandertals. Most, if not all, Aurignacian assemblages can be securely assigned to modern humans. However, to date, the various forms of Proto-Aurignacian have not yet yielded significant human remains. However, in several regions of Europe, so-called “transitional industries” (TI) are found above the late MP and/or under the first true Upper Paleolithic (UP) layers. These assemblages display to various degrees the persistence of older technologies (e.g. Levallois products) in combination with a proportion of UP tools/technologies. Falling into this group are the Lincombian-Ranisian-Jerzmanowician in northern Europe, the Châtelperronian and Uluzzian in western Europe, and the Bohunician and Szeletian in central Europe. To this group one can also add assemblages labeled “Initial UP”, as defined in southwestern Asia and some of the laminar assemblages that retain Mousterian characteristics observed in eastern Europe (Tsanova 2008) and in Southeast Asia(Kuhn et al. 2009). By far the TI that have yielded the largest number of human remains is the Châtelperronian, and the Neandertal nature of these remains is quite clear (Bailey and Hublin 2006; Hublin et al. 1996). However, even in this case the biological identity of the makers of the industry has been challenged. Other TI have yielded far fewer remains. This presentation will propose a brief review of the available fossil evidence. Likely TIs do not represent a homogeneous group of industries. In some instances they might be the expression of a local “transition” from MP to UP. But in other situations, especially in central and eastern Europe, TIs might well have been produced by modern humans. The demonstration of modern settlements pre-dating the earliest Aurignacian in Europe has important implications (Hublin 2012). It is consistent with a patchy pattern of modern colonization, with some significant chronological overlap between Neandertals and modern humans on a continental scale. In this model innovations observed in the Neandertal world around or after 50 ka cal BP may have resulted from cultural diffusion triggered by these influxes of populations into western Eurasia.

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Poster Presentation Number 125, Sa (17:00-19:00)

## A landscape perspective of hominin behaviour at Schöningen 13II-4 “Spear Horizon”

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Schöningen (Lower Saxony, Germany) has received much attention due to the remarkable discovery of well-preserved wooden spears and Middle Pleistocene fauna, dating to 300,000 years ago (OIS 9). Despite the site’s prominence, there have been few concerted efforts to place these archaeological remains into a general context of hominin behavioural evolution. Here we introduce an ambitious research programme to contextualize the unique depositional history at Schöningen 13II-4 “Spear Horizon.” This project will offer an interpretive window into the functional organization of hominin behaviour and adaptive mechanisms to Pleistocene interglacial environments, and will provide an integrative research framework for hominin behavioural evolution that is widely applicable across the European Lower and Middle Paleolithic. The centrepiece of this new investigation is a landscape perspective of hominin behaviour designed to reconstruct the additive biostratigraphic and diagenetic chain of events that lead to site formation—a holistic approach to establish the ecological contexts of hominin lifeways. The extraordinary preservation at Schöningen affords a level of resolution that is not available at most archaeological sites and provides a foundation for disentangling the archaeological indications of hominin behaviour from other natural processes of accumulation. Evaluating the material evidence for hominin subsistence behaviour constitutes a major theme of this research programme, but the larger scope extends beyond discrete inferences of hunting strategies and butchery practices within the “Spear Horizon.” In this respect, we will focus on the entire sedimentary sequence at Schöningen in order to contextualize hominin activities on the desired, high-resolution spatio-temporal scale. Foremost among our immediate objectives is the first archaeozoological and taphonomic analyses of the complete faunal assemblage from Schöningen 13II-4 “Spear Horizon.” Building from previous studies (Voormolen, 2008), preliminary analysis suggests an assemblage of more than 40 horses whose demographic profile includes individuals from several bands, implying that the horse remains from the “Spear Horizon” likely represent multiple hunting episodes by Middle Pleistocene hominin groups. A comprehensive documentation of the faunal remains will be conducted in parallel with a systematic agenda of actualistic experimentation and ongoing efforts to analyse the lithic and wooden artefact assemblages to reconstruct the full range and sequence of hominin activities at the site. Further work will involve microstratigraphy and the recovery of additional (micro- and macro-) faunal and botanical remains from excavation blocks lifted from the site during initial fieldwork. These will provide supplementary contextual data regarding the dynamics and ecological conditions of site formation. Additionally, an in-depth spatial analysis will allow for the ability to orient the overall accumulation and to position the traces of hominin activities within the lake shore environment. Our research programme constitutes a thorough evaluation of the unique archaeological record and sedimentary sequence at Schöningen. This holistic approach will provide crucial insight into the ecological adaptations of Middle Pleistocene hominins to interglacial environments and encourage a broader perspective of hominin behavioural evolution during the Lower to Middle Paleolithic and beyond.

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Poster Presentation Number 72, Fr (18:00-20:00)

## Identifying lances, javelins, and mechanically-launched projectiles using macrofracture analysis and fracture propagation velocity: a controlled experiment

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In the last few decades, zooarchaeological studies have demonstrated beyond doubt that the hunting abilities of hominins were quite formidable from quite early on. Unfortunately, direct evidence for the use of weapons in hunting is quite rare and depends heavily on the preservation of organic elements. In particular, in the absence of such evidence, it is notoriously difficult to pinpoint the first appearance of complex, mechanically-assisted projectiles (such as darts and arrows) in the archaeological record, despite some recent attempts (e.g., Brown et al., 2012). In this paper, we present data from a controlled ballistic experiment with the aim of establishing patterns in the formation of impact fractures that would allow for the discrimination of thrusting spears, (hand-thrown) javelins, and spearthrower darts and arrows. We employ nearly identical glass copies of a Levallois point hafted to identical shafts and a) fired from an air gun (for the projectile simulation, see Franke and Jäger, 2004) and b) launched using a pendulum (for thrusting spear simulation) into a standardized target made of synthetic bone and ballistic gelatin. The velocity (ranging from 1.1-2.7 m/s for thrust spears and 7-30m/s for javelins/darts/arrows) is measured using laser curtains and a transient recorder connected to a computer (see also Iovita et al, 2013). By controlling for the weapon tip shape, weight, and raw material, impact angle (IA), as well as target composition, we are able to focus on the key elements that separate the different launching systems: velocity and kinetic energy output. The results show that fracture scar length is proportional to kinetic energy at impact, but only if the impact is perpendicular, as acute IAs reduce the energy requirements for the production of large, typical impact fractures. Furthermore, thrust spears tend to produce more longitudinal impact fractures, as has been previously suggested (Fischer et al., 1984; Lombard et al., 2004). We also confirm previous results of Hutchings (2011) regarding the relationship between precursory loading rate and fracture propagation speed, documenting a weak linear relationship between the two in our sample. However, no instantaneous fracture velocities in the dynamic range (sensu Hutchings, 2011) were recorded here, implying that impact velocities of significantly more than 30m/s are needed to enter this range. Given the level of noise in controlled data, we caution against the use of these criteria for the identification of different armature types in anything other than very large archaeological samples.

Acknowledgements: This work is part of the research strategy of the MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution, RGZM. Thanks to Jörg Herbst, Heinz Hertel, Maik Röhr, and Hans-Georg Staats (PTB) for help with carrying out the experiments. Thanks to Jürgen Richter (University of Cologne) for authorizing the mould of the original specimen, to Leslie Pluntke (RGZM) for the production of the mould, and to Susanne Greiff (RGZM) for advice with the process. Thanks to Walter Mehlem (Praehistoric Archery, Kruft, Germany), who designed and constructed the target and to Wolfgang Mehr (and the glass-casters of Meka Glas GmbH, Kaufbeuren, Germany), who produced the glass copies, and to Yvonne Völlmecke (University of Mainz), who sorted the fractured points and prepared them for the microscopic analysis and fracture propagation speed calculations. Funding for this work was provided by the “Neandertal Projectile Technology” (NeProTec) grant from the Deutsche Forschungsgemeinschaft (DFG).

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Poster Presentation Number 120, Sa (17:00-19:00)

## Assessing the role of bone retouchers from the Mousterian to the Aurignacian in the North of Italy

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Hard osseus retouchers have been ever more accurately studied and it appears that they are very diffused; their role in the shaping of lithic tools is now well known. In North Italia, they are abundant in final Middle and Early Upper Palaeolithic. In order to pinpoint the possible cultural discrepancies in using these artefacts, this study mostly relies on a qualitative stratigraphical comparison within the Fumane Cave (VR) sequency, where over 370 elements from four different techno-complexes were discovered (Discoid, Levallois, Uluzzian and Aurignacian). The faunal spectra of the retouchers present an important homogeneity as far as the species (mostly red deer) and the anatomical segments (femurs and tibias) are concerned. However, the Aurignacian layers have a bigger amount of medium game, such as ibex, chamois and roe deer, which follows the general trend at Fumane. Archaeozoological studies in fact show that a shift occurs between the end of the Middle Palaeolithic, when cervids are predominant and the beginning of the Upper Palaeolithic, where bovids are more frequent (Fiore et al. 2004; Gurioli et al. 2005; Romandini et al. in press; Tagliacozzo et al. in press). The taphonomical analysis seems to attest some degree of systematic selection of the diaphysis. Four kind of stigmata have been identified: punctiform and strecthed impressions, strias and notches. They are usually located in small superficies, with up to three areas on the same shaft. We noticed generally wide technical similarities, but some differences were observed, such as a difference in the intensity and the utilisation modalities. Indeed, the important changes in the lithic technologies (from Late Mousterian to Aurignacian) does not seem to alter the frequency nor the function of this little elaborated tool.

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Poster Presentation Number 12, Fr (18:00-20:00)

Sex Determination of Human Skeletal Remains Using Next Generation Sequencing Technology

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The development of next generation sequencing (NGS) technology has revolutionized the study of ancient DNA, widening the scope of genetic analyses from single loci and genes to whole genomes. Although this technology has significantly increased the potential of palaeogenetic studies, ancient DNA research still faces inherent challenges associated with the fragility and scarcity of ancient nucleic acids as well as with isolation of endogenous DNA from the heterogeneous mixture of biomolecules that exists in fossil remains. Here we report a novel method for the sex determination of human skeletal remains using NGS data. This method is built on the premise that the number of sequencing reads aligning to a particular chromosome is proportional to the length of that chromosome. As females carry twice as many X chromosomes as males, it is expected that the female complement of X chromosome reads will be double that of males. We have used this information to statistically evaluate the sex of forty human specimens, ranging in age from Mesolithic to Iron Age. The benefits of this approach are that it requires only a small amount of endogenous DNA and hence can even be used for poorly preserved remains. It is also less prone to contamination than PCR-based methods of sex determination and does not depend of the preservation of particular informative genes. This method may be particularly useful for establishing the sex of juvenile individuals as well as fragmentary remains. It can also be applied to different species and to non-skeletal remains such as hair, tissue and coprolites.

Acknowledgements: European Research Council

Poster Presentation Number 104, Sa (17:00-19:00)

Diet or infection pressure on selection of FADS polymorphisms in hominins?

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Omega-6 and omega-3 long-chain polyunsaturated fatty acids (LC-PUFA) are important for immunoregulation and for development and functioning of the hominin brain. They can be obtained from the diet or synthesized in the body, mediated by fatty acid desaturase (FADS) enzymes. Modern humans have two FADS haplotypes: ancestral haplotype A associated with low LC-PUFA synthesis capacity, and derived haplotype D associated with strongly enhanced LC-PUFA synthesis capacity (ref 1,2). The latter more efficient haplotype appeared after the split with Neandertals and before expansion of modern humans out of Africa. Presently, the geographic distribution of FADS haplotypes differs dramatically between continents: in Africa the efficient haplotype D dominates (99%) while in native Americans it is almost completely absent. In Europe, Asia and Oceania the relative frequencies are intermediate (ref 1,2). The origin and consequent dominance of a derived FADS haplotype in Africa, and its apparent decrease and loss during out-of Africa expansion of early humans, is assumed to have been influenced by onset and relaxation of dietary selection pressures through aquatic resource use (ref 1,2), but essentially remains unexplained. Here we propose that origin and dominance of haplotype D is driven by the infectious disease burden in tropical Africa, which is greater than elsewhere in the world -notably the Americas (ref 3). Omega-6 LC-PUFA are pro-inflammatory and “tune up” the immune system, combating many infectious diseases involving immediate death or survival (ref 4). Omega-3 LC-PUFA are anti-inflammatory and “tune down” the immune system, increasing vulnerability to e.g. fatal sepsis (ref 5). On the other hand they can counteract inflammation diseases (ref 4,5) and have a strong anti-malarial activity (ref 4), thereby increasing survival chances. We hypothesize that in tropical Africa it is favourable to have enhanced LC-PUFA synthesis capacity since higher levels of both omega-6 and omega-3 LC-PUFA help hominins (humans) to cope with these “rapid killers”. The enhanced levels of synthesized LC-PUFA may also have contributed to brain growth and development. When the infection pressure lessened during out-of-Africa movement, the metabolically costly haplotype D became less favourable compared to haplotype A, especially when aquatic resource use provided enhanced dietary input of LC-PUFA. As a first test of this hypothesis we present our genetic data on FADS polymorphisms in three modern African populations with different diets: Maasai from Ruvu, Pare from Pare Mountains, and Nyakius from Sengerema (Tanzania). Both non fish-eating and fish-eating populations had very high frequencies (> 97%) of FADS haplotype D, indicating that an aquatic diet had no influence on prevalence of this haplotype, and suggesting that infection pressure maintained the need for retaining costly haplotype D in Africa.

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Poster Presentation Number 138, Sa (17:00-19:00)

## New Excavations at Sefunim Cave, Mount Carmel, Israel

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New excavations in May, 2013 at the entrance to Sefunim Cave in Mount Carmel, Israel yielded two new anthropogenic horizons attributed to the Kebaran and early Epipaleolithic/late Upper Paleolithic. These layers yielded many lithics, well preserved macro-faunal and microfaunal remains, bone tools, shell and stone beads, and worked red ocher. Here we present our preliminary findings from the recent excavation. Additionally, we report on our studies of the lithic artifacts from Avraham Ronen's Levantine Aurignacian layer 8 and the shell beads from all layers. The first season ended at the top of layer 8, which Ronen excavated in other areas of the cave between 1965-1970. His excavations documented a cultural sequence spanning the Middle to Upper Paleolithic transition, as well as layers containing finds from the Neolithic and younger periods. Open questions concern the transitional industries from Mousterian to Initial Upper Paleolithic, and the nature of the Levantine Aurignacian – to what extent it represents a different lifeway than the contemporary Ahmarian. Issues of subsistence and human-environment relationship were also not resolved by the former excavations. With an aim to answer some of the unresolved issues, we decided to conduct new excavations in order to: 1) confirm the presence of unexcavated Paleolithic materials in the cave, which we now estimate to cover at least 12 square meters at the entrance; 2) analyze the Middle to Upper Paleolithic transition using radiometric dating, micromorphological analysis and botanical studies; 3) examine the nature of Levantine Aurignacian technology compared to the other Paleolithic cultural entities encountered in the cave and regionally, as well as examining its stability and pattern of change in the three layers in which it is represented; 4) conduct detailed archaeozoological studies of the macrofaunal assemblages to determine the nature of subsistence over time and the effects of taphonomy; 5) establish environmental criteria based on studies of microfauna and botanical remains; and 6) assess the feasibility of studying the largest known dripstone features of Mount Carmel that are present in this cave to synthesize regional climatic change during the time Neanderthals and modern humans occupied the cave. Radiocarbon dating, micromorphological analysis and palynological studies are already underway. In all, the main goal of the new study is to use a multidisciplinary approach to better understand diachronic variation in Paleolithic lifeways from the late Middle Paleolithic to the end of the Upper Paleolithic in Mount Carmel.

Poster Presentation Number 37, Fr (18:00-20:00)

## Microevolutionary Trends On Proximal Hand Phalanges

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Investigating microevolutionary trends on the modern human skeleton is vital for further understanding of the evolutionary processes, in the genus *Homo*. A number of studies from various regions have demonstrated that proximal hand phalanges exhibit sexual dimorphism. A recently published study conducted by Karakostis et al. (2013) examined the nature, level, and interpretation of sexual dimorphism, in Modern Greek populations of the 20th century (reached as high as 24.78%). The same research discusses that explaining sexual dimorphism in proximal hand phalanges could be approached on an evolutionary basis. Therefore, the aim of this study is to determine and explain differences between the size and the sexual dimorphism of Modern Greek and Ancient Greek populations, concerning this anatomical part of the skeleton. A total of 105 proximal hand phalanges of 41 adult individuals (25 males and 16 females), from the skeletal sample unearthed in the Hellenistic site of Demetrias, were studied. Seven measurements were taken on each bone, involving the maximum length and the diaphyseal and epiphyseal widths at the basis, the midshaft, and the head of proximal phalanges. Descriptive statistics, t-values, and percentages of size and sexual dimorphism were estimated and compared between groups. Compared to the Modern Greek sample, ancient females present significantly smaller size of width dimensions of the 5th proximal phalanges (by 9.6%) and larger size of width dimensions of the 1st (by 8.1%), the 3rd, (by 12.5%) and the 4th, (by 9%) ones. On the contrary, ancient males present insignificant size-differences. Sexual dimorphism appears to have been lower for the Hellenistic population (reached 12.45%), while its distribution on the proximal phalanges shares extensive similarities with the Modern Greek individuals. However, the 5th proximal phalanges presented a surprisingly high degree of sexual dimorphism (approximately 12%), being almost as dimorphic as the proximal phalanges of the thumb. In addition, the head dimensions of proximal hand phalanges were more sexually dimorphic in the Hellenistic population, in relation to the other measurements. These variations in size and sexual dimorphism could indicate different patterns of physical activity, in combination with gradual change in the sexual distribution of labor. Concerning the maximum length of phalanges, the absence of statistically significant size difference between the two samples suggests that the lower sexual dimorphism presented by the ancient population (by approximately 4%) may be due to nutritional factors, during development. The factors that resulted in the aforementioned developments are analyzed, from both a biological and an archaeological perspective. Finally, the present study discusses the role of these microevolutionary trends in the evolution of proximal hand phalanges.

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Poster Presentation Number 9, Fr (18:00-20:00)

### 3D reconstructions from standard digital photographs of human crania

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This study assesses the precision of 3D photogrammetry as a tool for capturing and quantifying human skull morphology. 3D imaging techniques based on ionizing radiation (microCT) and 3D scanning techniques using structured light or lasers have become widespread in paleoanthropology. More recently, 3D photogrammetry has resurfaced as an alternative to dedicated surface scanners. Its principal advantages are substantially reduced equipment costs, simplicity and portability of setup and speedier data collection “in the field,” which may also reduce costs. We tested the precision of 3D models of human skulls reproduced from conventional digital photography and compared them to models derived from a 3D surface scanner. Overall, the photogrammetry and scanner meshes showed low degrees of deviation from one another. Surface area estimates derived from photogrammetry models tend to be slightly larger. Average deviations of landmark coordinates recorded on photogrammetry models were within the generally allowable range of error in osteometry. Principal components and neighbor-joining tree analyses generally did not show patterning of landmark configurations based upon the reconstruction technology used. Thus, while dependent upon the needs of the particular research project, 3D photogrammetry appears to be a suitable, lower-cost alternative to 3D imaging and scanning options. The cost savings have the potential to make 3D photogrammetry a highly attractive method for professional and graduate student research.

**Acknowledgements:** This study was funded with generous support from the Wenner Gren Foundation and the National Science Foundation (Award No. BCS-1232590). We would like to thank Philippe Mennecier, Aurélie Fort and Véronique Laborde for access to the collections of the Musée de l'Homme, and Tim Weaver and Mark Grote for their comments.

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Poster Presentation Number 145, Sa (17:00-19:00)

### Neanderthals of the North? Re-investigating the fallow deer from Hollerup and their implication for a possible pre-Weichselian occupation of southern Scandinavia

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Despite the fact that the Neanderthal – *Homo neanderthalensis* – is the best represented pre-modern human in the fossil record, the extent to which they were able to adapt to habitats above 55°N is still of considerable debate. In Denmark only sporadic and unsystematic attention has been given to the archaeological investigation of the possibility of a pre-modern human occupation of these regions. For long only the Hollerup-locality prevailed as the flagship-site used to argue for a possible Neanderthal presence. Here (Hollerup, eastern Jutland, 56,40°N, 09,78°E), the remains of two almost complete fallow deer, Dama dama, skeletons situated in chrono-stratigraphically dated Eemian sediments were unearthed and investigated in 1954 by Zoologist Möhl-Hansen. He concluded that the bones had been split open by Neanderthals in order to retrieve the nutrient-rich marrow inside. While there is little doubt on the Pleistocene age of the bones, the hominin affiliation is less certain. Möhl Hansen (1954) first proposed an anthropogenic modification based only on the symmetry in the breakage of the epiphyses, since he also noticed the lack of secure cutmarks usually affiliated with human butchery practice. He argued that this could be explained by a more primitive behaviour conducted by Neanderthals compared to modern humans. However, this pattern is not recognised in comparable European Neanderthal butchery sites where tools are present and seem to play an important role in the removal of flesh from the bones (Gaudzinski & Kindler 2012). Considering the improved methodologies developed since Möhl Hansens study, though cutting-edge for its time, a re-evaluation of the material was long overdue. In 2012 we set out to do this re-evaluation and the results are published in Egeland et al. 2013. In this new analysis many of Möhl Hansens original observations are supported, but we equally fail to identify any secure prehistoric cutmarks. The study also suggests that the bones have been exposed to several taphonomic phases that have left a mixture of nutritive (before fossilisation), non-nutritive (after fossilisation) and post-depositional marks on the bone that suggests that several natural episodes could have caused the epiphyseal breakage. The study concludes that the Hollerup specimens most likely died naturally and therefore that they cannot be securely linked to Neanderthal behaviour. Apart from this site a small amount of Palaeolithic-looking handaxes and flakes are known in southern Scandinavian, although unfortunately none of them have been found in secure stratigraphic context (for a review of handaxes see: Johansen & Stapert 1996). This poster will present the results of the re-evaluation of the Hollerup-bones, as well as discuss the authenticity of the lithic material in order to closer clarify the possibility of a pre-Weichselian occupation of southern Scandinavia. In order to clarify if, when, where and how Neanderthals colonised southern Scandinavia a systematic assessment of the empirical, environmental and ecological evidence is needed. The poster will present the results of the analysis of the Hollerup-material as well as the underlying strategy for future research into the possibility of a pre-Weichselian occupation of Denmark.

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Poster Presentation Number 74, Fr (18:00-20:00)

## Aptitude, practice and teaching: Tracking human cognitive evolution through skill acquisition experiments in early flaked stone technologies

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The Leverhulme funded Learning to Be Human Project, led by Professor Bruce Bradley, was an experimental study that investigated how humans can develop skill in Lower and Middle Palaeolithic flintknapping technologies and the implications this has for the evolution of modern human brains and intelligence. This project tracked the development of a group of 16 volunteers as they were taught how to flake rocks, make handaxes and shape Levallois cores. Volunteers were given aptitude tests at the start of the project and hours spent practicing and in taught sessions were logged as knapping progressed over the course of 2 years. Focus in the study was given to achieving an understanding of the interplay between comprehension of concepts of knapping and physical ability to perform knapping tasks and also to the relative importance of natural aptitude, teaching and personal practice. This long term experimental project has allowed for a more thorough understanding of the learning process and, uniquely, has given an indication of the areas of aptitude that may precondition a person to develop high-level skill in flaked stone technologies. These areas of aptitude have implications for the relative importance of different spatial and motor abilities to the humans in the study and the hominids who originally made these stone tool types. These are being used to answer questions about their necessary cognitive and behavioural abilities. The importance of technologically focused teaching in handaxe and Levallois technologies can also indicate the types of social interaction that may have been necessary to allow high levels of skill to be acquired. The long term nature of the project has allowed an unprecedented level of data to be gathered on skill acquisition in these early technologies and, it is hoped, will give us a more thorough understanding of the necessary cognitive capacities that would allow these technologies to be realised.

Poster Presentation Number 124, Sa (17:00-19:00)

## Actualistic experiments to establish the biostratinomic sequence at Neumark-Nord 2

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Temporal and spatial resolution at archaeological sites strongly affects our perception of the archaeological record as a mirror of past hominin behaviour. Defining temporal and spatial resolution are ultimate challenges in the analyses of Early and Middle Palaeolithic sites. Analyses of site formation processes and/or taphonomical histories aim to implement a chronological and biostratinomic frame for analyses here, which constitutes the very baseline to translate excavated material into past human behaviour. In this presentation we introduce experimental approaches to establish a biostratinomic sequence for the faunal assemblage of the Eemian site Neumark-Nord 2/2 (NN2/2), Saxony-Anhalt, Germany. The basin Neumark-Nord 2 was a small pond in a wider Eemian lake land area, which was partly uncovered in a former open cast mine. Along the northern margin and slope of the basin we excavated a 500m<sup>2</sup> sized archaeological unit NN2/2 which yielded 20,000 flint artefacts and more than 120,000 excellently preserved faunal remains. Two third of the archaeological assemblage is spatially clustered in a small 5m<sup>2</sup> wide strip, which constitutes a step in the slope of the basin. Multiple sedimentological and palynological investigations of the basin's infill indicate a very narrow time interval ( 500 years) for the formation of NN2/2B. Micromorphological studies reconstruct constant and rapid sedimentation of fine sands and silts by overland flow and varying water table of the pond. On the basis of our current study of the faunal assemblage traces of human interference are abundant, while traces of carnivore involvement is almost lacking. Beside cut marks a large amount of bones display striations. The appearance of striations is related to cut marks on bones and both correlates with degree of bone surface abrasion, suggesting tight temporal interactions and progression of processes responsible for these bone modifications. Disentangling the relationship between these processes may have tremendous consequences for the understanding of human behaviour at NN2/2B. To contextualise results of the faunal analyses and processes of site formation under one holistic umbrella we established actualistic experiments to achieve a taphonomic history of NN2/2B. Trampling of bones is generally considered as an important process abrading and striating bones. We present the set-up and initial results of a series of controlled experiments to assess the role of trampling in the additive biostratinomic sequence at NN2/2B. Furthermore, we simulate the sedimentary dynamics during the formation of the faunal assemblage in a small scaled version of the Neumark-Nord 2 basin to get substantial insights into the processes responsible for the spatial patterning of archaeological material at NN2/2. Results of these experiments enable us to recognize the spatial extent of specific taphonomic processes. Reconciliation of the experiment results with those from faunal analyses enables us to fit human activities at NN2/2 in a comprehensive biostratinomic sequence.

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Poster Presentation Number 139, Sa (17:00-19:00)

New chronological data for late Middle and early Upper Paleolithic in south-west of France: the open-air site of Canaule-La Ferme study

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The open-air site of Canaule-La Ferme is situated in Creysse, near Bergerac, in Dordogne (France). It has been discovered and studied in 2012, thanks to housing works. 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 chatelperronian heaps. Downstream a gravettian layer has been unearthed. A sinkhole is present in this second part of the site. It lays close (tens to hundreds of meters) to the chatelperronian open-air site of Vieux-Coutets and the middle and upper Paleolithic sites of Barbas I, II and III (Boëda et al. 1996). It is also close to the chatelperronian open-air site of Canaule II, digged at the end of the 1960's (Guichard 1970) and that has been subject to new analysis recently (Bachelierie et al. 2007). Given the vicinity to these very important sites for the understanding of the end of Middle Palaeolithic and the beginning of the Upper Palaeolithic, especially rarely observed in open-air sites, we decided to give a special focus to the dating of the newly discovered sequence of Canaule-La Ferme. A complete chronological study has been undertaken, with TL dating of the heated flints from the three layers (Aitken 1985, Mercier et al. 1995), OSL (Blue) dating of the quartz grains (Murray and Wintle 2000, Wintle and Murray 2006) and IRSL dating of the feldspars grains within the sediments. The combination of these different methods and different protocols allows us to give a renewed framework for the human occupations of the site, and also brings new clues for the understanding of some of the Barbas, Canaule and Vieux Coutets occupations that all lay in the vicinity of Canaule-La Ferme.

Acknowledgements: The authors would like to thank the Aquitaine Region Council for financial support (through the program entitled “La radioluminescence des feldspaths: un nouvel outil de datation des gisements archéologiques et des séquence quaternaires d'Aquitaine”).

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Poster Presentation Number 18, Fr (18:00-20:00)

The pathology of the proximal femur MLD 46 (*Australopithecus africanus*)

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MLD 46 (*Australopithecus africanus*) from Makapansat, South Africa, is a partial proximal femur, which is the only example of a mushroom-like osteophytosis at the femoral head to neck junction in early hominins (Reed, et al. 1993). Theoretically, almost any disease of the hip joint can cause similar pathological bone growth as in MLD 46. The differential diagnosis thus includes primary osteoarthritis such as degenerative joint disease and secondary osteoarthritis, such as hip dysplasia, Legg-Calvé-Perthes disease or infections (Ortner 2003). A comparison to modern human pathology collections, including the autopsy based Galler collection (Rühli, et al. 2003), shows that hip joint disorders, as well as bacterial infections, can lead to a marked deformity with flattening and destruction of the femoral head. In MLD 46, however, the head shape is minimally affected with no detectable evidence of deformity or destruction. A possible disorder with a pathological bone growth similar to MLD 46 would be the femoroacetabular impingement, particularly the CAM impingement, which can also lead to extensive osteophytosis of the rim of the femoral head and does not involve flattening of the femoral head in early stages of the disease. Another possible disorder is a primary or secondary protrusion of the acetabulum. Here, the femoral head extends further into the acetabulum and the limbus acetabuli could cause osteophytes on the head circumference without involving a deformation of the femoral head itself. A potential explanation for the peculiar morphology of MLD 46 compared to modern humans is the different locomotor behaviour of australopithecines. Tree climbing might have led to mechanical loading that is more evenly distributed on the femoral head, thus preserving the round shape and leading to a more uniform distribution of the pathological bone growth.

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Poster Presentation Number 71, Fr (18:00-20:00)

## Keeping the White Weaponry: Developing a Methodology for Investigating Pleistocene Osseous Projectile Point Maintenance and Discard

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Projectile points manufactured from antler, bone, ivory and horn were a significant component of the Pleistocene hunter-gatherers' toolkit. While this situation appears to have been particularly the case for Upper Palaeolithic Europe where thousands of implements from Aurignacian to Azilian contexts have been recovered, elements of this technology are increasingly being identified in Africa, Asia, Australia and North America. Projectile weaponry tipped with osseous raw materials therefore constitute a major dataset for technology, subsistence, and social aspects of various and numerous Pleistocene populations. Having once been described as 'impossible to evaluate', investigation of maintenance and discard patterns in osseous projectile point assemblages has been severely neglected in the archaeological literature. As previous work has generally been restricted to qualitative descriptions of single artefacts exhibiting clear signs of resharpening or recycling, our knowledge of 'the keeping' of these toolkits is, therefore, currently extraordinarily limited. This PhD research addresses this imbalance through beginning to build a robust methodology for investigating the maintenance, recycling and discard of osseous projectile weaponry. Through integrating a multifaceted approach incorporating metric analysis, statistics, use wear analysis, projectile experiments, the examination of contemporaneous depictions of the studied weaponry and examination of associated debitage and possible maintenance tools, it will be shown that significant insights into the second half of the chaînes opératoire - that is, from first use to final discard - can be obtained. Here, the results of an analysis of more than 3,000 whole and fragmentary barbed and unbarbed antler points from 25 Middle - Late Magdalenian sites located throughout France and Germany are presented. The described approach successfully identified regional differences in maintenance, recycling and discard patterns. Furthermore, these patterns may inform on both raw material availability and cultural conventions held in each region during this period of the Magdalenian. Now successfully tested on the most robust Palaeolithic dataset available, this methodology can now be applied to more challenging assemblages where less material is available for examination. These new data will then complement the already extensively studied lithic assemblages and allow for more comprehensive interpretations of Pleistocene lifeways to be constructed.

Acknowledgements: Many thanks to my PhD supervisor, Prof. Nick Barton, as well as the curators and staff of The British Museum, the Musée d'Archéologie Nationale, the Musée d'Angoulême, the Musée de Préhistoire (Lussac-Les-Châteaux), Universität Tübingen, and the MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution.

Poster Presentation Number 54, Fr (18:00-20:00)

## Paleoclimatic Events Conductive to the Migrations of the Paleolithic People from the Southern Siberian Mountain Range to the North

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Settlement of Siberia by Paleolithic Man began 900-800 Ka from opening up of Southern Mountain Belt of Siberia. This Belt was settled poor by till maximal glaciation 300-260 Ka. Mosaic of this Mountain Belt natural conditions created possibility of long live in small disconnection areas. It assisted narrow specialization Man and hindered of Man settling in this Belt. 300-260 Ka natural conditions abrupt changed. Quantity of favorable niches grew shorter. Association which adapted oneself to joint living survived. Gaves were active settled. Archaic Mousterian arose on Altai. In rare areas, which were fit for Man, density of population reached of demographic satiety of population reached of demographic and narrowing of hunting areas led to demographic super-satiety. Glacial and ice-dammed lakes blocaded this Mountain Belt. Way for migration remained only to North-East. Abt 200 Ka most ancient wave of migration in this direction. Many sites of this wave are known on Angara, Lena, Chukotka. However ecological catastrophe of 300-260 Ka did no lad to settlement of territories to North from Southern Mountian Belt, because past glaciation in this Belt many favorable niches were opened. Tazovsky glaciation don't accompanied by migrations abroad in Belt limits, but it did not lived through pre-Mousterian population and Mousterian Man changed industry of archaic Mousterian on middle Mousterian. In kazantsevsky time migration in this Belt came from Europe, abt 40 Ka - from Middle Asia. Natural crisis of Ziriansky glacition abt 60 Ka was the condition of beginning of of Late Paleolithic culture on basis of local Mousterian at first on Altai and Transbaiklye. Climatic crisis, which leaded to big change industry, were coincided to glaciations, which big interglacials preceded: tobolsky-samarovsky, kazantsevsky-ziriansky. Full demographic satety of Mountain Belt was abt 36 Ka. Sharp cooling 33-30 Ka was 1st natural crisis, which led to settlment of huge territories to North from Southern Mountain Belt of Siberia. Acknowledgements: Work was supported by grant No 9 of integration project SB RAS — FEB RAS and RFBR grant No 13-05-00854a

Poster Presentation Number 107, Sa (17:00-19:00)

## New synchrotron-based visualization technique for incremental growth lines and stresses in fossil teeth

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The clear identification of incremental growth lines on the outer enamel surface (perikymata), and irregular stresses in the enamel and dentine (hypoplasias) is crucial for determining the age at death of fossil hominins, as well as crown formation times and other life history traits. This is traditionally investigated by observing histological sections with polarized light or of casts of the tooth crown with stereo- or scanning electron microscopy (Smith and Tafforeau, 2008). Alternatively, synchrotron virtual histology provides more freedom than classical histology, by non-destructively allowing for the control of slice thickness and sample orientation (Tafforeau and Smith, 2008; Smith et al., 2010). Here, we present an innovative procedure based on 2D and 3D synchrotron phase contrast data for visualizing growth lines and developmental stresses on the outer enamel surface and enamel-dentine junction (EDJ). Permanent developing hominin teeth were scanned at 5µm on the beamline ID 19 (ESRF) with 4m propagation distance. The enamel surface and EDJ were segmented by capturing the white fringe at the interface between enamel-air, and enamel-dentine. After rendering with Phong's algorithm (Phong, 1975), the tooth is lit with a first light that is white and directed forward. In addition, a second light source is oriented from the top and the bottom successively, with an orange diffuse component and a pale blue specular component. This lighting procedure reveals fine topological structures and density information. Reinforcement of high frequencies structures on both sets of images, in combination with the two light axes, reveals fine incremental structures and stresses on external and internal surfaces. The lighting system, coupled with 3D topo-densitometric rendering of synchrotron phase contrast data, enhances the visibility of perikymata and stresses on the enamel surface, and also reveals stresses and long period lines on the EDJ. It is now possible to match several teeth belonging to an individual using stresses at the EDJ as a bar-code. This approach is very efficient when the external surface or the virtual histological sections prohibit more traditional approaches to matching teeth. The combination of synchrotron phase contrast, Phong rendering and multi-angle colored lights greatly increases the possibilities for the analysis of developmental data on dental surfaces. This permits studying teeth for which incremental growth lines are not visible in the 2D virtual sections, or which are still unerupted. This yields precise age at death estimates for juvenile hominins. Acknowledgements: We thank all the curators and collaborators that granted us access to the fossil material, as well as the ID19 staff at the ESRF. Funding: NSF Grant N° BCS 1126470, Harvard University and ESRF, Grant N° EC697.

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Poster Presentation Number 115, Sa (17:00-19:00)

## Oblique wear and molar enamel thickness topography in early agriculturalists

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Differences in patterns of tooth wear between hunter-gatherers and agriculturalists have been related to changes in diet and food preparation (e.g., Smith, 1984; Deter, 2009). Oblique molar wear has been reported as characteristic of agriculturalists (Smith, 1984). Nevertheless, no study has aimed to evaluate the correlation between such tooth wear patterns and distribution of enamel thickness (ET) in the whole crown. Here, we employ a microCT-based record to virtually assess molar ET topographic distribution in a population of Neolithic European farmers showing oblique molar wear. The second upper permanent molars (UM2) of 17 individuals from the Neolithic site of Gurgy (France) were scanned using high-resolution microCT at the MRI platform (Skyscan 1076 X-ray microtomograph). Acquisitions were performed with an isotropic voxel size ranging from 17.93 to 36.18 µm3. Semi-automatic threshold-based segmentation was conducted using Avizo v.7 (VSG). Crowns were digitally isolated from roots and virtual cross-sections through the dentine horn tips of the mesial cusps were realized (Martin, 1985; Olejniczak et al., 2008). For each crown, 17 linear, surface, and volumetric variables describing topographic variation in ET were digitally measured or calculated (e.g., Martin, 1985; Beynon and Wood, 1986; Macchiarelli et al., 2007). 3D maps of ET distribution were created with the segmented enamel and crown dentine components. As a preliminary assessment of ET evolutionary trend, a comparative Mesolithic individual from La Vergne, also in France, was included in the study. Oblique wear is observed in Neolithic UM2s and maximal wear is localized in lingual position. Results of quantitative analyses show that linear ET is significantly higher in the lateral aspect and the apex of the lingual cusp than in the respective analogues of the buccal cusp. Within the lingual cusp, ET on the lateral aspect is significantly greater ( $1.90 \pm 0.33$  mm) than on both the apex and the occlusal aspect (respectively  $1.38 \pm 0.56$  and  $1.44 \pm 0.21$  mm). For the buccal cusp, differences in ET are not significant between lateral and occlusal aspects. For Neolithic UM2s, 3D maps of ET topographic distribution show that maximal ET is found on lingual aspect of the crown (about 2.5 mm vs. ca. 1.5 mm on buccal aspect) while in the Mesolithic crown, repartition of ET is more homogeneous. ET for Mesolithic UM2 is globally thinner than that of Neolithic crowns, particularly for the apical third of the lingual aspects. These results show that this Neolithic UM2s sample has major ET on the lingual aspect where the maximum wear is located, as also reported on larger samples (Smith, 1984). As a working hypothesis, we suggest that a positive selective pressure for high ET occurred on the crown side where the occlusal wear is the most important. In this respect, it is noteworthy that variation in ET has been linked to differences in tooth function in extant hominoids (Schwartz, 2000). Additional samples are needed to clarify the intra- and inter-population variability and the possible implications of cultural and environmental influences on enamel thickness topography.

Acknowledgements: We thank Renaud Lebrun and the MRI platform (Montpellier RIO Imaging, Université Montpellier 2). We are grateful to Patrice Courtaud and Henri Duday for access to dental material from La Vergne. This study was supported by the DHP project (Université Bordeaux 1, LaScArBx).

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Poster Presentation Number 92, Sa (17:00-19:00)

The evolution of the language faculty: why the environment was key

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In the protolanguage literature, one finds references to musical, gestural, and lexical protolanguage hypotheses (see Fitch 2010 for review), but there is nothing like what in the present work we put forth as ‘syntactic protolanguage’. This notion of protolanguage is theoretically motivated given the division between syntax and morphology in frameworks such as Distributed Morphology (Halle & Marantz 1993), which takes the lexicon to rely on the syntax. An extreme view of this kind (Boeckx 2010) naturally leads to a syntax ‘without words’. Positing a syntactic protolanguage does not cast any doubt on the other notions of protolanguage that are proposed in the literature: there could be stages in the course of language evolution that would correspond to different kinds of ‘protolanguage’, but we argue that the notion of ‘syntactic protolanguage’ allows us to make sense of well-established findings in the evolution literature. More specifically, if the course of evolution is mapped to a complexity continuum that has some kind of protolanguage on the one end and fully modern language on the other, the emergence of anatomically modern humans ca. 150,000 B.P. could correspond to a crucial threshold on the evolutionary continuum; more specifically, it would correspond to the emergence of syntactic protolanguage: a pure Merge-based system without lexical influence. (We follow Mithen 2006 in assuming that Neandertals had a musical protolanguage.) The next crucial point to be pinpointed in the evolutionary continuum is the subsequent major demographic expansion that the fossil record places within the time range from 80,000 to 60,000 B.P.. This expansion coincided with a major increase in the complexity of the socio-cognitive behavior of modern humans (Mellars 2006), which basically amounts in linguistic terms, to the emergence of a fully-fledged modern language, if proposals like that of Wray and Grace (2007) are on the right track. Between these two crucial points, an interaction of genetic and the environmental factors led to the emergence of certain linguistic principles such as duality of patterning, rule-based morphophonology, complex grammatical markers and surface (‘parametric’) variation. The closest equivalents of syntactic protolanguage would correspond to the language of a genetically/anatomically modern human, which however lacks an adequate degree of environmental stimulation. The predictions that follow are: (I) syntactic protolanguage would lack certain design characteristics (some of them, in Hockett’s sense) of human language such as duality of patterning, recursion, or complexity in terms of fine-grained grammatical markers, because all these would arise gradually and as a response to environmental, externalization-related needs. (II), assuming (I), we expect to find absence of such properties in languages that are in the earliest stages of development and/or come alongside a special ‘environment’ factor. This prediction seems to be borne out in the case of (a) Al-Sayyid Bedouin Sign Language and duality of patterning (Sandler et al. 2011), (b) Riau Indonesian and the emergence of salient morphosyntactic distinctions on categories (Gil 2005, 2008), and (c) Pirahã and ‘internal merge’ structures (Bolender 2007).

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Poster Presentation Number 128, Sa (17:00-19:00)

How well do plant microremains in dental calculus reflect diet?: A test with the Ovatie forager-horticulturalists of Namibia

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Starch granules and phytoliths recovered from dental calculus are increasingly used as markers of diet in ancient human populations (*cf.* Henry et al., 2011; Henry and Piperno, 2008; Piperno and Dillehay, 2008; Boyadjian et al. 2007), but it is not clear how well these plant microremains reflect overall diet breadth, and over what time scale they record diet (Henry, 2012). This project examines the relationship between the diet and plant microremains in dental calculus from Ovatie forager-horticulturalists of Northwestern Namibia. The Ovatie diet includes both foraged plant foods and cultivated domesticates such as maize, squash, and melon. The importance of foraged plants has decreased since 2007, due to a government program that provides maize porridge to Ovatie living in government camps. Easily collected wild plant foods are still consumed regularly and in large quantities. These include fruits from *Diospyros mespiliformis*, *Berchemia discolor*, *Ximenia americana*, and *Hyphaene petersiana*. We collected dietary data through observation and interview over three months between August and October 2012 and April 2013, and obtained calculus samples from 88 individuals between the ages of 20 and 83. Preliminary results show that both starch granules and phytoliths are present in Ovatie calculus. Several starch granules show damage consistent with partial digestion by salivary amylase. Key questions in this research include how well plant microremains in calculus record overall diet breadth, and whether these plant microremains are reflective of recent diet, or of diet over a longer time span. Assumptions about diet play an important role in many prominent hypotheses about human evolution. Plant microremains in dental calculus provide a tool for testing these assumptions. This is the first study to test the relationship between diet and plant microremains in dental calculus from a population with a known diet. Results from this project have implications for interpreting plant microremain data from archaeological dental calculus samples.

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Poster Presentation Number 44, Fr (18:00-20:00)

The meaning of hominin bipedalism : epistemological issues

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Bipedalism is usually considered as hallmark of human lineage. In the 1950’ neo-Darwinian synthesis, erect bipedal locomotion has been recognized as key adaptation and diagnostic feature of Hominidae (Mayr, 1950, Le Gros Clark, 1955). Although both fossil postcranial record and theoretical framework have changed since then, bipedalism is still used to claim the hominin status of fossils, such as *Ardipithecus ramidus*, *Orrorin tugenensis* and *Sabelanthropus tchadensis*. Thus, bipedalism is still handled as a firm phylogenetic criterion, whereas its morphological, temporal and spatial diversity has made its meaning fuzzy. We examine here the assumption that bipedalism evolved only in the hominin lineage and only once within this clade (Wood, 2010) as a phylogenetical hypothesis underlying the inferences drawn from fossil record. This epistemological reassessment of hominin bipedalism will rely on history of paleoanthropology, linking our interpretative framework to debates and theories surrounding Australopithecines locomotion (mainly *A. africanus* and *A. afarensis*). Philosophical issues attached to bipedalism as human uniqueness will also be highlighted. As a result, we present two major approaches of bipedalism, linked to very different conceptions of human evolution, yet assuming the same basic hypothesis about bipedalism. The former states that one human-like bipedal pattern has emerged early in the hominin lineage, implying that only derived features are phylogenetically relevant and supporting a linear model of human evolution. The latter approach accepts that several locomotor behaviors may have coexisted in early hominin evolution, including several forms of bipedalism. Functional interpretation, taking also primitive or ape-like characters into account, is then favored. Although it could imply a more bushy view of human evolution, phylogenetical implications of this locomotor diversity have not yet been grasped, leaving the theoretical basis of hominin bipedalism unquestionned. While discussing the idea that phylogeny and behavior are two different questions asked to fossils (Ward, 2002), we demonstrate that both levels are interconnected. Reassessing phylogenetical and behavioral meaning of bipedal morphological features would also refine our understanding of evolutionary mechanisms within and around the hominin clade : selection processes acting on derived characters (which may also be homoplastic) as well as distinction between genetic, developmental and epigenetic features are here core concerns. It could also bring new insights on explaining from what and what for hominin bipedalism evolved. Thus, our aim is not to argue that bipedalism shouldn’t be used anymore as a criterion to define hominins, but rather that it needs to be redefined in a theoretical framework making it epistemologically useful in the understanding of early human evolution.

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Podium Presentation: Session 5, Fr (16:40)

The Plants in the Every Day Life of *Homo sapiens sapiens* from Kostenki Region of the Russian Plain

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The presentation is focused on: 1) The first generalization of all Upper Palaeolithic floristic materials of the span 50-12 kyr BP obtained by palynologists and palaeobotanists in Kostenki-Borschevo region of the Russian Plain from the sites Kostenki 1, 8, 11, 12, 14, 17, 19, 21 and Borschevo 5 which layers of different archaeological cultures five of which have the anthropological remains of *Homo sapiens sapiens* (Anikovich, Popov, Platonova, 2008); 2) The first results of mass SEM studying (Levkovskaya 1999, Levkovskaya et al., 2005) of the Palaeolithic pollen complexes (not only individual forms), which appeared due to the new Levkovskaya’s method of preparing pollen materials for SEM research; 3) The new results of identification of charcoals by Crawford and Hoffecker. The rich pollen flora was obtained by many palynologists for mentioned above archaeological sites. Only individual seeds and charcoals were found by Levkovskaya in 1972-1977 (excavations of Rogachev and Praslov) as a result of floatation of the large volume of sediments from archaeological layers of Kostenki 1, 12, 21 sites. The large SEM magnifications (about 10000) allowed discovering the microremains of the woods, epidermises, Diatom algae, etc. between pollen grains (Levkovskaya et al. 2005). About 100 charcoals were identified by Crawford for Kostenki 1 (excavations of 2007-2011). The Upper Palaeolithic Kostenki pollen and paleobotanical flora includes about 80 taxa of the plants. It is interpreted in context of the useful properties of about 2600 species and/or genera of modern plants suggested in monograph of Grossgaim (1952) and based on the ethnographical data and results of plants chemical studies. The Kostenki flora includes plants that could be used for food, medicine, fire wood, joinery, weaving, polishing, tanning, vitamins and making mats and paints. Especially important are the pollen and paleobotanical floras discovered in three subterranean dwellings connected with the upper Kostenki 1 Palaeolithic layer (excavations of 1974) because they were buried as a result of the human activity inside the constructions closed from wind. The following remains of the plants were found in them: - charcoals of *Picea*, *Quercus*, *Pinus*, *Corylus*; - seeds of *Betula verrucosa*, *Salix*, *Lactuca*, *Taraxacum*, *Lamium*; - epidermises of *Quercus*, *Betula*, *Typha*, *Equisetum*; - pollen of *Picea*, *Larix*, *Pinus sylvestris*, *Betula humilis*, *Betula verrucosa*, *Alnus*; - spores of *Fungi*. The studies show that *Homo sapiens sapiens* preferred the multifunctional plants like *Typha sp.* which roots, leaves and stems are all edible. According to Grossgaim (1952) *Typha sp.* is the source of starch and vitamins. It is also used for making baskets and mats as well as spinning plant. The dry rhizomes of *Typha sp.* and roots of other identified starch-containing plants could be used as important source of carbohydrates in the *Homo sapiens sapiens* mostly meat diet even during winter seasons. The Kostenki flora is for the first time interpreted as a source of plants available for the use of the Upper Palaeolithic people. Contrary all paleobotanical remains are seen as the result of the plant gathering by *Homo sapiens sapiens* (if they have the clear archaeological context).

Acknowledgements: The authors are grateful to palynologists and paleobotanists M. P. Gritchouk, R. V. Fedorova, V. P. Gritchouk, E.A. Spiridonova, G. N. Lisysina, T. V. Blochina, E. S. Chavchavadze and V.I. Pisareva whose published materials were used in our new studies.

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Podium Presentation: Session 3, Fr (14:20)

### Development, integration, and modularity of the pelvis: implications for fossil hominin evolution

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1 - Harvard University

The hominin pelvic girdle underwent dramatic change after the divergence 7 Ma from the *Pan* lineage and with the concomitant adoption of bipedal locomotion. The earliest known hominin pelvic material, attributed to *Ardipithecus ramidus* and dated to 4.4 Ma, exhibits key transformations from an ape-like to a human-like ilium, including shortened and more anterolaterally placed ilia with a large anterior superior iliac spine, and a short and wide lower iliac height. In contrast, the *Ar. ramidus* ischium is long and ape-like. The temporally later *Australopithecus afarensis* and *Au. africanus* material exhibit further shortening and lateral flaring of the ilium that are likely related to increasing bipedal locomotor efficiency, as well as the shortened and dorsally projecting ischium morphology characteristic of later hominins. Thus, some adaptive features thought to be related to bipedal locomotion exist in the earliest hominin pelvic material, which suggests that the pelvis—specifically the ilium—was one of the first aspects of the hominin skeleton to adapt to bipedality. It is clear that the morphological transformation of the pelvic girdle occurred relatively quickly, but little is known about the factors that facilitated this rapid evolution. This study addresses this question by 1) reviewing the timing and genetic regulation of vertebrate pelvis development, 2) deriving and testing a hypothesis of developmental modularity, and 3) examining patterns of morphological integration and evolvability. A series of linear pelvic dimensions were calculated from three-dimensional landmarks that were obtained from 752 individuals from 35 extant primate taxa comprising strepsirrhines, platyrrhines, and catarrhines. This sample encompassed all of the body size variation and locomotor behaviors that exist in primates today. Standard measures of morphological integration and evolvability were calculated from correlation and variance-covariance matrices and compared across species using bootstrap analyses. Modularity was assessed using the RV test. As a whole, primates—including humans—share a common pattern of low levels of morphological integration, high levels of evolvability, and modularity of the pelvic girdle. Moreover, while humans are significantly similar to the majority of primates in their level of morphological integration, they are most similar to our closest primate relatives, the African apes (p < 0.0008). These results suggest that the rapid evolutionary change observed in the fossil hominin ilium was facilitated by pelvic modularity, which allowed changes in ilium morphology without necessarily effecting change in the ischiopubis. More fossils are needed to determine at what point during the 2.5 million year gap between the estimated chimpanzee-human divergence and the appearance of *Ar. ramidus* these ilium morphologies first evolved.

Acknowledgements: This study was supported by the National Science Foundation (BCS 0752575) and The Leakey Foundation.

Poster Presentation Number 61, Fr (18:00-20:00)

### The Ecological Catastrophe of the Time of Existence of Kostenki-Streletskaya Culture at the Russian Plain (Data on Kostenki 12/III Site) and Formation of Late Mousterian Layers in Six Cave Sites of the Western Caucasus

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The report is based on archaeological, radiocarbon uncalibrated and calibrated, pollen, SEM-pollen and geological data obtained for Kostenki-Streletskaya culture (Levkovskaya et al., 2005; Anikovich, Popov, Platonova, 2008) of the Russian Plain, late Mousterian layers from Caucasian cave sites Monasheskaya, Matouska, Mezmayaskaya, Kudaro I, Akhshtyr, Malaya Vorontsovskaya and pollen pit-bog standard Dziguta from southern Abkhazia (Arslanov, Gey, 1987; Levkovskaya, 1999, 2006; Levkovskaya, Lyubin, Belyaeva, 2012). One especially extreme climatic phase is reconstructed in all regions within the span 47-35 kyr BP. According to calibrated radiocarbon dates obtained for Dziguta standard this climatic extreme began about 42 000 cal. years ago (about 38 800 years BP according to the uncalibrated C14 data). The beginning of this phase at Dziguta is very abrupt. The dry upper-mountain *Pinus* forests dominated during this phase at the West Caucasus in the recent broad leave forest and subtropical belts (data on Monasheskaya, Matouska, Akhshtyr, Malaya Vorontsovskaya and Dziguta).The subalpine *Cichoriaceae* meadows are reconstructed for modern upper mountain wet *Abies-Picea* forest belt of the West Caucasus (near Mezmayaskaya cave site). According to the SEM data (Levkovskaya, 1999) the *Cichoriaceae* produced only ultra-dwarf pollen grains. The evidences of desquamation subalpine sedimentation are registered even in the lower part of the modern forest belt at the area of Matouzka cave. The discussed climatic extreme was so dry that *Pinus* forests dominated even in the Colchis — the region with the recent European maximum of precipitations and domination of dark coniferous forests in the upper forest belt. *Pinus* dominates in the modern upper mountain forests of the Caucasus to the East of Colchis, where the climate is more dry and continental. Data on Matouzka cave site (Levkovskaya, 2006) shows that this extreme was the driest within cold climatic phases of the OIS 4 and 3. Data on the Russian Plain shows that at the basin of the Don river (Levkovskaya et al., 2005) all plants produced only underdeveloped and dwarf pollen grains (data on the upper part of the layer III of Kostenki 12 site). They are indicators of the geobotanical catastrophe — the crisis for the reproductive sphere of the most plants of the area (Levkovskaya, 1999). Data on the two discussed regions shows that cold and extremely dry climatic phase of 42-35 kyr BP had a global character. It was a period when the formation of the Mousterian layers with Neanderthal finds in some Caucasian cave sites have finished. At the same time at Russian plain the most ancient layer of Kostenki-Sterletskaya culture was formed.

Acknowledgements: The authors are grateful to the Royal Society for the grant provided in 2006 that allowed working in the Oxford Log-term Ecology Laboratory and use its pollen collections for the identification of pollen flora. We would like to thank Prof. Kathy Willis, the head of the Oxford Log-term Ecology Laboratory, for her advice. We are thankful to Ludmila Kartseva the SEM specialist of Komarov Botanical Institute of the Russian Academy of Science for her help in SEM studies.

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Poster Presentation Number 21, Fr (18:00-20:00)

## Do non-human primates provide a good analogy for hominin dispersal?

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**Introduction** Intensive multi-disciplinary research effort is currently applied to reconstructing hominin dispersals, integrating genetic, palaeoenvironmental, palaeoanthropological and archaeological evidence. Research questions address the types of dispersal processes involved and how hominins adapted behaviourally and biologically to new and challenging conditions. Here, we address a broader question: does larger brain size, and/ or greater behavioural flexibility favour success in dispersal across species? Our aim is to put hominins in a broader comparative context and to assess the relevance of a model based on non-human primates. **Background** A number of recent studies have shown that both bird and mammal species with larger relative brain size tend to be more successful invaders; in the case of birds these were also the more innovative species (Sol et al 2005, 2008). Non-human primates are particularly interesting because of their close relationship with humans and large relative brain size. However, there are few recent cases of successful invasion by non-human primates, who have been strongly affected by habitat loss. An alternative approach is to explore correlations between brain and behavioural variables and their current geographic distribution and environmental variation within the range. Previous studies indicated no obvious association between these variables (MacDonald 2006, Reader and MacDonald 2003). In addition, relative brain size in Old World monkeys and apes is negatively correlated with dietary seasonality but positively correlated with dietary ‘buffering’ of environmental seasonality (van Woerden et al 2012). **Methods** We carried out a new study employing a larger dataset, new measurements of intra-range environmental variation and new statistical methods. Endocranial volume and body mass were used for a measurement of relative brain size, and species geographic range maps were obtained from the IUCN Red List database. Measures of internal spatial and temporal environmental variation, structure and area of geographical ranges were calculated using geographic information system facilities (GRASS 6.4). Phylogenetically controlled comparisons were carried out using PGLS algorithms and primate phylogenies from the ‘10k Trees’ Project. **Results** The main result is that there is no correlation between relative brain size and any of the geographic range size or internal diversity measures. We argue that a nonhuman model of hominin range dynamics should therefore focus on feeding-related innovation rates and on the ability to use these to ‘cognitively buffer’ against habitat seasonality, rather than on the consequences of these for spatial range expansion.

**Acknowledgements:** Katharine MacDonald received a visiting scholar bursary from the AHRC Centre for the Evolution of Cultural Diversity.

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Podium Presentation: Session 3, Fr (14:40)

## *Paranthropus boisei* – generalist or specialists?

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The dietary ecology of the Plio-Pleistocene hominin *Paranthropus boisei* is currently subject of intense debate. The hominin’s derived dento-cranial morphology and thick-enamelled, bunodont teeth are traditionally interpreted as an adaptation to hard-object feeding. Yet, based on microwear texture analyses and isotope analyses feeding on abundant low-quality foods, like grasses, has been suggested. These latter interpretations are not only in conflict with the species’ dento-cranial morphology, but also with broader life history considerations. *Paranthropus boisei* was a large-brained primate that would have required high quality foods to grow and maintain their brains. Also, the fact that *P. boisei* was a highly successful species (2.37-1.41 Ma) makes it improbable that it was living on the brink. To assess the dietary ecology of *P. boisei* an energetic model was created, based on empirical data collected for yearling *Papio cynocephalus* from the Amboseli, Kenya (Altmann, 1998). Yearling baboons habitually consume some 21 different (recorded, core) C4 foods, which differ considerably in nutritional value, availability and mechanical properties. The time spent feeding on individual foods does therefore not inform about the amounts consumed, or their nutritional value. Both need to be calculated. To account for differences in body mass between yearling baboons and adult hominins and -consequently- metabolic rate, volume of food processed, manipulatory capabilities and energetic cost of locomotion, various scaling procedures were employed. The basic model thus created was then manipulated such that feeding time was (differentially) increased for foods that have the material properties suited to be broken down by the masticatory apparatus of *P. boisei*, i.e. hard, brittle and soft. Dental microanatomy precludes habitual consumption of tough foods. Feeding on fruits and invertebrates was also constrained, as these foods are seasonal and/or not readily available. It is shown that *P. boisei* was probably less specialised than previously assumed. A mixed C4 diet appears most advantageous, that is, *P. boisei* only needed to feed some 3-2.5 hours per day on C4 sources to meet 80% of its daily requirements for energy, and all its requirements for proteins and lipids. Reliance on only one food category led to a worsening of the outcome, either with regard to nutritional yield or feeding time, or both. The specific properties of the preferred foods are consistent with expectations derived from their thick-enamelled (but not particularly strong) teeth, the apparently powerful masticatory musculature, as well as microwear textures. This will be discussed and explained. Perhaps most importantly, the results are consistent with broader life history considerations and with what is known about hominin dietary ecology in general.

**Acknowledgements:** This work was funded by the Ministerio de Ciencia e Innovación (CGL2010-20868)

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Podium Presentation: Session 6, Fr (16:40)

## The origins of Me: Material engagement and the making of the self-conscious species

Lambros Malafouris<sup>1</sup>

1 - University of Oxford

When, why and how did humans become self-aware? The emergence of human sense of self (the ‘Me’), i.e., the ability to become the object of one’s own reflection, is, arguably, among the most fundamental issues of human becoming. Yet, unlike other central aspects of human psychology (e.g., language, memory, social intelligence, theory of mind (ToM), and symbolic thinking), it rarely occupies the focus of archaeological study. This paper will set out to outline a possible epistemological foundation towards an archaeology of selfhood. I will be focusing on two major categories of archaeological evidence, namely, tool making and personal decoration, which I think provide fertile ground for the identification and analysis of the different developmental aspects of self-consciousness. First, I ask how can we identify the presence or absence of self-consciousness on the basis of archaeological evidence? What counts as self-information and when is that information self-specific? Second, I ask what are the chief ingredients and processes responsible for the making and constitution of the self. How did the ability to think about one’s own self come about in human evolution? Last, I ask what, if anything, is unique about human self-awareness? Trying to answer those questions I apply ‘material engagement theory’ (or MET) (Malafouris 2013; Malafouris and Renfrew 2010). The distinctive feature of the material engagement approach is the explicit emphasis on the role of material culture and embodied cognition in the making of the human self. Drawing on the extended mind and other related approaches MET emphasizes the need to conceive of mind as extended across brain, body and world. Changes in material culture are seen as a transformative constitutive intertwining of neural, bodily, and material recourses, rather than in terms of a pre-specified set of adapted neural structures and cognitive functions. That means that new forms of bodily extension and material engagement are not simply external markers of a distinctive human mental architecture. Rather, they actively and meaningfully participate in the process by which hominin brains and bodies make up their sapient minds.

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Poster Presentation Number 82, Sa (17:00-19:00)

## Postnatal growth changes in suprahyoid muscle configuration, mandible morphology and hyoid position in modern humans, chimpanzees and Neanderthals

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Hyoid position in Neanderthals has previously been reconstructed using mandibular and basicranial dimensions to quantify Neanderthal vocal tract anatomy (Barney et al., 2012; Boe et al., 2002; Falk, 1975; Houghton, 1993; Lieberman et al., 1971). However, suprahyoid muscle attachments on the mandible and basicranium have received less attention. To maximise information about growth changes of the cranium, mandible and suprahyoid muscle complex we asked how this functional musculoskeletal unit might provide a basis for reconstructing hyoid position and vocal tract dimensions in Neanderthals using modern humans and chimpanzees as a model. We used 3D geometric-morphometrics to make statistical comparisons (PCA, permutation tests and discriminant analysis) of a) the shape changes of the suprahyoid hyoid-muscle complex (31 landmarks: hyoid bone; stylohyoid, digastric, geniohyoid, mylohyoid attachments), from birth to adulthood in modern humans (n= 56) and chimpanzees (n= 19). We then analysed shape changes, from birth to adulthood, of suprahyoid muscle attachments of humans, chimpanzees and Neanderthals (n= 4, analysis b and n=11, analysis c) and on b) the mandible and temporal bone (19 landmarks) and c) the mandible only (13 landmarks). a) In both species the timing of hyoid descent was similar in early infancy, but the growth trajectories were larger in humans than chimpanzees. The mylohyoid line also elongated with increasing age in both species. In humans the mylohyoid line developed a steeper slope than in chimpanzees. The greater horns of the hyoid rotate below the plane of the stylohyoids and posterior digastrics, whereas in chimpanzees, the horns remained within this plane throughout growth. In humans the posterior digastric origin is widely separated on the temporal bone and widens further with age. b) When muscle attachments only are analysed, we observe the same differences between humans and chimpanzees as when muscles and bones are analysed together (see a). The muscle attachment areas of the four available Neanderthal mandibles and associated temporal bones were consistently classified as human rather than chimpanzees. c) The comparison of the muscle attachments on the mandible only revealed significant shape differences (p<0.01) between humans and Neanderthals vs. chimpanzees. This is intriguing as *bony* mandibular shape and growth patterns between all three species are well established (e.g. Coquerelle et al., 2010; Nicholson and Harvati, 2006). In chimpanzees, the geniohyoid mandibular origins arise from a fossa rather than a tubercle as in humans. The position of this attachment appears to remain constant as the symphysis rotates anteriorly or posteriorly leaving the muscle in either a pit or attached to a tubercle. Our results support the finding that a similar growth pattern, but a different growth trajectory, underlies the distinct adult functional hyoid and suprahyoid muscle complex of chimpanzees and humans (Nishimura et al., 2006). Furthermore, Neanderthal and modern human postnatal growth both result in comparable adult suprahyoid muscle attachments on the mandible and temporal bone. These can now be considered when reconstructing Neanderthal vocal tracts.

Acknowledgements: We are very grateful to C. Stringer, R. Kruszynski C. Soligo, L. Bondioli, A. Froment, P. Menecier and A. Balzeau and www.NESPOS.org for Neanderthal fossil CT scans housed at the British Museum Natural History, London, UCL and at Musée d’Histoire Naturelle, Paris and various other locations across Europe. We thank C.E.P. Zollikofer and M. Ponce de Leon, F.Spoor and P. O’Higgins for access to comparative chimpanzee material and J. Hodler and his team at orthopaedic University Hospital Balgrist, Zurich for CT scan access and support. We are also very grateful to S. Blau and VIFM, Monash University, Melbourne for providing the human infant CT scan data set. This research was supported by the European Commission in a grant to the HANDTOMOUTH project (FP6, Contract No. 29065, NEST-2004-PATH-HUMAN).

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Poster Presentation Number 109, Sa (17:00-19:00)

## Undressing teeth: Trigonid crest patterns at the enamel dentine junction of the Sima de los Huesos molars

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Variation in dental form, as well as the frequency and degree of expression of many dental traits are highly heritable, making teeth more useful than other skeletal elements to assess phylogenetic relationships among fossil hominins and modern humans. The increasing availability of high resolution micro-computed tomography (microCT) allows the virtual separation of the different tissues that compose a tooth, allowing the precise 3D reconstruction and examination of naked inner surfaces like the enamel dentine junction (EDJ). In this study, we present the variation of expression of trigonid crest patterns at the outer enamel surface (OES) and the EDJ of the Atapuerca-Sima de los Huesos dental sample. Until now, the analysis of lower molars dentine surface, within the genus *Homo*, has been basically limited to Late Pleistocene hominins such as *Homo neanderthalensis*, fossil *Homo sapiens* and modern humans. Sima de los Huesos site has provided the largest Middle Pleistocene *Homo* fossil record coming from the same place and, to date, the human fossils recovered sum up more than 6500 remains, about the 80% of the worldwide human fossil record for the Middle Pleistocene. This extraordinary accumulation gives us the opportunity to study intrapopulation variability in a fossil population as well as to explore the origins of the Neanderthal lineage. A sample of 62 lower molars has been scanned with a micro-computed tomograph (Micro CT-80 Scanco Medical), and 3D models of the outer and inner surfaces were reconstructed and analyzed with the Amira 5.3 software. We characterize the pattern of trigonid crest expression at both surfaces and we compare it to a wide sample of Neanderthal and *H. sapiens* specimens. We evaluate the concordance of expression between the OES and the EDJ and we investigate the phylogenetic signal of the trigonid crest variation in Sima de los Huesos sample, particularly in relation to *H. neanderthalensis*. Although our results show a higher variability of trigonid crest patterns at the EDJ compared to the OES, in almost all cases the expression of a continuous mid-trigonid or distal crest at the OES corresponds with a continuous mesial/mid-trigonid or distal trigonid crest at the EDJ. This feature is particularly useful as it may imply the possibility of guessing the type of trigonid crest pattern at the OES in the case of teeth that are too worn. As in previous morphometric studies, our analysis ratifies the similarities found between the trigonid crest patterns of SH and *H. neanderthalensis* and the differences with the *H. sapiens* group. However, Sima de los Huesos also reveals some trigonid crest types that were present neither in the *H. neanderthalensis* sample nor in the *H. sapiens* sample.

Acknowledgements: The investigation has been supported with funding from the Dirección General de Investigación of the Spanish Ministerio de Educación y Ciencia (Project NCGL2009-12703-C03-01); Secretaría de Estado, Investigación, Desarrollo e Innovación of the Spanish Ministerio de Economía y Competitividad (Project N CGL2012-38434-C03-02); Consejería de Educación de la Junta de Castilla y León (Project CEN074A12-1); Fundación Atapuerca and the Leakey Foundation.

Poster Presentation Number 41, Fr (18:00-20:00)

## Marathon Man: evidence of stress fracture in a *Homo antecessor* metatarsal from Gran Dolina site (Atapuerca, Spain)

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*Homo antecessor* (Gran Dolina site, Atapuerca) 4th right metatarsal (ATD6-54) exhibits a proliferative dome-shaped lesion on its medial periosteal surface. Periosteal reactions are the bone response to a wide number of injurious processes; several studies have unsuccessfully tried to link periosteal reactions to a specific pathological process. In order to describe the lesion and to diagnose the most likely aetiology, we have analyzed the metatarsal lesion with two microscopic techniques: microtomography (mCT) and scanning electron microscope (SEM). The fossil was scanned with Scanco microtomographic system (Scanco mCT 80) housed at the CENIEH using the following parameters: 70 kV, amperage 140 mA and isometric voxel size= 30 mm<sup>3</sup>. The image stack was imported into AMIRA® software package to observe the inner structure and reconstruct the cortical bone and the periosteal reaction as two different materials. SEM (FEI, model Quanta 600) housed at CENIEH was used to characterise the morphology of the periosteal reaction. Externally, the osteoblastic lesion presents a highly porotic and disorganized morphology that would correspond with Rana's (2009) classification as *thick irregular* or *class C* periosteal reaction. Internally, we observe a series of micro-fractures on the compact bone although the medullary canal is not affected. In light of these results we suggest that the lesion could correspond to a stress fracture, also known as fatigue or march fracture, at the initial stage of healing. The incidence of metatarsal stress fractures has increased during the last decade due to fitness popularity, and in particular to marathon races. This type of continued, prolonged and strenuous activity puts in risk the integrity of the bones, especially of the lower leg. The tibia counts with the 55% of these fractures, followed by the metatarsals with 23%. Due to this type of injuries athletes are obligated to interrupt their training sessions and repose for weeks. Studies enumerate biomechanical and metabolic aetiologies as the main causes of stress fractures (Hartmann, 2011). Due to the scarcity of pedal fossil remains we cannot assess if the stress fracture is the consequence of high-arched or low-arched feet, as it has been proposed by some authors. We believe that the *H. antecessor* metatarsal fracture was related to muscular fatigue (Arndt et al., 2002) or increased load to the metatarsal heads (Nagel et al., 2008) due to prolonged and continued walking/running. In a recent study Pablos et al., (2012) suggested that the morphology of the *H. antecessor* left talus (ATD6-95) could be in association to an increased body mass, higher biomechanical demands and great robustness. Moreover, the hilly terrain also would increase the risk of lower leg lesions. We believe that this type of fracture could be common in early Pleistocene hominins, as they probably covered long distances by foot. However, as the complete healing process leaves no trace of the fracture, the finding of this type of lesions in the hominin fossil record becomes an extraordinary discovery. Interestingly, only other example, recovered from the near locality of Atapuerca-Sima de los Huesos has been documented (Gracia et al., 2012).

This research was supported with funding from the Dirección General de Investigación of the Spanish Ministerio de Educación y Ciencia (MEC), Project N° CGL2009-12703-C03-01, 02 and 03 and from Consejería de Educación de la Junta de Castilla y León (Project CEN074A12-1), and Leakey Foundation project. Fieldwork at Atapuerca is supported by the Consejería de Cultura y Turismo of the Junta de Castilla y León and the Fundación Atapuerca. Laura Martín-Francés is beneficiary of a predoctoral grant of the Fundación Atapuerca. Ana Gracia-Téllez has a Contract-Grant from the Ramón y Cajal Program, RYC-2010-06152.

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Podium Presentation: Session 6, Fr (17:20)

## Art without Symbolic Thinking: The Embodied Origins of Visual Artistic Expression

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The present paper demonstrates how models in cognitive neuroscience can help in the understanding of the evolutionary origins of visual artistic traditions. In this regard, contributions from neuroscience can be divided according to two main domains: perceptual and motor. In the perceptual domain, ornamental or figurative artworks can be viewed as manifestations of a single process, which is the reward of hyper-stimulating visual systems. Several perceptual principles –most of them of apparent survival value- have been proposed as exploited by art, this making art so appealing to the human brain (Ramachandran, 2011). Most of these principles represent basic, primary perceptual properties (e.g., contrast, grouping, orderliness, symmetry), which in turn suggests that no symbolic mind is a requirement for art to be appreciated. The large similarities between the visual systems of human and non-human primates, however, would leave unanswered why the latter lack this behavior, as many of these principles would be shared by both human and non-human primates. The motor domain discussion will demonstrate, on the other hand, important dissimilarities that exist in the motor neural systems between human and non-human primates. Discussion is focused on the corticospinal system, which permits the ability to perform voluntary fine movements. Only in humans and the most dexterous primates are there terminations of the corticospinal system directly onto motor neurons that innervate the most distal muscles, humans presenting the noticeably largest number of these direct terminations (Hofer and Frahm 2009). Humans also exhibit a considerable increase of the cortical surface of the corticospinal system devoted to control hands and wrist movements; in this regard, while cortices for the hand are three times larger in the human than the chimpanzee, the hand of the human is not that much bigger (Passingham 2008). Part of these dissimilarities, could also be present within the human lineage, this plausibly enlightening the main differences between art by *Homo sapiens* and possible samples of this behavior by pre-modern humans. Neural arguments are further complemented with data relative to the musculoskeletal functional anatomy of the hand, which reveal subtle but possibly relevant differences between non-modern and modern humans at this level. Due to these dissimilarities, the postures that appear unique to image making would be complicated for non-modern humans, this possibly inhibiting the development of artistic skills, at least on a discernible scale (Culley, 2006). Accordingly, the motor aspects of artistic behavior could plausibly and parsimoniously explain the lack of artistic behavior in non-human primates and pre-modern humans. Current theories of embodied cognition can be added to better understand why art enjoyment would also not be totally achieved by other than modern humans, as supported by the relevance of the primary motor and somatosensory aspects in art appraisal (Di Dio and Gallese 2009). A new scenario materializes, which permits a better understanding of the emergence of artistic behavior, its evolution across millions of years, as well as the main differences between ours and other human and non-human species in this regard, without necessarily appealing to a symbolic mind.

Acknowledgements: The author is supported by grant PSI2010-19619 from Ministerio de Economía y Competitividad, Spain (MICINN).

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

## Sima de los Huesos *al dente* : a “modern” Neanderthal?

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Previous dental analyses have already pointed out the highly derived state of the Sima de los Huesos (SH) hominins compared to other Middle Pleistocene populations. SH dentitions present all the morphological features that either in their degree of expression, frequency or particular combination have been classically considered typical of *Homo neanderthalensis*. These studies have also revealed that SH dentitions are morphologically “more Neanderthal” than other pencontemporaneous Middle Pleistocene samples such as Mauer or Arago and even more derived in some traits than some Upper Pleistocene Neanderthals (Gómez-Robles et al., 2007; Martínón-Torres et al., 2012; Prado-Simón et al., 2012). However, these dental derived traits are combined with other dental and skeletal characters that do not display such derived states such as cranial, facial and postcranial features, which show intermediate or primitive conditions with respect to classic Neanderthals (Arsuaga et al., 1997). In our opinion, the evolution of the dentition would be in favor of a less gradual and anagenetic process for the evolution of the European Middle Pleistocene populations towards Neanderthals, than suggested in the *accretion model* (Hublin, 1998). Alternatively, we proposed that the morphological variability of the European Middle Pleistocene hominins and their apparent non-lineal evolution to *Homo neanderthalensis* would fit better a “sink and source” model (Dennell et al., 2011) with repeated dispersals, fragmentations, regional extinctions and recombinations driven by the climatic conditions. However, a recent analysis on the cusp proportions of SH upper first molars (M1s) adds complexity to this scenario. Surprisingly, our study reveals that SH M1s present a mosaic of *Homo neanderthalensis* and *Homo sapiens* features. Regarding cusp angles and the relative occlusal polygon area, SH matches *H. neanderthalensis* pattern (Gómez-Robles et al., 2007). However, the total crown base area and the pattern of cusp proportions of SH M1s coincides with that of *H. sapiens*, presenting a small crown area, and a relative protocone enlargement and hypocone reduction. This “modern” pattern would match the *signal* of other dental features such as the small size of the postcanine dentition and the qualitative traits derived from this metric reduction (e.g., significant reduction or even absence of the hypoconulid/hypocone) that have been classically considered typical and even exclusive to *H. sapiens* (Bermúdez de Castro and Nicolás, 1995, Martínón-Torres et al., 2012). To the light of this evidence, we re-evaluate the state of art of the taxonomic and phylogenetic position of the SH population with regard to *H. heidelbergensis*, *H. neanderthalensis* and *H. sapiens*. Our dental analyses oblige to reconsider the “uniqueness” not only of the Neanderthal features, but also of the so-called modern traits.

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Poster Presentation Number 93, Sa (17:00-19:00)

Language and the Evolution of Complexity

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The notion of complexity recurrently shows up in the context of human cognition, namely in the study of the evolution of the faculty of language. Assuming the uniform character of language acquisition, and given that all humans are equipped with the same machinery, it has been traditionally argued that all languages are equally complex or simple (despite the surface variation). As Fromkin & Rodman (1974) put it, “[a]ll languages are equally complex and equally capable of expressing any idea in the universe”. The present work approaches the evolution of complexity in the language domain, mainly relying on Deacon’s (2006) distinction between various levels of emergence. The discussion focuses on grammars of Internal-languages and how these display traces of cumulative complexity (Deacon’s third level) that go beyond the narrow confines of internalism, since they entail the notion of development. We will discuss the evolution of complexity by drawing insights from two different domains. First, we will focus on instances of recent (sign) language emergence, such as Al-Sayyid Bedouin Sign Language. This language emerged in the 70-75 years in a relatively isolated community in Israel, which arose due to the presence of a gene for nonsyndromic, genetically recessive, profound pre-lingual neurosensory deafness (Scott et al. 1995), coupled with consanguineous marriage patterns. It is now only in its third generation of signers, and fieldwork suggests a gradual evolution of certain prosodic and syntactic structures (Sandler et al. 2005, 2011). Second, we will look at studies on birdsong: song quality in Bengalese finches “partially reflects early ontogenetic conditions”, whereas “considering that song syntactic complexity is subject to female preference in the Bengalese finch, it is likely that maternal resource allocation strategies play a role in song evolution” (Soma et al. 2009); such strategies obviously being a component of the environment factor. Moreover, it has been argued that long-domesticated Bengalese finches display a phonologically and syntactically more complex courtship song compared to their cousins that leave in the wild (Okanoya 2012). Evidently, the path to deriving complexity goes through the environment and this happens not only in the case of human language. It seems that the existence of properties like varying complexity in what gets externalized is not restricted to humans and also the factors that affect these properties are quite alike across species in that they are environmentally-driven adaptations. By comparatively reviewing findings in recently emerged sign languages and birdsong, this work argues that it is important to take into account the role of socio-cultural factors and how they affect the linguistic phenotype, which goes in line with an evolutionary perspective.

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Poster Presentation Number 28, Fr (18:00-20:00)

The primate upper arm: A study on the deltoid index

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On the proximal humerus we find several features that help making the shoulder joint stable and at the same time more mobile and it provides the attachment place for the main rotator cuff muscles. The humerus of *Hylobates lar* (n=66), *Pongo sp.* (n=20), *Gorilla gorilla* (N=36), *Pan troglodytes* (n=42) and *Homo sapiens* (n=87) of the collection of the Anthropological Institute in Zurich was analyzed and compared to casts of the humerus MH2 (*A. sediba*) and KNM WT 15000 (*H. erectus*). A number of 9 landmarks were defined on the humerus according to Martin and Saller 1957, digitized with a MicroScribe-3DX and converted into index calculations in order to enable a comparison with older studies. The deltoid index is an indicator for the position of the most distal insertion of the deltoid muscle. The deep insertion of the deltoid muscle in humans and great apes helps to increase the lever advantage of the arm. *Hylobates lar*, in contrary, shows a much higher insertion of the deltoid muscle. This higher position of the insertion results from the elongation of the hylobatid arm and the special distribution of the muscle mass as an adaptation for the much specialized form of locomotion in this species. For *Australopithecus sediba* and *Homo erectus*, nearly equal values have been calculated, both of which fall into the range of *Homo sapiens* and are significantly different from the values of *Hylobates lar*.

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Podium Presentation: Session 7, Sa (8:20)

## New Data on the Context of the Middle Paleolithic Bone Tools from Abri Peyrony and Pech-de-l’Azé I (France)

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The sites of Abri Peyrony and Pech-de-l’Azé I are located in SW France about 35 km from one another. Both sites have been known for 100 years with multiple excavations that have consistently yielded Mousterian of Acheulian Tradition (MTA) stone tool industries with no overlying Upper Paleolithic industries. More recently these sites were re-opened by our respective teams to re-assess the stone tool and faunal assemblages in an updated geological, chronological, and paleoenvironmental context. This work resulted in the discovery of four nearly identical bone tools (three from two separate levels at Abri Peyrony and one from Pech-de-l’Azé I) that are comparable to lissoir, a tool type previously known only from Upper Paleolithic contexts including the Châtelperronian (Soressi et al. 2013). Whereas most previously reported Middle Paleolithic bone tools are an extension of existing stone technologies into a new raw material type, these bone tools are manufactured with distinct techniques and exploit properties of bone that differ from stone. They were likely used for purposes that stone was unable to address. Late Neandertal behavior in western Europe is marked by changes in the material culture that parallel developments in assemblages shown or considered by many to be associated with modern humans. Debate continues on whether these changes predate the arrival of modern humans in Europe or whether they are the result of modern humans. Until recently the MTA has been considered part of the period pre-dating modern arrivals; however, recent dates continue to push the arrival of modern humans still earlier and some MTA assemblages appear to have continued quite late. Seven <sup>14</sup>C AMS age determinations on cut-marked bone from the Abri Peyrony layer containing the lissoir produced an age range of 47,710 to 41,130 cal BP, which overlaps with evidence of modern humans in western Europe. OSL dating of the Pech-de-l’Azé I lissoir produced a weighted mean age of  $51.4 \pm 2.0$  ka. Even with the statistical uncertainties, this age makes the lissoir from Pech-de-l’Azé I the oldest specialized bone tool in Europe and it pre-dates the best evidence of modern humans in Europe. However, it is contemporaneous with industries such as the Bohunician from central Europe that may represent modern humans in Europe but for now has no associated bone preservation. Here we present additional OSL dates from Pech-de-l’Azé I that place the Level 4 dates in the context of the complete sequence. For Abri Peyrony, we also present new OSL ages using the same protocol that was applied at Pech-de-l’Azé I. These data are complemented by a now completed analysis of the faunal assemblages associated with the two levels from Abri Peyrony that contain lissoir. Finally, new data on the industrial attribution of the basal lissoir level are presented based on an expanded sample from this level. This latter point is important for establishing whether lissoir are exclusive to the MTA or simply a late Middle Paleolithic phenomenon.

**References:**2013. “Neandertals Made the First Specialized Bone Tools in Europe” Proceedings of the National Academy of Science (United States) (Marie Soressi, Shannon P. McPherron, Michel Lenoir, Tamara Dogandžić, Zenobia Jacobs, Yolaine Maigrot, Chris Miller, William Rendu, Mike Richards, Matt Skinner, Teresa Steele, Sahra Talamo, Jean-Pierre Texier).

Poster Presentation Number 36, Fr (18:00-20:00)

## Denisovan girl manual phalanx: developmental age and patterns of bone formation from x-ray volumetric microscopy

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An important breakthrough in knowledge about the taxonomic status of the early inhabitants of Southern Siberia was achieved thanks to paleogenetic studies. Based on the sequencing of mitochondrial DNA extracted from the infant distal phalanx of the fifth manual digit from stratum 11, it was concluded that the Altai hominin was genetically twice further from modern humans than were Neanderthals (Krause et al., 2010). Total sizes of the phalangeal fragment without sinostosis led B.Viola to conclude about possible biological age as 6-7 years. In new study of the same phalanx of Denisovan girl we used the nondestructive method of volumetric X-ray microscopy (the resolution < 0.7 μm). Our purposes were histological estimation of developmental age, as well observation of microstructural patterns in comparative view. It is detected that diaphyseal and metaphyseal parts of the bone reflected the different stages of bone formation and grew active till the death of individual. The lamellar structures predominance, rare osteons in the slices from diaphyseal wall are typical for 6-7 years of modern human development. Opposite, quite “adult” histological picture was earlier described for close age juvenile Neanderthal from Okladnikov Cave in Altai (Dobrovolskaya, Mednikova, 2011, 2013). It can be supposed that growth tempo for Denisovans were similar modern humans in contrast to the specific patterns of Neanderthal growth and ageing.

Acknowledgements: The study was supported by grant RFBR ofi-m 130-06-12024

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Poster Presentation Number 151, Sa (17:00-19:00)

The Pioneer Modern Human Colonisation of Western Europe: Theoretical Models and Archaeological Case-studies

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Despite recent claims for a potential ‘tenfold increase in populations densities at the Neanderthal-to-Modern human transition in western Europe’ (Mellars and French 2011), it would be inappropriate to envisage this as an effective ‘army’ of socially-coordinated Aurignacian groups marching progressively across Europe, and rapidly overwhelming the native Neanderthal populations by sheer ‘force of numbers’ in the different regions. Both ethnographic and archaeological data indicate that any process of human demographic expansion into new, already-occupied territories must have taken the form of a much more gradual ‘piece-meal’, and probably intermittent, process, in which the initial ‘pioneer’ groups of modern human colonists moved as initially small human groups into specific regions of Europe, preceding their subsequent demographic expansion into larger and more socially integrated population groups. The present paper will review some of the potential demographic mechanisms and processes by which this progressive expansion of the initial Aurignacian or ‘Proto-Aurignacian/’Fumanian’ groups penetrated new geographical territories in western Europe, and interacted with, and eventually replaced, the ‘aboriginal’ Neanderthal groups within specific regions. A number of specific archaeological case studies will be examined to assess how far we can identify these early, pioneer penetrations of the initial modern groups into particular regions of western Europe. The potential implications of how these processes might impinge on any attempts to estimate the relative ‘population densities’ of the final Neanderthal versus initial modern human groups within particular regions will also be examined.

**References:** Mellars, P. & J.C. French. 2011.Tenfold Population Increase in Western Europe at the Neanderthal-to-Modern Human Transition. *Science* 333: 623-27.

Podium Presentation: Session 10, Sa (13:00)

Behaviour, adaptation and environment in the Turkana Basin during the later Quaternary

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The Eastern African Rift System is known to have played a major role in human evolution. The network of lakes, uplands, and mosaic habitats provided a variable and dynamic environmental context for hominin survival, while the region’s excellent fossil preservation offers unique opportunities to understand the ecological landscape in which hominins lived. In this paper, we report on recent work on the western side of Lake Turkana, aimed at providing information about the evolution of modern humans and their diversity, from the later Middle Pleistocene to the early Holocene. A substantial hominin fossil record has been recovered that spans different periods in the later Quaternary, especially rich for the period 12 Ka to 6 Ka, as well as stone tools and associated fauna, while palaeoenvironmental studies reveal a complex history of lake transgressions and recessions. Analyses of the fossil, faunal and archaeological records provide evidence for distinctive patterns of human morphology, cultural adaptations to the use of aquatic resources, and information on the technological evolution of the Middle Stone Age. Some of the material discovered in West Turkana also provides insights into the nature of inter-group relations among prehistoric hunter-gatherers. We discuss the implication of these findings for the evolution of modern humans and their adaptations in eastern Africa.

Acknowledgements: The research reported is part of the ERC In-Africa project. We acknowledge financial support from the Leverhulme Trust, the Newby Trust and the University of Cambridge. The work is carried out under a research permit from the Office of the President, Republic of Kenya, and with the support of the National Museums of Kenya and their staff. We also thank the District Officer (Central Turkana), staff at the Turkana Basin Institute Turkwel, and communities of Central Turkana for their help.

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

### An Acheulean Millstone workshop older than 650 ka at la Noira, Brinay, France

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The site of la Noira was discovered in the early 1970's in a sandy quarry located in the Cher Valley at Brinay. The lower unit has yielded an assemblage composed of Large Cutting Tools (LCTs), cores and flakes. ESR dates and technical characteristics of the assemblage suggest that it is among the oldest evidence of the Acheulean in Western Europe. Since 2011, following geological and geochronological studies, new excavations of the archaeological level have been undertaken on the top of the Tertiary lacustrine limestone bedrock. More than 20m<sup>2</sup> have been opened. Artifacts in this part of the site do not show any evidence of disturbance and spatial distribution allows us to describe what can be considered millstone workshops. Hominins recovered millstone slabs which were available in huge quantity on the river's edge, for flaking or shaping. These slabs are the result of diagenetic silicification during tertiary lacustrine deposits (Stampian) and were brought to light during the river incision. Slabs moved downslope in a diamicton deposited during an early glacial stage on the bedrock after the river incutting. Numerous slabs show few invasive removals on the slab surface or are broken by hard direct percussion. Associated with these crude possible cores, there are large and small flakes. Some of them may have been intentionally modified. None are retouched. Attempts at refitting are in progress. Some LCTs are dispersed among these artifacts and natural slabs of diverse sizes. Most of them are crude bifacial pieces, some of which are broken. One is a completely worked biface with an asymmetrical cross-section and retouch on the edges and tip. Microscopic analysis shows possible evidence of use for butchery. Artifacts were covered by around five meters of sandy fluvial deposits which are composed of constituents of the local fluvial formation called les Fougères Formation. This fossil formation, deposited during a periglacial or early interglacial stage and today located between +13 / +21m of relative altitude above the actual alluvial plain level, is related to sheet D of the fluvial system of the Middle Cher Valley. The mean age value of ESR dates obtained on bleached fluvial quartz grain for the sandy layers sampled in la Noira Site is 665 ± 55 ka (Despriée et al., 2007, 2011; Voinchet et al., 2010), confirming the antiquity of the archaeological assemblage. Archaeological, geological and geochronological data obtained on la Noira site permit to confirm that Hominins were present at the beginning of a Lower Middle Pleistocene glacial-interglacial cycle, after the river incision and before a pleniglacial phase (MIS 16). The site was fossilized under interglacial sands deposited during MIS 15. La Noira seems to be one of the oldest Acheulean workshop presently known in Western Europe. It is contemporaneous with sites without LCTs such as Happisburg, Pakefield in England or Isernia in Italy, and sites with LCTs such as levels P-Q of Arago in France or Notarchirico in Italy.

Acknowledgements: The excavations are supported by an ANR project devoted to onset of Acheulean in Western Europe, and by the Region Centre (France).

**References:** Despriée, J., Voinchet, P., Bahain, J.-J., Tissoux, H., Falguères, C., Depont, J. & Dolo J.-M. (2007) - Les nappes alluviales pléistocènes de la vallée moyenne du Cher (région Centre, France) : contexte morphosédimentaire, chronologie ESR et préhistoire. Premiers résultats). Quaternaire, 18 (4), 349-368. Despriée, J., Voinchet, P., Tissoux, H., Bahain, J.-J., Falguères, C., Courcimault, G., Depont, J., Moncel, M.-H., Robin, S., Arzarello, M., Sala, R., Marquer, L., Messenger, E., Puaud, S., Abdessadok, S. (2011) - Lower and Middle Pleistocene human settlements recorded in fluvial deposits of the middle Loire River Basin, Centre Region, France Quaternary Science Reviews, 30 (11-12), 1474-1485. Voinchet, P., Despriée, J., Tissoux, H., Falguères, C., Bahain, J.-J., Gageonnet, R., Depont, J. & Dolo, J.-M. (2010) - ESR chronology of alluvial deposits and first human settlements of the Middle Loire Basin (Region Centre, France), Quaternary Geochronology 5. 381-384.

Poster Presentation Number 62, Fr (18:00-20:00)

### Stratzing/Krems-Rehberg in its lithic landscape: Economic behaviour in the late Aurignacian of the Middle Danube region

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As far as the Palaeolithic archaeological record is concerned, the open air site of Stratzing/Krems-Rehberg in Lower Austria represents the most extensive open air settlement in Austria (Neugebauer-Maresch 1999). The loess ridge on which the site is located has been explored over 1100 m<sup>2</sup> between 1985 and 2003 in an interdisciplinary research project (Neugebauer-Maresch 1996, 2008). Besides the discovery of Austria's oldest work of art – an anthropomorphic figurine out of amphibolitic slate – the outstanding character of the site relates to the preservation of *in situ* features, among which several fireplaces, some of which were constructed (Neugebauer-Maresch 1996, 2008). The latter evident structures pertain to the main archaeological horizon (AH 2), which has produced a consistent series of radiocarbon dates on charcoal. Three samples directly taken from hearths in the main area cluster between 31.4 ka and 31.2 ka BP and foster the late Aurignacian character of the occupation already indicated by the typological composition of the lithic assemblage (Neugebauer-Maresch 1996, 2008). This paper presents the results of a study that aims to examine the factors that conditioned the choices in lithic resource procurement for tool making at Stratzing/Krems-Rehberg, based on a large sample of ca. 7000 lithic artefacts from the main, mostly *in situ* area of the site (ca. 500 m<sup>2</sup>). The raw materials used in the analysed assemblage are varied and partly relate to various proveniences. Assuming that present day raw material occurrences can serve as a reasonable proxy for the lithic landscape experienced in the prehistoric past, the aspect of costs and benefits associated with the provisioning of different raw materials can be addressed. It turns out that artefacts of high quality exogenous erratic flint numerically dominate the assemblage compared to the respective amounts of local raw material classes. Thus, there appears to be a positive relationship between source area attractiveness based on raw material quality and the number of lithic artefacts found at the site, at the expense of distance of procurement. In an effort to objectify the organization of economic behaviour at Stratzing/Krems-Rehberg with regard to the question why some sources were used and not others, and why some were used more than others, we use the “attractiveness equation” developed by L. Wilson (Browne & Wilson 2011) to quantify the attractiveness of each raw material source area in terms of quality, extent, size/abundance and terrain difficulty.

Acknowledgements: This research is funded by a post-doctoral research grant from the Deutsche Forschungsgemeinschaft (MO 2369/1-1).

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Poster Presentation Number 15, Fr (18:00-20:00)

Distribution of Ages-at-Death of Fossil Hominins from the Early Pleistocene site of Drimolen, South Africa: Preliminary Results and Behavioral Implications

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Most taphonomic analyses agree that the large assemblage of early Pleistocene hominins (mostly *Paranthropus robustus* and fewer *Homo* sp.) recovered from Swartkrans Cave (South Africa) was, in large part, accumulated and modified by carnivores, such as leopards, other large cats and possibly hyenas. Importantly, the distribution of ages-at-death—which can be estimated based on tooth development and occlusal macrowear—of the 100+ craniodentally identified individuals from Swartkrans corroborates this scenario. The Swartkrans hominin mortality profile (Mann, 1975) does not reflect the age distribution of a natural living primate (e.g., modern baboon, modern chimpanzee) population, but instead agrees more closely with that produced as a result of carnivore predation, skewed towards immature individuals. To date, the nearby and penecontemporaneous cave site of Drimolen site has yielded >80 hominins, mostly of *P. robustus* but also of *Homo* sp. (Moggi-Cecchi et al., 2010). Given the similarities between the two sites, it is not unreasonable to forward a carnivore-accumulating hypothesis for Drimolen, as is suggested for Swartkrans. In order to begin testing this hypothesis at Drimolen, we compared the sites’ age-at-death distributions. Following Mann’s (1975) methods, we assessed the age-at-death of the Drimolen individuals based on our analyses of high-resolution dental casts and written descriptions of the fossils. Each aged Drimolen individual was then placed into one of eight age groups and the number of individuals in each group tallied. These data were compared to those provided for the Swartkrans hominins by Mann (1975). The relative age-at-death distribution for Drimolen differs significantly from that described for Swartkrans (Kolmogorov-Smirnov test,  $p < 0.05$ ). The main differences are found in the classes of young-adults (10-15 years old) and infants (0-5 years old), the former far better represented at Swartkrans and the latter more so at Drimolen. The pattern of hominin mortality observed in the Drimolen assemblage agrees closely with that observed in wild populations of extant baboons and chimpanzees. Given the difference in the mortality patterns in the two hominin assemblages, we hypothesize that the Drimolen hominin fossils accumulated at the site under different conditions and by different mechanisms (including, possibly, more non-predation related deaths) than those that were accumulated at Swartkrans .

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Poster Presentation Number 45, Fr (18:00-20:00)

What can fireplaces tell us? A methodological approach to investigate the use life of late Upper Palaeolithic hearths

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Since the 1960s fireplaces have been an importance feature in understanding Upper Palaeolithic settlement patterns. For example, at Pincevent (France) fireplace data was used to understand the context for spatial behavior patterns by Upper Palaeolithic hunters-gatherers (Leroi-Gourhan and Brézillon, 1966; 1972). Numerous studies have illustrated that fireplaces were focal points both for everyday life and specific activities, represented by diagnostic tool types and debris (e.g. Bodu 1993; Leesch, 1997; Bullinger et al., 2006). Thus, hearths themselves contain numerous sources of archaeological data to help decipher their duration of usage, functions and operational modes (e.g. Plumettaz 2007). The current analysis investigated 133 fireplaces from 16 Magdalenian open air sites from Germany, Belgium, Switzerland and France. For understanding the operational mode of a fireplace the reconstruction of its initial shape was the most important and, coincidentally, most difficult exercises (cf. Coudret et al., 1989). Thus, to categorize the features (e.g. flat or pit hearths; with or without stone slabs) morphometric analyses were implemented in conjunction with statistical procedures. These methods helped define the expansion and depth of the features. Since the appearance of a fireplace changes during prolonged usage, it is vital to understand the duration of usage for each feature. To determine the relative operating life of a specific fireplace the following factors were examined:

1. fragmentation of elements integrated in the stone construction inside the fireplace: (totally weight divided by the quantity),
2. proportion of removed stone debris with traces of fire in the total amount of heated rocks,
3. number of burnt material dumps within periphery of feature,
4. total area covered by the fireplace,
5. depth of the fireplace,
6. total quantity of artifacts and debris in the vicinity of the hearth,
7. clarity of spatial patterns.

This research has shown that the total expansion of a hearth increases with prolonged usage due to the spreading of ashes, charcoals and heated stones. Statistically the depth of a hearth increases proportional to the total expansion. So expansion and depth are good indicators for the relative operating life. Coincidentally, there is a proportional rise in the total quantity of cultural material and of different activities carried out around the hearth relative to the length of the operating time. Spatial patterns lose their clarity after a prolonged use of space because of an overlapping of different activities obscuring specific workplaces. Overall evidence suggests that during the Magdalenian fires were relatively small and regularly constructed with stone slabs. The quantity of used stones within the fireplaces and its vicinity is dependent of its use life. Different construction types were used, e.g. stone lined or paved hearths but also fireplaces without stones, and most of the investigated features were initially flat. Following on from these results the next logical investigation is whether different types of construction identified relate to different functions and operational modes.

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Poster Presentation Number 63, Fr (18:00-20:00)

### Palaeoenvironments, Anatomically Modern Humans and Neanderthals: The contribution of Pod Hradem Cave (Czech Republic) to recent debates

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Excavations in Pod Hradem cave in the Moravian Karst region of Czech Republic during 2011-12 have uncovered paleontological, palaeobotanical and archaeological evidence from Marine Isotope Stage 3. Using various proxies such as faunal remains, palaeobotanical materials and properties of sediments, information has been gathered about habitats and the immediate environment surrounding the cave as well as climates. Faunal analysis has shown that the cave was primarily used by cave bears for hibernation and birthing. Glacial flora and fauna was present in this area during most of the twenty thousand year period that the excavated sediments represent. Scant but tantalising archaeological evidence also indicates human visitations during the period of the Middle-Upper Palaeolithic transition between ca. 35-50 thousand years ago. Raw materials used to manufacture stone tools have offered evidence for a unique transport pattern, previously unknown in the Moravian Palaeolithic. Precise dating of the layers has been made possible by excellent organic preservation of bones, teeth and charcoal. Several instances of archaeological remains offer clues about the movements of early Anatomically Modern Humans through this region and also potential clues about the possible coexistence of Neanderthals and Anatomically Modern Humans in this region.

Acknowledgements: We would like to thank Professor Jiří Svoboda for his support and guidance in this project. We would also like to thank the staff of CHKO, especially RNDr. Antonín Tůma and and RNDr. Leoš Štefka for their generosity and support of this project. Special thanks to Mr David Sojka for technical support during fieldwork. This project was funded from the SoMoPro program. Research leading to these results has received a financial contribution from the European Community within the Seventh Framework Program (FP/2007-2013) under Grant Agreement No. 229603. The research was also co-financed by the South Moravian Region and the Department of Anthropology, Masaryk University.

Poster Presentation Number 85, Sa (17:00-19:00)

### Virtual reconstruction of the KNM-ER 42700 (*H. erectus*) endocast

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Despite its small size, the calvaria KNM-ER 42700 from Ileret, Kenya, was described as a subadult *Homo erectus* individual (Spoor et al., 2007). This species allocation implies levels of sexual dimorphism larger than previously recognized for *H. erectus* and extends the variation of this species. A geometric morphometric study of neurocranial shape by Baab (2008) found that KNM-ER 42700 did not cluster with *H. erectus* and that allometric scaling cannot explain this fact, suggesting that it might represent a different, presently undescribed species of early *Homo*. However, Baab's study did not account for the facts that (1) the fossil suffered from post-mortem damage and deformation, and (2) might not yet display full adult morphology as the sphenoccipital synchondrosis is not fully fused (Spoor et al., 2007, 2008). Therefore, we present here a virtual reconstruction of KNM-ER 42700 and its endocast. Endocranial morphology is a good proxy for brain morphology and known to mature earlier than ectocranial morphology. It is not influenced as much by the development of ectocranial superstructures related to muscle attachments during adolescence and young adulthood like ectocranial morphology (Strauss et al., 2012) and consequently might be more suitable when evaluating neurocranial shape of subadults. We used high-resolution CT data of the original specimen to electronically remove stone matrix attached to the endocranial surface, to isolate bone fragments, to mirror-image parts of the bony braincase and to reassemble the fragments according to anatomical expertise and smoothness criteria. These steps corrected for the misaligned frontal bone and right parietal fragment, crushed right orbital roof, as well as the asymmetry of the calvaria that was especially apparent in the sphenoid/temporal region. Based on the reconstructed bony braincase, we generated a virtual endocast that can serve for endocranial volume determination and for comparative geometric morphometric analyses (Neubauer et al., 2009). The latter will add to our knowledge about this individual and its morphological relationships to other specimens and help to better understand early *Homo* evolution including sexual dimorphism in *H. erectus*.

Acknowledgements: We thank the government of Kenya, the National Museums of Kenya, E. Mbua and F.K. Manthi for research permission and support. This work was supported by the Max Planck Society.

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Poster Presentation Number 33, Fr (18:00-20:00)

## The biomechanical role of trabecular bone in the siamang (*Symphalangus syndactylus*) manual proximal phalanx

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Although the functional role of cortical bone has been well-studied, less is understood about the biomechanical role of trabeculae. Here we test the mechanical role of trabeculae in the siamang (*Symphalangus syndactylus*) third proximal phalanx using high-resolution microCT and finite element (FE) modeling. Four siamang third rays were microCT scanned (40µ) at the Department of Human Evolution, MPI-EVA. Using MedTool (Pahr and Zysset, 2009), the cortical bone was isolated from the trabecular structure. To test the biomechanical role of trabeculae, we used two methods of FE modeling. First, 3D homogenized FE modeling (Pahr and Zysset, 2009), for which we created two models: Model 1 comprised of cortical elements only with the trabecular region empty, and Model 2 with cortical elements and the trabecular region modeled with homogenized isotropic elements. Second, we created a 3D isosurface-based micro-FE model (Model 3; Nguyen et. al., in press) in which the cortical and trabecular bone structure were modeled directly with 7 million tetrahedron elements. Using Hyperworks®, each model was loaded in a free-body biomechanical model of the third ray in a suspensory posture following the boundary conditions outlined in Nguyen et al. (in press). In general, the strain patterns across all three Models in each of the four phalanx specimens were similar, especially along the diaphysis where cortical bone is thick and trabecular bone density is low or absent. The phalanx experienced compression along the dorsum and tension on the palmar side. Differences in axial strain across all three models were not large because most strain energy was absorbed by the cortical bone. However, there were substantial differences in dorsal-palmar displacement; maximum difference in displacement between Model 1 (no trabeculae) and Model 3 (micro-FE) varied from 1.60-20.44%. In phalanx specimens with thick cortical bone, the cortex was strong enough to suffer external and joint reaction forces, and thus the mechanical role of trabecular bone was not as important (e.g., reducing displacement by only 1.60%). However, in specimens with thinner cortex, the trabecular bone contributed more to the reduction of displacement (i.e., up to 20.44%) by absorbing more of the joint reaction force at the articular areas. Thus, load bearing of the joints cortical surface was effectively improved, leading to smaller and more regular strain across the articulated area and overall less displacement. Maximum difference in displacement between Model 2 (isotropic trabeculae) and Model 3 was 3.49%. This suggests that the homogenized-FE model of Model 2 may substitute microFE modeling in cases where deformation of each bone tissue is not of concern. Our analysis shows that trabecular bone of the siamang proximal phalanx – especially in specimens with thin cortical bone - helps to reduce strain (stress) concentration on the articular surface and, as a consequence, reduces displacement and produces a more stable joint. These results suggest that FE modeling of variation in cortical thickness and trabecular structure has important implications for the functional interpretation of overall bone form.

Acknowledgements: We thank Frieder Mayer and Saskia Jancke of the Berlin Museum für Naturkunde for access to specimens, Patrick Schönfeld for help with CT scanning and Steffi Grote for help processing the CT scans. This research is supported by the Max Planck Society.

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Poster Presentation Number 60, Fr (18:00-20:00)

## Exploring Neanderthal and modern human occupation east of the Carpathian Mountains: New fieldwork in the Dniestr valley (Ukraine)

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Neanderthal and modern human adaptations to diverse environmental conditions are heavily debated in palaeoanthropology. Since 2011 we are conducting archaeological fieldwork in eastern Europe in order to contribute to a better understanding of the adaptations of both species in this region during roughly MIS 6 to 2. As a case study we selected the Middle Dniestr valley (western Ukraine). This area is characterized by thick loess deposits with a high palaeoclimatic resolution and a rich archaeological record revealed by archaeological fieldworks in the 1950s and 1960s (e.g. Chernysh 1973, Ivanova & Chernysh 1965, Klein 1973). Our fieldwork consists of survey and test-excavations of sites newly exposed by a huge reservoir lake. The goals of our work include (1) reconstruction of environment and climate, (2) study of site formation processes, and (3) analyzing lithic and faunal assemblages. Here we present preliminary results of our survey in the Dniestr valley, east and up to 20km downstream of the well-known sites of Molodova I and V. We surveyed new, vertical exposures created by the changing water table of the Dniestr reservoir lake. The stratified context of all our discoveries including samples for dating, cultural attribution, and environmental reconstruction ensures a reliable relative chronology. Samples for dating are in processing stage. For the first time a chronostratigraphic approach (Haesaerts et al., 2003; 2010) is applied to the Last Interglacial – Early Glacial pedo-sequence of the Middle Dniestr valley. The 2012 fieldwork resulted in the discovery of new Middle and Upper Palaeolithic sites. The focus of the poster will be on the Middle Palaeolithic site of Neporotovo 7 and on the Upper Palaeolithic site of Korman 9. Neporotovo 7 is a Middle Palaeolithic site exposed over 50m along the Dniestr. Our collection - partly from exposures by the water but also from one test pit - yielded a large collection of lithics (incl. Levallois cores and flakes, scrapers) and a few faunal remains (Bos/Bison). The archaeological horizon is stratigraphically located below the Last Interglacial – Early Glacial pedo-complex and hence dates probably to MIS6 or older. The Late Pleniglacial site of Korman 9 is located in an over 40m long and up to 5m deep succession of loess units and tundra gley horizons. In this sequence three main archaeological horizons have been identified, individual artefacts in other stratigraphic positions hint at more levels. The richest archaeological horizon is exposed laterally on 12m. The abundant faunal remains are highly fragmented (long bone splinters, green breaks), often burned and include fetal specimens. The lithics (backed bladelets, cores, burins, etc.) point towards an Epigravettian. We recovered several long sequences with high-resolution palaeoenvironmental as well as archaeological data that will help us to better understand hominin adaptations to diverse environmental conditions and may change the view of Middle and Upper Palaeolithic chronology of the Middle Dniestr region.

Acknowledgements: This research is funded by the Leakey Foundation, a EU FP7 MC Career Integration Grant, the Max-Planck-Society, the McDonald Institute for Archaeological Research (D M McDonald Grants and Awards Fund), the Sir Isaac Newton Trust, the University of Cambridge, and the MO/36/021 Research Project of the Belgian Science Policy.

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Poster Presentation Number 10, Fr (18:00-20:00)

## Diet-related variation in global human cranial shape

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Masticatory stress is known as a major driver of regional human cranial variation, however it remains debated whether diet can explain geographic variation in human cranial shape on a global scale. Here we tested whether there is a correlation between diet and global cranial variation, and whether this can be explained from a masticatory functional perspective. For this purpose we measured a worldwide cranial sample of 15 populations (n=255) with known information on subsistence strategy. We used four landmark datasets designed to capture the functional shape of (1) the temporalis and (2) masseter muscle attachments, (3) the upper dental arch and (4) neurocranium shape. Mantel tests showed significant matrix correlations with diet for all shape datasets except the upper dental arch. Importantly, a diet factor emphasizing differences between predominantly plant- and meat-eating populations was more strongly correlated with cranial shape than a diet factor that emphasized differences between agriculturalist and non-agriculturalist groups. This could be explained by large cranial shape differences between hunting and gathering groups. After corrections for climate, population history and cranial size, diet correlated only significantly with the temporalis muscle and neurocranium shape. However, these correction factors were all intercorrelated, as well as correlated with diet, which complicated the interpretation of these corrected results. A 2-Block Partial Least Squares analysis was used to visualize the cranial shape variation related to diet. The first PLS described shape variation related to a cline from high stress (hunting / fishing) to low stress diets (agriculture), whereas the second PLS related to influences of gathering. Multivariate multiple regressions showed that about one third of the shape co-variation with diet could also be explained by effects of climate, population history and allometry. However, the observed shape differences in temporalis, neurocranium and overall cranial shape were highly consistent with expected morphology for creating and resisting high bite forces. Our study therefore suggests that diet is an important additional global factor in explaining modern human geographic variation.

Acknowledgements: This research was supported by The Leakey Foundation, The Wenner-Gren Foundation, SYNTHESYS DK-TAF, SYNTHESYS UK-TAF and SYNTHESYS AT-TAF. We are grateful to all museum curators for access to collections and hospital staff for CT scanning help that made this study possible.

Poster Presentation Number 7, Fr (18:00-20:00)

## The degree of glabella and supraorbital ridge expression – the meaning for phylogenetic study

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The aim of this research was to establish whether the degree of glabella (GL) and supraorbital ridge (ST) development in the case of recent *Homo sapiens* skulls are associated with the overall size and shape of the neurocranium and if the same set of variables indicates a significant and strong influence on the degree of development of these two superstructures. The occurrence of the same variables assessed as most important for GL and ST development can strongly suggest that these superstructures are part of the one functional/developmental complex, and thus they should not be used as independent traits in any phylogenetic study. In this study, a sample of recent *Homo sapiens* crania (244), including adult specimens from Europe (146), Africa (52) and Australia (46), was examined. The degrees of GL and ST development were assessed separately, using the scoring system described by Buikstra and Ubelaker (1994) and a modified scale (only the degree of ST development was assessed, and the fourth grade of this trait encompassed the fifth original grade) proposed by Lahr (1996) – respectively. Sixteen quantitative variables were analyzed – 15 describing the shape of the neurocranium and one describing its overall size. The association between the degree of the two superstructures development and cranial variables was investigated through discriminant function analyses. The results of this study indicate that the degree of GL and ST development is associated with the overall size and shape of the neurocranium and they also suggest that the set of variables which most influenced the degrees of GL and ST expression is not the same; thus, it is highly probable that these two superstructures are not part of the same functional/developmental complex. The results of discriminant analyses indicated that from the sample of the 16 variables, only 8 variables were chosen for the model concerning the degree of GL development, and 7 variables were chosen for the model of ST development (only four variables were the same in these two models). The low value of the partial lambda and the value of the Wilk's lambda indicated that the relative maximum cranial breadth and next overall size of the neurocranium (in the case of GL development) and overall size of the neurocranium and next angle at nasion (bregma-metopion) (in the case of ST development) had the greatest significant contribution to general discrimination. Although less important than the last two variables mentioned above, the relative maximum cranial breadth and parietal angle contributed significantly to general discrimination in the case of ST development. One (in the case of GL) and two (in the case of ST) significant discriminant functions were obtained. The low value of the eigenvalue established for the first discriminant function in the GL model in comparison to the value of the eigenvalue established for the first discriminant function in the ST model can suggest that the model of the GL could not include the variables which could be important to the degree of GL development. In light of the results of this study, the current problem is the assessment of when we can be certain (and on what basis) if the two, or more, traits express one functional/developmental complex.

Acknowledgements: We would like to thank B. Pawłowski, S. Kozieł and S. Gronkiewicz for providing recent human specimens used in this work.

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Poster Presentation Number 76, Fr (18:00-20:00)

Mosaic habitats and human evolution

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When we describe the landscape in which our hominin ancestors lived in Africa, we often use the term ‘mosaic’. However, if we look at early-mid 20th Century palaeoanthropological literature, this term was not used. So where did the term “mosaic habitat” come from, how does it fit within other habitat reconstructions for our ancestors (such as the ‘Savannah Hypothesis’ and the ‘Forest Hypothesis’), and is it a true reflection of hominin habitats? We have tracked the history of the concept through literature, illustrations and questionnaires to senior scientists in the field. Our research shows that the term ‘mosaic habitat’ was not used in the palaeoanthropological literature until the early 1970s, although the heterogeneity of hominin landscapes was articulated before this. Illustrations of hominins in variable habitats may have preceded the use of the term ‘mosaic’ by some 15-20 years, and it is clear that such ideas were being discussed at meetings (such as the IXth International Congress of Anthropological and Ethnological Sciences, Chicago, in September 1973), prior to their appearing in published journal articles. From a few early mentions (such as Kortlandt 1972; Cachel, 1975), it went on to become the prevailing paradigm by the mid-1980s and is still widely used today. However, there is little agreement on what a ‘mosaic’ habitat or landscape may actually be. We are taking a new approach that is independent of the fossil record, where we attempt to ‘Quantify the Mosaic’, using satellite remote sensing to examine the heterogeneity of modern African habitats. We are explicitly quantifying the characteristics of African mosaic habitats using sequential pairs of wet and dry season Landsat ETM+ images. These are used to generate land cover maps incorporating seasonal landscape dynamics. We present our preliminary results where we have examined East vs. South African landscapes to determine if the habitats are more variable in one region or another and explicitly quantify how they differ using a variety of landscape metrics derived from FRAGSTATS. We will ultimately use these data to help determine whether it is likely that our ancestors evolved in mosaic habitats, or if this frequent habitat reconstruction is simply a result of our being unable to refine the fossil record. Acknowledgements: The ”Quantifying the mosaic: testing modern analogues for African palaeoenvironments” project is funded by Leverhulme Trust grant number RPG-2012-472.

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Podium Presentation: Session 6, Fr (17:00)

The Neuropsychology of Numbers and the Paleolithic Record

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The present paper discusses the innate cognitive ability for quantity appreciation—numerosity—and its implications for interpreting the archaeological record. Numerosity is the ability to recognize discrete quantities up to three or four (subitization) and quantity differences of ‘bigger’ and ‘smaller’ above that level (magnitude appreciation), characteristics governed by the Weber constant of just-noticeable differences. Numerosity is shared across species, even fish, and it appears in human infants well before they acquire language. The phylogenetic distribution and prelinguistic manifestation suggest numerosity is innate and evolutionarily adaptive, enabling organisms to exploit resources and avoid threats. In primates, numerosity is a function of the intraparietal sulcus of the parietal lobe, which also performs functions of spatial awareness and multi-modal association (Bruner, 2010). In humans, evolutionarily new regions in the intraparietal sulcus contribute to enhanced visual representation and fine motor control of the fingers (Orban et al., 2006). This unique neurocognitive architecture enables humans to express the quantity sense as concepts of number (Coolidge & Overmann, 2012). The human neurocognitive architecture for quantity has implications for interpreting Palaeolithic artifacts such as the negative handprints at Cosquer and Gargas (about 26,000 years old), notched sticks and plaques such as those found at Cellier and the Grotte du Tai, and beads, which go back to 100,000 years and occupy a nexus of identity, status, and value. The body and material artifacts act as material scaffolds, instantiating the intangible sense of quantity in physical form (Malafouris, 2010). The mind–material interaction afforded through scaffolding yields explicit concepts of discrete quantities, as well as principles such as stable order, achieved through quantification behaviors (e.g., making one-to-one correspondences between sets of objects) and cognitive strategies such as grouping (which involves working memory and memory chunking). Material scaffolding by the body and artifacts enables transcendence of the subitization constraint to achieve discrete quantities within the previously undifferentiated “many, the universal term for undifferentiated quantities above the subitization constraint (Overmann & Coolidge, 2013). How the neurocognitive architecture for quantity appreciation structures modern linguistic phenomena and its applicability to interpreting symbolic emergence are also reviewed. Lexical terms for numbers (words like ‘one’ and ‘ten’) and grammatical number (singular–plural distinctions) emerge in cross-culturally universal sequences that reflect structuring by the Weber’s constant governing quantity perception. This is similar to Berlin and Kay’s (1969) observation that trichromatic color perception structured the expression of color terms and is consistent with the cognitive framework for language offered by Bybee (2010). Languages that lack one of these features are concentrated along the major prehistoric migration arcs into Southwest Asia/Australia and the Americas, with most languages lacking both features concentrated at the endpoints. This distribution suggests the change that occurs when small, isolated cultures become larger, interactive ones, implying that the emergence of concepts and symbols for numbers (or in other domains) is a function of increasing cultural complexity (Overmann, 2013), which necessitates movement away from high familiarity (shared preconceptions/perceptually immediate) contexts, where linguistic content is assumed rather than spoken, toward increasing explicitness in language.

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Poster Presentation Number 40, Fr (18:00-20:00)

## One tarso-metatarsal association from the Middle Pleistocene site of the Sima de los Huesos (Atapuerca, Burgos, Spain)

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In the Sima de los Huesos (SH) Middle Pleistocene site more than 6500 human fossils have been recovered (Martínez et al., 2013), which belonged to at least 28 individuals (Bermúdez de Castro et al., 2004). However, these fossils are mixed and it is difficult to associate them with each other due to the fact that there are some individuals with similar morphology and biological ages. Here we present the first tarso-metatarsal association from the site: foot 1 and foot 2. It is postulated that they belonged to the same individual. These bones have been attributed to the same individual based on their stage of development, sexual assignment and in large part due to anatomical congruence (Lorenzo et al., 1998, Pablos et al., in press). All the tarsals and the metatarsals from this association are preserved except the left lateral cuneiform. Almost all the bones are complete and show an exceptional state of preservation. However, some of the metatarsals are eroded at the midshaft and in the left fifth metatarsal (AT-1015) only the proximal half of the bone is preserved. All fossils preserved in foot 1 and foot 2 present complete development of the bone and the articular facets. Moreover, all the epiphyses are completely fused, which indicates that these foot bones belonged to a fully adult individual. Previous studies conducted on the components of the association suggest that, of the 23 elements from this individual, 19 are large when compared with others within the Sima de los Huesos variation. Therefore, the elements in question probably belonged to a male individual (Pablos et al., in press). Morphologically, it is a modern human-like robust individual, but the study carried out on the talus bones from the Sima de los Huesos indicates that there are some differences between Neanderthals, modern humans and the hominins from SH in terms of that particular bone (Pablos et al., in press). Despite the fact that the current regression formulae typically used to estimate stature are population dependant (Pablos et al., 2013), we have estimated the height of this individual using a forensic sample as reference in order to add insight into the body proportions of the Sima de los Huesos population. The estimates based on the different individual elements of the foot provide a mean height of  $173.9 \pm 0.9$  cm. However, combining different elements slightly improves this estimate (Pablos et al., 2013). The stature estimated for this individual combining tarsal and metatarsals is  $173.3 \pm 1.3$  cm, which is similar to the mean stature for this population obtained using the long bones from the site (Carretero et al. 2012).

Acknowledgements: We are grateful to the Sima de los Huesos excavation team. Adrián Pablos has been supported by a grant from the Ministerio de Ciencia e Innovación of Spain (FPI grant BES-2008-002034). Ana Gracia-Téllez has a Contract-Grant from the Ramón y Cajal Program, RYC-2010-06152. This research has received support from the Ministerio de Ciencia e Innovación of Spain (CGL2009-12703-C03-03 and CGL2012-38434-C03-01 projects) and 2009-SGR-2009-324 project.

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Poster Presentation Number 69, Fr (18:00-20:00)

## An attempt to monitor the process of use-wear formation on quartzite stone tools

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Quartzite and in general most of non-flint rocks have not been sufficiently studied from the functional point of view, nor their own parameters concerning the process of wear formation and development have been underlined. The urgency of creating a specific methodology for quartzite is connected to the idea that its structural behaviour, when a force is applied, is different from that of flint. With this contribution we aim to present a procedure for monitoring use-wear formation on experimental quartzite stone tools. The detailed observation of this process is judged to be crucial for recognizing and describing the particular wear attributes of this rock. Our experimental program involves different varieties of quartzite and a basic combination of motions and worked materials, attempting to comprehend the main steps and variables related to the development of the different wear features. Control of experiments is done sequentially, which means that microscopic analysis is performed focusing on the same control points before and after several stages of use. For data recording, we resorted to imaging through the SEM because of its high resolution, and used a wide range of magnifications according to the wear feature type to be recorded. Results obtained on experimental flakes allowed us to infer more closely the behaviour of quartzite under stress as well as to describe specific wear features according to the worked materials and performed actions. Basically, we found out that quartzite has a considerable brittle respond at the first stage of use. Therefore, while the task is being executed, quartzite tends to present a constant fracturing anytime the edge is under stress conditions. This fracturing sometimes leads to a definite rounding, which stops the loss of material and allows massive wear features to develop. The complementary recording of the worked materials residues on the experimental tools provided additional clues to better understand the wear process itself. Key-words Use-wear, quartzite, sequential experiments

Podium Presentation: Session 4, Fr (15:00)

### Innovative and traditional aspects of the Uluzzian technology at Fumane cave

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The Middle - Upper Palaeolithic transition in Europe was a period of dramatic changes in human behaviour as a consequence of processes mostly related to the spread of Anatomically Modern Humans and the demise of native archaic humans. The origin and the significance of these changes are the subject of an intense debate, which also involves the material record, represented by different technocomplexes constrained to specific regions or diffused at larger scale. Out of these technocomplexes, the Uluzzian has recently been considered crucial for investigating the social organization and the subsistence strategies of the Modern Human population. The same regions of the Mediterranean Europe were after occupied by the Aurignacian population, and characterised by new repertoire of bone and lithic artefacts. In last years, several studies have increased our understanding of the chronology, taxonomy, material culture and subsistence of the Uluzzian in Italy (Benazzi et al., 2012; d’Errico et al., 2011; Ronchitelli et al., 2009; Higham, 2011; Riel-Salvatore, 2007) and Greece (Kaczanowska, 2010), and generated debate (Bietti and Negrino, 2007). Yet, more data are required especially from material culture, which reveals an ensemble of innovations in stone and bone technologies. Persistence in flake production, increase in the incidence of blade-bladelet making, and appearance of new types of implements characterise Uluzzian flint knapping whereas new formal tools define bone technology. The social significance of such technological improvements should be assessed on a wider, supraregional scale, through a comparison with older, contemporaneous and younger technocomplexes. The authors present new data from the Uluzzian sequence of Fumane cave in Northern Italy with the aim of reducing the current patchiness of data about Uluzzian technology (Peresani, 2008). Fumane still represents an isolated case with regards to the central and southern regions of the peninsula. Our arguments concern the persistence and variability in the Levallois flake making, the substitution of this method by others, the progressive use of new tools, the shift in the functional design of tools, the appearance of few worked bones. As it is still statistically impossible to distinguish the chronology of the oldest Uluzzian at Fumane from the southern sites, we discuss the impact produced by these first changes and innovations.

Acknowledgements: Research at Fumane is coordinated by the Ferrara University in the framework of a project supported by the Italian Ministry of Culture - Veneto Archaeological Superintendence, public institutions (Lessinia Mountain Community - Regional Natural Park, Fumane Municipality, Veneto Region - Department for Cultural Heritage), and private associations and companies (Cariverona Foundation, Banca di Credito Cooperativo della Valpolicella).

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Poster Presentation Number 118, Sa (17:00-19:00)

### The recent mousterian settlement of Grotta Reali at Rocchetta a Volturno (Molise, Italy)

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The site of Grotta Reali (Rocchetta al Volturno, Isernia) has allowed to put in evidence an important Mousterian occupation, in cave, in a territory where the occupation of the Neanderthal has still not been signalled. The cave is located in the high-hilly area of the Abruzzo-Molise Apennines, a few kilometers from the Volturno springs. The cave, today partially modified by old quarry works, is part of a system of karst phenomena affecting a platform of calcareous tufa outcropping in the area, arranged in the form of plans and cliffs, that document an ancient lake-cascade system. The archaeological deposit, discovered in 2001, has been object of systematic investigation until 2007 directed by the formerly Department of Biology and Evolution of the University of Ferrara in collaboration with the Soprintendenza archeologica del Molise (Peretto, 2012). Within the sequence, composed of seven depositional units two anthropic levels have been recognized, that fall into two distinct moments of occupation attributed to an to an interstadial phase of MIS 3. The paleontological and paleontological remains coming from the two anthropogenic levels (SU 5 and 2βγ), are the result of intense but short-term occupations and suggest a multi-purpose use of the site, aimed at the production and use activities: the artifacts were produced and processed in situ (as confirmed by the presence of many replacements) and were used inside the cave for the treatment of animal carcasses (as indicated by the cutmarks and intentional fractures identified on some ungulates diaphysis fragments). In SU 5 an unstructured fireplace has been recognized. The short-term occupations of the site are also suggested, mostly on the top the sequence, by the presence of many carnivores remains (deciduous teeth of bear and hyena), which used the cave as a den for the pups weaning of the pups during the phases of abandonment by the Neanderthals. The technoeconomy is roughly comparable in the two horizons, both in the raw materials choice (local flint) and in the aims and methods: moving up the sequence such prominent attention to the optimization of production is detectable, while pursued through the application of diversified technical models (predetermined and low anticipation). The sporadic use of retouching and the frequent production of elongated supports (blades and bladelets), often obtained through laminar débitage (significant data for the debate about the origin and the role of the laminar débitage in the Mousterian). In conclusion, the chronological attribution and the technological specificities confer to the site of Grotta Reali a certain significance in the international debate on the techno-economic behavior adopted during the Neandertal/*sapiens* transition in Southern Europe.

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Poster Presentation Number 101, Sa (17:00-19:00)

### Peschanitsa Mesolithic Man from Northern Russia according to craniometric data

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A Mesolithic man from Peschanitsa, (archeological excavations by S.V. Oshibkina, Lake Lacha, Kargopolie, Russian North), has been first described about 20 years ago. The find has an important role in resolving anthropological profile of the ancient populations in the Northern and Eastern Europe. This study is dedicated to its multivariate statistical analysis and comparison with a variety of European and Levantine Mesolithic materials. Peschanitsa remains belong to a male individual 45-55 years of age and date to 9890+/-120 BP (GIN-4858). Previously, it has been claimed that Peschanitsa is unique and falls outside of the Russian, Baltic and Middle Dnieper Mesolithic fossils' polymorphism. We use Principal Components' analysis in order to study classical craniometric measurements of a number of Mesolithic cranial remains from the European Russia. We show that Peschanitsa's morphology is similar to a number of individuals from different sites: Vasil'evka I (burials 13, 17) and Voloshskoe (burials 1, 5) (Middle Dnieper region); Oleni Ostrov, burials 44, 156 (Lake Onega). General craniometric characteristic of the above crania allows identification of a relatively rare anthropological type in Russian Mesolithic, "Peschanitsa type". This is a large, hyper-dolichocranic cranial type, which is characterised by a very high brain case, average width of the forehead, both relatively and absolutely wide face with a relatively narrow nose and orbits of an average size. This new craniometric characteristic allows close comparison with crania from Korsnør, Denmark (except for the lower brain case and narrower nose of the latter) and Hoëdic, France (except for the lower face of the French fossil). Even closer similarity exists between the "Peschanitsa Type" and representatives of Natufian culture from Levant, especially with non-typical Natufians from Eynan (Mallaha). Equally striking is the closeness between the "Peschanitsa Type" and North African crania from Afalou-Bou-Rhummel. Further research into the origin of the "Peschanitsa Type" in European Russia is under way.

Acknowledgements: The authors are very grateful to MM Gerasimova for providing an opportunity to work with the original Peschanitsa material. The present work is supported by the Russian Foundation of Fundamental research, grant No HK 13-06-00045-13.

Poster Presentation Number 65, Fr (18:00-20:00)

### Characterizing the later part of the MSA sequence at Sibudu, KwaZulu-Natal, South Africa

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Studies of the African Middle Stone Age (MSA) have become central to define the cultural adaptations that accompanied the origin and spread of modern humans. Southern Africa plays a central role in this research due to the wealth of excavated sites and a well-dated chrono-cultural framework. Much of recent research has focused on Still Bay (SB) and Howiesons Poort (HP) assemblages. These industries are often considered to be essential to our understanding of cultural evolution during the MSA. In contrast, the periods following the SB and HP have often been neglected. Here, we analyze lithic assemblages from the Sibudan ("post-HP") layers at Sibudu in KwaZulu-Natal as part of the process of correcting this bias. Sibudu constitutes an excellent candidate for such a study as it preserves an exceptionally thick and rich archaeological sequence that dates to ca. 58 ka. The site can thus provide key data to help gain a better understanding of cultural evolution during the MSA. For this characterization of the Sibudan type sequence, we analyzed lithic assemblages from the seven uppermost layers that were excavated between 2011-2013 by a team from the University of Tübingen. We examine the use of lithic raw materials, investigate reduction sequences, evaluate reduction methods and perform a techno-functional analysis of tools. Our main goals are to define the key elements of the "post-HP" lithic technology and evaluate its diachronic and functional variability. Dolerite and hornfels constitute the main raw materials used for producing stone artefacts in all layers. However, their frequencies vary significantly between assemblages, indicating differential procurement and use of raw materials. While both the local dolerite and the non-local hornfels show complete reduction sequences, the latter exhibits an emphasis on the production, resharpening and curation of tools. Flakes are the most frequent debitage product, but blades and points are also common. Knappers employed both hard and soft stone hammers and preferentially selected pointed and elongated forms for retouch. Various methods of core reduction occur, including laminar, discoid and Levallois systems. We developed a new classification scheme for retouched tools based on a techno-functional approach. Five tool classes and tool cycles characterize the Sibudan of the type locality: Tongatis, Ndwedwes, naturally backed tools, asymmetric convergent tools and biseaux. Together, these tool classes make up more than 60% of formal tools in each assemblage. We propose the term "Sibudan" for the lithic assemblages that we have analyzed. Future work will study the entire Sibudan sequence at Sibudu in more detail and characterize the variability within the sequence. We will also evaluate the temporal and spatial distribution of this cultural unit.

Poster Presentation Number 135, Sa (17:00-19:00)

## Morpho-geometrical approach to the study of the débordant *déjeté* flakes of Pirro Nord (Apricena, Foggia)

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Pirro Nord (Apricena, Foggia, southern Italy) is a reference site for understanding the technological behavior of the early hominin groups that populated Western Europe since 1.5 Ma. In the present work, we attempted to describe some features of this behavior through a 3D geometric morphometric analysis of a specific category of artifacts found in Pirro 13 karst fissure. This category is composed by ten débordant flakes characterized by a morphological axis which is offset (*déjeté*) in relation to the débitage axis. Technologically, these blanks are ascribed to a centripetal knapping method, which represents at Pirro Nord, the prevailing processing method on flint pebbles of small to medium size. The unique triangular morphology with two convergent sharp edges makes these flakes extremely particular within the lithic assemblage, the only ones who seem to retain a certain degree of "predetermination" in terms of knapping direction organization and form (*sensu lato*). We employed geometric morphometric to quantify the morphological similarities and differences between these artifacts, by focusing on the comparative analysis of their geometrical structure (shape) and on the relationships between technologically significant morphological parts. The Generalized Procrustes Analysis of the spatial coordinates of eight "morpho-technical" landmarks recorded on flakes' 3D digital models and the multivariate analysis of the resulting Procrustes residuals were the main tools used in this investigation. The aim was to demonstrate if the presence of these products is just the random result of a centripetal knapping method adapted to a difficult raw material (small flint pebbles), or whether they are the foreseen products of an intentional human technological choice, i.e. a specific technical objective, the outcome of a standardized production. The analysis revealed clear patterns of convergence, dividing the sample into different subgroups of flakes characterized by a high degree of shape similarity. According to the meaning of the points of interest digitized, a significant technological and qualitative uniformity was proved. The morpho-technical and morph-geometrical homology expresses a relationship between lithic structures that have the same "embryonic" origin, given by the productive choice (conceptual) and by the act of its implementation. These results confirm the stability and the effectiveness of a knapping method originated from a precise "predetermination concept".

Poster Presentation Number 78, Sa (17:00-19:00)

## Development of subadult *Homo heidelbergensis* from Atapuerca during puberty: evidence from the analysis of the occipital sinuses in brain endocasts

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The Sima de los Huesos (SH) crania collection includes subadult specimens (i.e., Crania 3, 6, 7, 9), some of them within the period of puberty (around 12 years old). Using this collection, this study aims to understand aspects of development in this species from childhood to adulthood as compared to modern humans. Puberty or early adolescence (Petersen 1998) is a phase in human development during which a series of hormonal and physical changes occur, with the body preparing the transition from the childhood to the adult stage (Blakemore et al., 2010). Throughout this period, the bases for the adult brain are established, and the performance of cognitive tasks is extraordinarily improved. In our species (*Homo sapiens*), this phase is well known, and has been thoroughly studied using magnetic resonance imaging for the fields of psychology and medicine (Giedd et al., 1999). Unfortunately, fossils do not allow these types of analysis. Kobayashi et al. (1996) showed that the regional Cerebral Blood Flow (CBF) has shown age-related changes. Cerebral vessels are capable of altering their diameters and can respond in a unique fashion to altered physiological conditions (Kandel et al., 2000). Cerebral vessel as the occipital sinuses are visible in brain endocasts, and their diameter could be a good indicator of the CBF. In order to study the diameter of the occipital sinuses at different age ranges, the occipital sinuses have been measured (following Rosas et al., 2008) in a small collection of modern human crania and compared to the SH *H. heidelbergensis* sample. Following Paul et al. (1992) and Petersen (1998), the specimens were separated into four age groups: 2-9 (childhood), 10-13 (early adolescence), 14-20 (middle and late adolescence) and >20 (adults). Analyses of the modern sample revealed that the early adolescence group (10-13 years old) can be differentiated from the other groups, by having higher occipital sinus diameters and having a slightly different distribution of the CBF. To test the hypothesis that *H. heidelbergensis* and *H. sapiens* developed similarly during puberty, the subadults from SH were compared with the modern sample. Despite the fact that some of the SH specimens are considered adolescents (Arsuaga et al., 1997), the results show that the SH *H. heidelbergensis* subadults display a pattern similar to the younger childhood (2-9 years old) group in modern humans. Two explanations may help clarify these results. First, there may not be a clear period of puberty (which is well defined in modern humans) in *Homo heidelbergensis* in Spain. The development and changes from childhood to adulthood, in this species, may have been achieved more gradually, or in a different way, but may not have occurred in a short and critical period of the development, as is observed in modern humans. Or alternatively, if the SH *H. heidelbergensis* had a period of puberty similar to modern humans, the lower values for cerebral blood flow (i.e., occipital sinuses measurements) could be explained by lower brain volumes.

Acknowledgements: We are very grateful to Jose Miguel Carretero for the access to San Pablo crania collection and to Laura Rodríguez and Rebeca García for the determination of the ages in the modern individuals used in the study. We also thank to the Sima de los Huesos team. The project S2010/BMD-2330 funded by the Community of Madrid and the project CGL2009-12703-C03-03 founded by Ministry of Science and Innovation of Spain supported this research.

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New hominin remains from the Nachukui Formation, West Turkana, Kenya (West Turkana Archaeological Project)

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Over the past four decades, research in the Turkana Basin in northern Kenya has an extraordinary impact on our understanding of human evolution as well as the environmental and ecological context of these hominins. This basin is one of the richest areas in terms of Pliocene and Pleistocene hominin remains. Even if the number of specimens is less in the Nachukui Formation (western side of the Lake Turkana) than in the Koobi Fora Formation (eastern side), these specimens shed light on key questions in human evolution. Indeed, the Nachukui Formation (with no sedimentological gap between 4 and 0.7 Ma) is the richest area in terms of the number of hominin taxa. Several fossil discoveries from this formation have changed previous phylogenies and ideas concerning human evolution and the origin of the genus *Homo* in particular. We can mention for example KNM-WT 15000 ("Nariokotome Boy", a nearly complete skeleton of *Homo erectus/ergaster*, Brown et al., 1985), KNM-WT 17000 (the "Black Skull", Walker et al., 1986, commonly assigned to *Paranthropus aethiopicus*); the skull KNM-WT 40000 (holotype of a new genus and species *Kenyanthropus platyops*, Leakey et al., 2001); KNM-WT 42718 (the oldest occurrence of the genus *Homo* in the Turkana Basin, Prat et al., 2005). Here, we present the complete list and description of the hominin remains found by the West Turkana Archaeological Project so far: first, we recall the previously published specimens from Kokiselei 1 (KNM-WT 37744, 37747, 37748, 37100) attributed to *P. boisei* (Prat et al., 2003), from Lokalalei 1 alpha (KNM-WT 42718) assigned to early *Homo* (Prat et al., 2005); and second the unpublished findings from the site of Kokiselei 1 (KNM-WT 37749, 37750), Kokiselei 2A (KNM-WT 52107); Naiyena Engol 2 (KNM-WT 47767), Naiyena Engol 9 (KNM-WT 42710 a-j) and Kalokodo 6 (KNM-WT 47844). Metric and morphological analyses were undertaken in order to assign these specimens. The specimens from Naiyena Engol 9, Kalokodo 6 and Kokiselei (1 and 2A) are assigned to *Paranthropus boisei* while the specimen from Naiyena Engol 2 is assigned to the genus *Homo*. These findings increase considerably the number of specimens of these taxa from this region. Furthermore, they are in the same spatiotemporal range as the well-developed paleoecological and paleoenvironmental records, and thus could permit, in future, a determination (or not) of specific habitat preferences for *Homo* and *Paranthropus*.

Acknowledgements: We thank the team of the West Turkana Archaeological Project; the French ministry of Foreign Affairs, the ANR-12-CULT-006-02 for support and the National Museums of Kenya.

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# Signals in the Skull: Quantifying and mapping phylogenetic signal in the cranium of strepsirrhine primates

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Determining accurate phylogenetic relationships from fossil data is crucial for understanding species evolutionary history. Previous studies have found reliable signals of phylogenetic relationships in the temporal bone (Lockwood *et al.*, 2004) and cranial base (Cardini & Elton, 2008), of hominoids and guenons, respectively. Here, we use a combination of Pagel's lambda (Pagel, 1999) and phylogenetic mapping (Smaers *et al.*, 2012) to investigate the presence of phylogenetic signal in the skull of strepsirrhine primates. 3D landmark data were collected from a total of 1536 specimens across 27 species. The full composition, comprising of 60 landmarks was analysed, as well as 6 subsets or cranial modules (anterior oral-nasal, zygomatic, vault, teeth, palate and base). The validity of these modules was tested by calculating the multi-set *RV* coefficient after Generalised Procrustes Analysis (GPA) ( $RV_m=0.522$ ,  $p<0.0001$ ). Following GPA, the data were subjected to Principal Components (PC) analysis. The species average values for each PC were used to assess phylogenetic signal, both, under the assumption of a Brownian Motion model of evolution, by calculating Pagel's lambda, and through phylogenetic mapping, using the method of Independent Evolution (IE), based on an Adaptive Peak model of evolution (Smaers & Vinicius, 2009). The IE method infers ancestral states for each node and allows for independent rates of evolution on each branch of the tree, with a positive rate of change indicating an increase in the trait along that branch and a negative rate indicating a decrease in the trait. Using lambda estimation in conjunction with phylogenetic mapping means we can assess whether the trait demonstrates a phylogenetic signal across the entire tree (lambda), as well as which individual branches deviate from the average pattern of phylogenetic signal (phylogenetic mapping). A composite phylogenetic tree, from the 10Ktrees website (Arnold *et al.*, 2010) was used for the phylogenetic mapping. A strong phylogenetic signal was found for the whole cranium, with PCs 1-5 returning lambda values of  $>0.98$ . PC 1 represents a shortening of the face and a more globular vault. Phylogenetic mapping reveals a general trend to decrease this trait in the Lemuridae, and increase it in the Galagonidae. Analysis of the anterior oral-nasal region returns similarly high lambda values ( $>0.98$  for PCs 1, 3, 4 and 6), with PC 1 representing an increase in the length of the snout. Phylogenetic mapping shows a general increase in the Lemuridae, in accordance with the analysis of the whole skull, but a decrease for the other Malagasy strepsirrhines and for the Loridae and Galagonidae. Analysis of the teeth also returns a strong phylogenetic signal (for PCs 1 and 3), which reflects a decrease in tooth size in the Loridae and Galagonidae and an increase in the Lemuridae. The cranial based returned a strong phylogenetic signal for PC1, which represents an anterior-posterior shortening of the base. Phylogenetic mapping shows an increase in this trait in the Galagonidae. The zygomatic module was also found to have a strong phylogenetic signal (for PCs 1 and 2); largely due to change in the Galagonidae, but no signal was found in the vault or palate.

Acknowledgements: With thanks to the Natural History Museum, London; the Smithsonian National Museum of Natural History, Washington DC; the Muséum National d'Histoire Naturelle, Paris and the Museum für Naturkunde, Berlin.

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Poster Presentation Number 11, Fr (18:00-20:00)

## Sex and diet in fossil hominins: Is sexual dimorphism in cranial form associated with sexual dimorphism of masticatory function?

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Sexual dimorphism is a marked feature of several hominin taxa. It is associated with social structure and mating strategy and is often manifest in cranial form. Among papionins, a good model for early hominins, cranial sexual dimorphism can be significant, yet in terms of diet, differences tend to be smaller than those among species. This raises the question of whether cranial functional performance during mastication is functionally equivalent between the sexes when diets are not dimorphic but cranial form is. Here we test the hypothesis that males and females of the same species perform similarly despite differences in cranial form and consider the findings in relation to diet and cranial dimorphism in fossil hominins. Crania from one male and one female belonging to two closely related species of papionin monkeys, *Theropithecus gelada* and *Papio anubis*, were modelled using CT data. *T. gelada* is highly graminivorous, while *P. anubis* has a more generalist diet, consuming a variety of fruits, seeds and leaves. We used finite elements analysis (FEA) to assess mechanical performance in these crania during simulated biting along the dental row. How they deformed under load was compared between sexes and between species during 100N bites. Local deformations were compared using strain magnitudes at particular points. Large scale deformations were compared using contour maps and through analyses of changes in cranial size and shape during biting using 70 landmarks distributed over the cranium. The male and female of each species show much more similar strain maps and large scale changes in size and shape with each bite than do species. The *P. anubis* male and female deform most similarly, albeit the female to slightly lesser degree. In this species, mechanical resistance to load appears to be conserved in spite of differences in form. Differences between male and female *T. gelada* are a little more pronounced, but are mainly in degree rather than manner of deformation, with the female deforming far less than the male particularly during incisor biting. The differences in incisor bite performance among sexes of *T. gelada* may reflect reduced dietary constraints on the anterior dentition and facial skeleton, since the postcanine dentition plays a relatively more dominant role in food processing in this species than is the case in *P. anubis*. The increased deformation seen in the males is probably due to increased prognathism, which is adaptive for social display and the use of canine weaponry. The male *T. gelada*, unlike *P. anubis*, does not require extensive adaptations to increase cranial mechanical resistance to load during incisor biting due to its molar dominated graminivorous diet. In future, comparisons of cranial performance between the sexes of extinct hominins may well provide clues to their dietary and social behaviours, although this preliminary study needs extending to provide a more secure basis for such studies.

Acknowledgements: MP was funded by the Fundação para a Ciência e a Tecnologia (Portugal), through the PhD Programme in Computational Biology, Instituto Gulbenkian de Ciência (Portugal). LCF and POH were supported by the BBSRC award BBE0138051 and by the European Union Marie Curie Action 020601 (PALAEO).

Podium Presentation: Session 8, Sa (10:20)

## The KC4 maxilla (Kent’s Cavern, England) and the age of the arrival of early AMH to western Europe

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The site of Kent’s Cavern, Devon, UK contains key evidence for the presence of early modern humans in Europe. A Torquay Natural History Society excavation in the Vestibule (1926-1928 and 1932-1938) was the most significant work in the site, yielding Middle and Earlier Upper Palaeolithic industries and a fragment of human jaw (KC4). The maxilla was recovered in pieces at a depth of 10 feet 6 inches (3.2 metres) on 14/3/1927. It was examined later by Keith (1927) who considered it to be of modern human type. The maxilla was directly radiocarbon dated in 1988, yielding an age of  $30.9 \pm 0.9$  ka 14C BP, confirming its Early Upper Palaeolithic age. More recently, a reanalysis of new radiocarbon dates from the site suggested that the maxilla must date between 44.2-41.5 ka cal BP and therefore be oldest modern human fossil known from NW Europe (Higham et al., 2011). However, the excavation has been claimed to be poor in execution and recording by White and Pettitt (2012), casting doubt on the archaeological evidence from the site and the recent scientific dating results. In this paper we will present work we have undertaken over the last year that addresses this. We have undertaken a detailed examination of the excavation records and published reports from previous excavations, obtained detailed remeasurements and a new site survey. The next step is to build a 3D reconstruction of the sediments and archaeology. In contrast to White and Pettitt (2012) we conclude that the excavations were conducted to a reasonable standard that was typical of the time. We re-examined the sediment remnants throughout the cave to understand their taphonomy and depositional history and analysed artefacts in the light of bedding and sedimentary processes. We have obtained new 14C dates from identified animal bones to explore the possible movement of material through the site. Finally, we completed a detailed refitting exercise, which involves the analysis of broken stone tools and artifacts and the plotting of their locations in the site. This sheds light on whether the objects have moved post-depositionally. Using this new data we provide an updated estimate of the age of KC4.

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Poster Presentation Number 4, Fr (18:00-20:00)

## Cranial base variations in extant Hominoidea and fossil Hominins

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In this communication, we present the results of a 3D geometric morphometric analysis of the cranial base variations in living and fossil Hominoidea. A number of studies on cranial base morphology have dealt with basicranial flexion, mainly in relationship with cranio/facial size and shape (Bastir et al., 2010; Bastir et al., 2011; Lieberman, 2011). By contrast, our aim is to test to what extent basicranial morphology is related to functional and/or ontogenetic patterns. Particularly, we are interested in the evaluation of factors that may have influenced the cranial base morphology in Plio-Pleistocene Hominins. We used a configuration of 18 landmarks distributed on the cranial base on a sample of 128 specimens (infants, juveniles, and adults) of *Homo*, *Australopithecus*, *Paranthropus*, *Pan*, *Gorilla*, and *Pongo*; the age at death of the specimens was determined by patterns of molar eruption. The landmark set has been transformed into shape coordinates by generalized Procrustes analysis and the variance-covariance matrix was explored through principal component analysis (PCA). Shape predictions were performed by regression of the PC scores on the centroid size in order to display the respective pattern of growth within the different OTUs. The results discriminates two main ontogenetic series independently from phylogenetic/taxonomic relationships. The distribution of these clusters in the morpho-space may be viewed in relationship with ontogenetic trajectories as well as with posture and locomotion. *Pongo*, *Gorilla*, and *Pan*, share a common pattern of cranial base variation during growth, whereas modern humans show a different pattern of change with analogous ontogenetic polarity, shared with Mid-to-Late Pleistocene *Homo*. Australopiths and early-*Homo* specimens occupy a morpho-space that is distinct from both the other *Homo*, representatives and living great apes, while approach the ontogenetic series of the formers. It is worth mentioning that this is not in relationship with their degree of encephalization, but it is consistent with the Anova ( $p < 0.001$ ) performed on PC scores on posture and locomotion variables. When dealing with shape predictions, the P-values of the regression analysis of size related trajectories are statistically significant for the extant Hominoidea, while adult Australopiths and early *Homo*, are closer to the trajectories of both modern humans and Mid-to-Late Pleistocene *Homo*, (including Neanderthal juveniles) than to those of great apes. The phenetic relationships based on UPGMA cluster analysis (adult samples only) further demonstrate the independence of the observed patterns of cranial base morphology from phylogenetic/taxonomic relationships.

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Podium Presentation: Session 5, Fr (17:00)

## Evidence of processing and consumption of starch-rich underground storage organs at Dolní Věstonice II (Czech Republic)

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Recent research has addressed the question of hominin plant use and consumption in the Palaeolithic using various novel methodologies, including analysis of phytoliths, starch grains and chemical signatures of plants preserved in various contexts, such as on grindstones or in dental calculus (Revedin et al. 2010; Henry et al. 2011; Hardy et al. 2012). These studies have contributed significantly to our understanding of hominin plant use, however the number of sites where macro-botanical evidence for plant use has been recovered remains small, hindering attempts to assess or quantify the magnitude of the contribution of plants to Palaeolithic diet. Here we report on a case-study conducted on charred fragments of plant parenchyma tissue recovered from the Gravettian site of Dolní Věstonice II (Czech Republic). The archaeological fragments of plant parenchyma tissue - the primary component of plant storage organs responsible for the storage of starch, such as roots, rhizomes, tubers, bulbs and swollen stems, collectively referred to here as underground storage organs (USOs) - were analysed using a low-vacuum tabletop scanning electron microscope (SEM), resulting in a database of photographs showing cellular structure and associated features of the parenchyma tissue fragments at high-magnifications of up to 10µm. Use of a tabletop SEM negated the need to gold-coat samples prior to analysis, allowing samples to be easily rotated and re-photographed from different angles. In some instances fragments were photographed once to discover the orientation of the fragment, then split across the axis of growth and re-photographed to give a clear image of the tissue elements. At the time of writing our database includes ~1500 images of archaeological parenchyma. We also collected ~1300 images of modern reference USO samples from 65 plant taxa as a basis for comparison and interpretation. While we remain cautious about the validity of species-level identifications from parenchymous tissues, we demonstrate the presence of plants from both terrestrial and aquatic habitats at Dolní Věstonice II, including fragments that appear similar to the taxa *Typha* spp.. Many of the parenchyma fragments appear to come from monocotyledon taxa, a group of plants that are easily identified from their above-ground growth and which contain comparatively fewer plant toxins compared to dicotyledon species. We also identify evidence for plant processing and preparation techniques, and present a summary of our investigations to identify the specific processing mechanism used. We interpret the collated evidence as implying that plant gathering and consumption was a habitual activity at Dolní Věstonice II, suggesting that USOs made an important contribution to the diets of Gravettian hunter-gatherers (Pryor et al. in press). We conclude by highlighting parenchyma from USOs as a presently under-investigated source of information on plant use and consumption during the Palaeolithic, and argue that there is significant potential for further work not just for exploring diets, but also concerning techniques of plant processing, storage, and accessing seasonally-available resources located in different parts of the landscape.

Acknowledgements: We thank Gordon Hillman for sharing his expertise and thoughts on plant taxa that might have been consumed during the Upper Palaeolithic. We also thank the Cambridge Botanical Gardens, Milton Country Park, Wendy Carruthers, Giedre Motuzaite-Matuzeviciute and Dorian Fuller for access to materials for a USO reference collection; Whipsnade Zoo for elephant dung; Martin Walker and Catherine Kneale for assistance with the SEM; Michele Wollstonecroft, Robyn Veal, Sherwin Carlquist, Peter Gasson, Sarah Mason and Jon Hather for their comments on identifications. This research was funded by NERC, and the University of Cambridge.

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

## Reading function from long bones: implications for the reconstruction of early hominin postural and locomotor behaviours

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Several features of postcranial skeletal anatomy indicate that early hominins likely combined arboreal and terrestrial locomotion with climbing; manifesting some degree of upright posture and facultative bipedal locomotion (Senut et al., 2001; Thorpe et al., 2007; Lovejoy et al., 2009; Wood and Harrison, 2010). Key to interpreting fossil skeletal remains in terms of function is biomechanical interpretation of bone gross and micro anatomy. With regard to the cortex, bone distribution along the femoral shaft is expected to reflect the directions, frequencies, and magnitudes of habitual (locomotor and postural) loads. In turn, how long bones respond to loads can be assessed using FEA. Here we present the results of analyses that for the first time finely characterize the organization of cortical bone and mechanical behaviour of the femoral diaphysis in *Homo*, *Pan* and *Gorilla* using morphometric maps of cortical thicknesses and finite elements analyses (FEA). The results are used to assess the extent to which differences are evident between taxa and how these relate to locomotion and phylogeny. CT scans of adult femora from 15 modern humans, 10 chimpanzees and 8 gorillas were used to build standardized morphometric maps of cortical thickness over 20-80 % of the biomechanical length of each femur by vertically unrolling each shaft along the middle of its anterior aspect to visualise and compare variations in cortical thickness (Bondioli et al., 2010; Morimoto et al., 2011). FEA was also applied to the same femoral shafts and the results were compared using strain contour maps. In addition, the coordinates of 88 landmarks before and after loading were used to compare large scale deformations resulting from pure compression, medial and posterior bending (Milne and O’Higgins, 2012). Our results clearly identify two groupings, humans and African apes. *Pan* is most similar to *Gorilla*, rather than its sister taxon, *Homo*. Thus, femoral shaft cortical thicknesses and load resistance as assessed by FEA identify locomotor groupings. With this background, given the inferred mixed arboreal-bipedal terrestrial locomotion of early hominins, we predict that early hominin femora will present a distinctive anatomy and functional signature combining aspects of what is seen in the present study, but more closely approaching the bipedal condition. Such an exploration will form the basis of future work.

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Poster Presentation Number 68, Fr (18:00-20:00)

## A microscopic characterization of water induced stone tool edge damage and its implications for interpreting the lower pleistocene archaeological record

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The breadth of knowledge regarding human behavior during the Plio-Pleistocene comes from modified stone and bone concentrations that are often in distributed context along lake margins and watercourses. Flowing water is known to transport artifacts from their primary point of deposition, mix spatially and temporally unrelated assemblages, and cause damage to the artifacts themselves. In particular, stone tool rounding of sharpened edges has often been used to mark the hydrological influence within an archaeological site. Despite widespread knowledge of this phenomenon there has been little research into quantifying the degree and pattern of fluvial edge damage, and how it may manifest across different raw materials and within various hydrologic contexts. Tracking the effects of flowing water on stone tool edge condition will provide an informed basis for interpretations of archaeological site integrity, particularly those in fluvial context. Here we present a newly developed analytical method for documenting and measuring sediment and water abrasion on stone tool edges. This was achieved by subjecting stone tools consisting of basalt, phonolite, quartzite, and chert, to a controlled environment that combined a low-energy flow of water with fine-grained sediment. The edges of each stone tool were then examined with scanning electron microscopy and the results were quantified with ArcGIS. On the macroscopic level all of the stone tool edges were classified as fresh, while on the microscopic level the edges demonstrated an overlapping abrasion signature that varied for each raw material type. In general, damage included rounding of the edge and edge contour as well as the manifestation of other features such as microchipping and polish. The results also indicate a potential overlap between features identified as hydrologic edge damage and those considered to be traces of use-wear. These results provide a great deal of insight into how fluvial edge damage is produced and recognized along various raw materials, and bears important implications for our interpretations of how stone tool edges, site integrity, and human behavior are related.

Acknowledgements: I would like to acknowledge Dr. Ignacio de la Torre for his guidance and support throughout this project. I would also like to thank Sandra Bond and Kevin Reeves for providing me with sound training on the equipment required to carry out the experiments. Thank you to Fred Foster, Adrian Arroyo, Tomos Proffitt, and Carmen Martin Ramos for their support throughout this past. Special thanks to Nicholas Stephens and Michael Pante for reading the abstract. I would also like to thank my parents and my brothers for their ever-lasting support.



Poster Presentation Number 100, Sa (17:00-19:00)

## Testing the “Negrito” Hypothesis: Modern Human Phenotypic and Genetic Diversity in Asia

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Growing multidisciplinary evidence supports a model of multiple modern human dispersals out of Africa and into Asia, with an early, rapid migration into Southeast Asia and a later, recent migration into Eurasia accounting for most of extant modern human diversity (Rasmussen et al., 2011). Elements of this model have been constructed under observations of shared phenotype between populations of Africa and isolated, indigenous populations of Southeast Asia (Mirazón Lahr, 1996). In what is variably referred to as the “Negrito” hypothesis (Editors, 2012), individuals of short stature, dark skin color, and tufted hair have been hypothesized to be “relic” descendants of the earliest modern humans in Asia. We explore this hypothesis in a comparative approach by examining genetic and cranial shape diversity of eight Afro-Asian modern human populations. Our populations include recent Holocene samples from Sub-Saharan Africa, Central Asia, Indo-European India, Japan, and purported “relic” samples from Dravidian India, Papua New Guinea, Melanesia, and Aeta/Agta “Negritos” from the Philippines. Our samples consist of N=235 crania digitized with up to 91 landmarks and 13438 single nucleotide polymorphism genetic markers (SNPs) for N=160 individuals. We first validate the differential preservation of population history signatures for the cranium (Harvati and Weaver, 2006), finding that correlation of population genetic (Fst) and phenotypic (Mahalanobis/Procrustes) distances is strongest for the temporal bone (r=0.716, p=<0.0001) and moderate for the entire cranium (r=0.374, p=0.049). Independently in a principal component analysis (PCA), the genetic data reveals Aeta/Agta affinity closer to Japanese and Central Asians rather than other “relic” populations. Similarly, a PCA of the cranial shape variables results in a separation between the population means of Africans, Papuans, and Melanesians on one end of the ordination morpho-space, and Central Asians, Japanese, and Aeta on the other end, while both Indian populations are roughly intermediate. Correspondingly, thin-plate spline interpolation (TPS) of a rendered cranium surface along the PCA ordination morphospace reveals a broadly plesiomorphic pattern of shape at one extreme and a derived pattern at the other. The shape patterns and the relative position of the Holocene populations are consistent when including fossil Quaternary hominins in the analysis, capturing greater diversity across a large temporal scale and supporting plesiomorphic-apomorphic patterns in hominin crania (Day and Stringer, 1982). Specifically, the derived pattern is one of globular neurocrania, orgnathic faces, wide maxillae, and acute cranial base angles, while the plesiomorphic pattern is one of long, narrow neurocrania, prognathic faces, narrow maxillae, and obtuse cranial base angles. While our comparative genetic and phenotypic analysis can lend support for multiple modern human dispersals, it is not consistent with a broad “Negrito” hypothesis. Rather than being direct descendants of an early modern human migration, the Aeta/Agta may represent a complex evolutionary scenario of convergence, adaptation, population admixture, or a combination thereof. Our study has implications for understanding modern human dispersals into Asia, further informing population history of the continent and recent human evolution.

Acknowledgements: This work was supported by the Senckenberg Gesellschaft für Naturforschung and the European Commission (Erasmus Mundus IMQP; European Research Council, ERC Grant Agreement No. 295733, “LanGeLin” Project). We thank Aurélie Fort, Alain Froment, Liliana Huet, Véronique Laborde, Philippe Mennecier, and the EVAN-Society e.V. for discussion and access to the cranial collections. Genetic data was made available by the Pan-Asian SNP Consortium and the Fondation Jean Dausset-Centre d’Etude du Polymorphisme Humain (CEPH).

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Poster Presentation Number 57, Fr (18:00-20:00)

## Variability among Russian Mid Upper Palaeolithic backed bladelet assemblages: preliminary results

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In Western and Central Europe we have acquired the beginnings of a robust high-resolution picture of cultural diversity and history during the Mid Upper Palaeolithic (MUP). Alongside the common features which define the Gravettian, this picture shows much important variability between assemblages. Temporally and geographically restricted phenomena, including the Maisierian / Fontirobertian, Noaillian, Rayssian and Pavlovian, all have their place. Often described as a mosaic, this well-defined variability is not yet mirrored in our knowledge of the contemporary archaeological record of Russia. Despite obvious general similarities in lithic assemblages between Russia and the rest of Europe during the MUP, major difficulties remain for cross-continental comparison. Serious problems with absolute and relative dating of relevant assemblages are yet to be resolved, meaning that a reliable chronological framework is lacking. Furthermore, specifics of Russian research history and the fact that many collections remain relatively little studied mean that it is currently extremely difficult to make sound comparisons between Russian and other European material based on the literature. Ongoing research is seeking to address some of these problems through new radiocarbon dating and by revisiting Russian collections in the light of recent progress in understanding MUP lithics and culture histories elsewhere in Europe. New data on lithic assemblages (specifically regarding morphological and technological features of backed bladelets) from important Russian MUP sites, including Kostenki 8-2, Kostenki 4, Kostenki 9, Kostenki 21-3 and Khotylevo-2 will improve our understanding of the local culture history and provide the necessary data for comparative work. Preliminary results from study of this material will be presented here. The collections studied exhibit a mixture of idiosyncratic local traits, general Gravettian features, and specific aspects which have parallels elsewhere in Europe. The research has potential consequences for our understanding of cultural processes on a continental scale during the MUP, of the impact of climate change on ice age societies, and of the origins of shouldered points, an important MUP type-fossil. The work also feeds into ongoing debates on the use of projectile weaponry during this period.

Acknowledgements: Many thanks are due to my DPhil supervisors, Nick Barton and Tom Higham, and to Rob Dinnis, for their unfailing support and excellent advice. I am indebted to the following Russian colleagues for their assistance in allowing access to collections and sampling of material for dating, as well as for sharing their knowledge and literature, and their kind welcome: Aleksandr Bessudnov, Daria Eskova, Konstantin Gavrilov, Gennady Khlopachev, Sergey Lev, Sergey Lisitsyn, Aleksandr Otcherednoi, Mikhail Sablin, Andrey Sinitsyn, Sergey Vasil’ev and Maria Zheltova. The DPhil research on which this is based is funded by the AHRC. Travel grants were provided by the AHRC, the Meyerstein Fund (School of Archaeology, University of Oxford) and Wolfson College, Oxford.

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

## Chronometric and relative dating of the Middle Pleistocene sequence of Schöningen

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The Quaternary sequence of Open Lignite Mine Schöningen represents one of the longest terrestrial records in Europe and has the potential to provide unique insight into Middle Pleistocene environmental and climatic changes and the correlation of terrestrial records to the Marine Isotope Stage system (MIS). Schöningen is famous for the oldest weapons which could have been used for long range hunting – the well-known Schöningen javelins. However, formation processes and nature of the sediment trap containing this record, as well as the chronostratigraphic position are debated, including the age of the javelins. Extensive palynological work provides a relative framework for the age of the stratigraphical succession at Schöningen, including the definition of unique interglacial pollen assemblages which are difficult to be placed in a European chronostratigraphical framework. Chronometric dating is therefore needed to provide anchor points. First results are available from U-series dating of peat formation of the Reinsdorf Interglacial Schöningen 13 II-2 underlying the archaeological horizon of level 13 II-4 with an age of around 300 ka and from luminescence dating, notably TL ages on heated flint from the oldest human occupation at the site of Schöningen 13/I-1. These samples provide evidence for the presence of fire at Schöningen, but not necessarily for fire control. The TL results provide an age range between MIS 10 and MIS 7 for that layer and thus the human occupation at Schöningen 13/II must have taken place during/around MIS 9. This work builds the basis of a new project to provide a chronostratigraphical framework for Schöningen, funded by the Ministry of Science and Culture (PRO\*Niedersachsen) of the state of Lower Saxony, which will be based on the dating of the entire sequence with multiple chronometric techniques and refined high resolution palynological and sedimentological studies.

Poster Presentation Number 8, Fr (18:00-20:00)

## How Thick-Headed Are We? Differences between Robust and Gracile Cranial Vault Thickness of Modern Humans

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Humans should have thin skull bones – that is the received wisdom since early anthropologists, such as Dubois (1937) and Weidenreich (1940), remarked on the comparatively thick bones of *Homo erectus*. Their observations have been largely confirmed since thickening of the cranial vault is now considered one of the derived features of the genus *Homo*, and consequently, the loss of cranial vault thickness, an apomorphy of *Homo sapiens*. The evolutionary origins of the ‘thick’ vaults of the genus *Homo* have been linked to changes in cranial architecture, either in terms of biomechanics, or as part of a suite of interconnected features that regulate the expression of thickness on the basis of overall size. This allometric perspective is complemented by studies that show that variation in hormonal expression may be the proximate mechanism determining how thick cranial bones are in each individual. Finally, cranial vault thickness can also vary ontogenetically as part of pathological conditions, such as anaemia, that lead to the super-activation of blood-cell producing tissue. Yet, there has been no study to date that has adequately measured the variation in cranial vault thickness of each major bone (*i.e.* frontal, parietals, occipital and temporals) in total and by each layer (*i.e.* outer table, diploe and inner table). Therefore, we have not yet established what the range of thickness for different populations of *Homo sapiens* is, nor what the pattern of thickness of each layer should be in modern humans. This is understandable, since this variation across the vault and across populations is difficult to measure and limited on fossil material and with radiographs. However, with the advancement of technology and the use of Computed Tomography (CT) scans, questions regarding cranial thickness have now become answerable. CTs offer an exciting and more approachable means to better analyse and understand this feature. However, analyses of CT scanned crania are not without challenges, the most crucial of which is defining accurate boundaries for precise measurement. This is because CT scans generate digital data represented by grayscale values that reflect the density of an object, and structures of the same density are not easily distinguishable from each other. Some studies have implemented automated algorithms to detect structural borders; however, they too fail to differentiate between structures of similar density such as compact bone, which comprises the outer and inner cranial table. Thus, the most accurate method to measure cranial thickness - that is inclusive of all three of its distinct layers - is not by algorithmic automation, but rather by manual placement of landmarks at defined binary boundaries. This paper describes such a study, in which the total thickness and thickness of the three cranial layers were measured in *Amira 5.4.2* through 3D landmarks at 200 points throughout the vault of 120 CT scanned crania, and thus establishes the range of variation observed in modern humans, and creates a baseline from which evolutionary interpretations of cranial thickness may be placed into perspective.

Acknowledgements: LQWT Project & IN Africa Project- PI Dr. Marta Mirazon-Lahr, Professor Robert Foley; UKIERI- PI Dr. Marta Mirazon-Lahr; Fabio Lahr, Leverhulme Centre for Human Evolutionary Studies; Addenbrooke’s Hospital, Dept. of Radiology

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Poster Presentation Number 27, Fr (18:00-20:00)

A comparative analysis of vertebral microstructure in Neanderthal and modern human infant spines

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Significant advances in the functional analysis of hominin skeletal systems require the continued development of methodologies that take account of bone microstructure, within a comparative context. It has been shown that the microstructure of fossil hominin bone may vary between individuals and species, but to date few studies have attempted to compare patterns of bone growth and development at this scale. In this project a series of six complete vertebral columns from modern human infants aged between 6 months prenatal to 5yrs postnatal, and three partial Neanderthal vertebral columns aged between neonatal and 3yrs postnatal (La Ferrassie 4, 6, and 8) were visualised using micro-CT. Spherical volumes of interest were then defined, thresholded and measured using 3D bone analysis software. Modern human prenatal trabecular bone was characterised by high volume fraction and a tightly packed but disorganised structure, from which the neonate modelled an organised (anisotropic) configuration by removing 2/3rds of the bone volume. Hence an infant/adult vertebral trabecular arrangement, which is characterised by elements strongly orientated along the infero-superior axis in both modern humans and neanderthals, appears before 1 year. Infants continued to remodel tissue, but the change was comparably small relative to neonates. The overall pattern is one of initial overproduction (fetal) followed by constructive regression (neonatal) and subsequent refinement (infant). Together these findings suggest that fetal growth and development may follow a genetically pre-programmed pathway, whilst neonates and infants sculpt then build in response to functional stimuli.

Poster Presentation Number 122, Sa (17:00-19:00)

Ancient bone retouchers at Gran Dolina site: A recurrent technical behaviour during the Middle Pleistocene

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Soft hammer was supposed to be used in certain knapping methods (e. g. blade production) and for performing a variety of shaping processes (from Acheulean handaxes to finely elaborated small tools). Among them, bone retouchers were likely used to modify the edges of stone tools retouching or even resharpenering them. These simple tool-making tools are probably one of the first manifestations of soft organic percussion in Prehistory. Most of the bone retouchers so far identified in the archaeological record are simple shaft fragments showing surface marks modifications in the form of pits, scores and micro-striae concentrated in specific areas that identify them as tools. It has been documented experimentally that the intensity of use, the knapped raw material and state of bone (fresh, dried or defatted) are the main variables involved in the formation of the surface modifications and in their final appearance (Mallye et al., 2012; Mozota 2012). Bone retouchers were firstly recognized as part of the Mousterian technological kit in La Quina site (Martin 1906), being extensively documented in other Middle Palaeolithic sites. At the European Pleistocene, the earliest evidences of these tools come from Acheulean sites as Boxgrove (Roberts & Parffit 1999) and Orgnac 3 - Upper Acheulean levels (Moncel et al., 2012). In this work, we present a series of bone retouchers from TD10 level of Gran Dolina site (Sierra de Atapuerca, Spain). For the description of these items we have followed the criteria developed by Mallye et al. (2012). Taphonomic description has been performed according to a protocol that includes optical and electron microscopy as well as 3D scans. Observed surface modifications are pits, scores and associated micro-striae that show diagnostic characters of anthropogenic origin. Most of the TD10 retouchers are sparsely used. Nevertheless two cases show more intense use featuring scaled or pitted areas. In one case we have identified flint micro-residues inside a pit, attesting the interaction between materials. Through comparison with our own experimental results, we suggest that these bone hammers were used for slight retouch purposes, including edge resharpenering, more than for complete and intensive tool shaping. Isolated presence of a bone retoucher from TD10.1 level was previously reported (Rosell et al., 2011). New research has allowed us to identify new bone retouchers that come from TD10.1 and TD10.2 levels dated between at 300-430 kyr BP (Berger et al., 2008). Given the new evidence, we propose a recurrent use of bone retouchers by hominines who occupied the site during the formation of level TD10, move ahead at least to 430 kyr BP the emergence of this technical behaviour. Thus, TD10.2 bone retouchers could be considered one of the earliest examples of soft-hammer percussion technique in the archaeological record.

Acknowledgements: We want to thank the EIA (Atapuerca Research Team) for their support. This research was supported by Ministerio de Economía y Competitividad of the Spanish Government Grants (CGL2012-38434-C03-03), and by Generalitat de Catalunya Grant (SGR009- 188). ARH is beneficiary of a FPI Grant from Ministerio de Economía y Competitividad. JIM is beneficiary of a FI Grant from Generalitat de Catalunya and European Social Found. ALH is beneficiary of a Pre-doctoral Grant from Atapuerca Foundation. The field excavation work was supported by Junta de Castilla y León and Fundación Atapuerca.

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Poster Presentation Number 73, Fr (18:00-20:00)

Stone tool production and utilization by bonobo-chimpanzees (*Pan paniscus*)

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Using direct percussion, language-competent bonobo-chimpanzees Kanzi and Pan-Banisha produced a significantly wider variety of flint tool types than hitherto reported, and used them task-specifically to break wooden logs or to dig underground for food retrieval. For log breaking, small flakes were rotated drill-like or used as scrapers, whereas thick cortical flakes were used as axes or wedges, leaving consistent wear patterns along the glued slits, the weakest areas of the log. For digging underground, a variety of modified stone tools, as well as unmodified flint nodules, were used as shovels. Such tool production and utilization competencies reported here in *Pan* indicate that present-day *Pan* exhibits *Homo*-like technological competencies. Given that *Pan* has curved finger phalanges similar to those of australopithecines/*Homo habilis* and wrist bones and cranial capacity similar to those of *Homo floresiensis*, makers of Oldowan stone tools, the similarity between the wear patterns observed on Kanzi’s logs and those seen in early *Homo* artifacts from 2.5 mya is significant. Our experiments thus suggest that the wear patterns resulting from the various tool uses by *Pan* can be used to help decipher the earliest wear patterns preserved on bones. Therefore, our results reinforce the evidence for early *Homo* traits in *Pan*, and suggest that the potential for the development of the observed tool use existed in the last common ancestor of *Pan* and *Homo*.

Acknowledgments: We thank the late Prof. M. Goodman for his vision and leadership in *Pan-Homo* evolution and for his ongoing guidance. We thank R. Wrangham, D. Wildman, G. Rehavi for reading, commenting, improving the manuscript. We thank D. Wildman, Prof. C. S. Duvall, T. Ron for fruitful discussions; U. Schürer, A. Stadler, G. Kuntz, S. Terlinden (Wuppertal Zoo); S. Pugh, Kanzi, Pan-Banisha at the Bonobo Hope/Iowa Primate Learning Sanctuary; and L. Fontaine, S. Carter, R. Bitzer, M. Blumenthal, D. Blumenthal, J. Goodall, M. Lewis. We also thank G. Peleg, R. Permut, R. Ben-David, A. Beiles, E. Kabuliansky, S. Rajuan, and T. Shkolnik (Haifa University) for their help; L. Grossman, O. Haroch for the 3D photographs; A. Regev-Gisis for the graphic display. I. R. is supported by the Adams Fellowship Program of the Israel Academy of Sciences and Humanities. E.N. is supported by the Ancell-Teicher Research Foundation for Genetics and Molecular Biology.

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Poster Presentation Number 117, Sa (17:00-19:00)

Hunting Bear During The Late Mousterian. Evidence From The North Of Italy

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The revision of materials from a constantly growing number of European sites has contributed to an increased focus on the investigation of human-bear relationships during the Palaeolithic (Fosse, et al., 2002; Auguste, 2003; Quilès, 2004; Stiner, 1999). In recent decades this has been enhanced by important evidence of hunting activity (Munzel & Conard, 2004, Morel 1993, Auguste, 1995). In North-Eastern Italy, towards the end of the Middle Palaeolithic, cave bears (*Ursus spelaeus*), brown bear (*Ursus arctos*) and human groups (*Homo neanderthalensis*) were potential competitors over the same environmental resources (both above and below ground). Fumane cave, 350 m.a.s.l., on the Lessini Mounts and Rio Secco Cave, 580 m.a.s.l., on the Pradis Plateau witnessed close human-ursidae interactions, as documented by discoid and levallois lithic industries found associated with the remains of plantigrades. Taphonomic evidence from the remains of both species quantitatively and qualitatively illustrates a well-established exploitation between 49 and 42 kycal BP. These two sites can be considered as rare examples of the accumulation of carcasses derived from violent death during phases of hibernation or close to its end. The extraction of hides, the consumption of meat, the employment of portions of long bones for retouching the edges of flint implements and the variety of age classes among the represented individuals suggest an unprecedented role for bear in the nomadic economy of Neanderthal hunter groups. Key words: archaeo-zoology, Neanderthal, North Italy, Middle Palaeolithic, *Ursidae*.

Acknowledgements: Research at Fumane and Rio Secco is coordinated by the Ferrara University in the framework of projects supported by the Italian Ministry of Culture – Veneto and Friuli Archaeological Superintendence, public institutions (Lessinia Mountain Community - Regional Natural Park, Fumane and Clauzetto Municipalities, Friuli Region - Department of Cultural Heritage), and private associations and companies.

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Poster Presentation Number 87, Sa (17:00-19:00)

Temporal lobe surface anatomy and the bony relieves in the middle cranial fossa. The case of the El Sidrón (Spain) Neandertal sample

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The largely reabsorptive nature of growth dynamics at the cranial base (Duterloo and Enlow, 1970) leads to the partial imprinting of relieves of the cerebral surface on the cranial fossae. On this basis, a detailed analysis of the correspondence between brain external anatomy of the temporal lobe and the bony relieves on the middle cranial bases was performed in order to describe and compare new temporal bone remains found at the 49.000 years old El Sidrón neandertal site (Rosas et al., 2012). Three different methods were employed, based on the comparison of the soft (neuronal) and hard (bone) tissues from the same individuals. 1) We dissected two human heads and visual inspections were recorded. Once the dura mater was removed, both brain surface and middle cranial fossa were molded with resins. Positive molds were used to explore morphological correspondence. Superposition of brain and bone was also explored using optic surface scans, and computed tomography combined with magnetic resonance scans. In parallel, a large collection of dry skulls, virtual specimens, and reference books (Grimaud-Hervé, 1997; Holloway et al., 2004) were used for direct assessment of hard tissue variability. For the sake of clarity, the middle cranial fossa was divided into four regions: 1) anterior surface of the petrosal pyramid, 2) basal region around the oval foramen, 3) region of the temporal pole, and 4) temporal squama. A close correspondence among sulcus and gyri (sensu Ono et al., 1990) and bony relieves was detected, and a series of new anatomical details have been introduced in order to describe these correspondences. The inferior temporal sulcus and the inferior temporal gyrus are the cerebral structures that most strongly influence the underlying bone surface. The superior temporal sulcus, the middle temporal gyrus, and the fusiform gyrus also leave close matching on the endocranial surface. The El Sidrón internal temporal bone features were broadly compared. A wider and larger post-arcuate fossa (new nome) seems to be present in modern humans as compared with Neandertals. This area corresponds to the posterior limit of Brodmann area 20 and the anterior portion of Brodman area 37. However, other traits of the middle cranial fossa surface do not show evidence of dissimilarity between these two large-brained human groups. Regarding dural sinus pattern, a higher incidence of petrosquamous sinus is detected among Neandertal samples. Previous analyses have emphasized that modern humans present an apomorphic condition in its more anterior, lateral and superior position of the temporal lobe pole (Bastir et al., 2008; 2011), which fits with previously recognized overall endocraneal scaling differences (Bruner et al, 2003). Once fine anatomical correspondence of the temporal lobe circumvolution pattern on its bony base has been clarified, we put forward the hypothesis that the temporal pole is occupied by the middle and lower temporal gyri in Neandertals, while the pole is mostly defined by the superior temporal gyrus in modern humans. Further analyses need to test this proposition as well as the functional implications of these cortical cerebral reorganizations.

Acknowledgements: We are grateful to the remainder members of the PaleoAnthropology Group, Dr. M. Coquerelle and the El Sidrón Cave excavation team. CGL 2012-36682 and CGL 2012-37279 (MINECO, Spain). Field work is supported by Consejería de Cultura del Principado de Asturias, Grant sponsor: Convenio Universidad de Oviedo-CSIC, Grant number: 060501040023.

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Poster Presentation Number 141, Sa (17:00-19:00)

Regional behaviour among late Neanderthal groups in Western Europe: A comparative assessment of Late Middle Palaeolithic bifacial tool variability

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A growing number of studies have emerged that highlight spatio-temporal differences among Neanderthal stone tool assemblages (Soressi, 2002; Jöris, 2004; Ruebens and Di Modica, 2011). This directly contradicts previous views of the Middle Palaeolithic as a period of uniformity and stasis. For example, during the later phase of the Middle Palaeolithic (MIS 5d-3; ca.115,000-35,000BP) bifacial technologies re-emerge, after a near absence in the Western European Early Middle Palaeolithic (Iovita and McPherron, 2011). These bifacial tools occur across Europe, are associated with classic Neanderthals and contain a variety of types and forms. Moreover, several types seem associated with a restricted geographic occurrence. Therefore, Late Middle Palaeolithic bifacial tools provide a unique record for a data-driven, wider-scale assessment of Neanderthal behavioural variability, population dynamics and regionality. Previous studies of Late Middle Palaeolithic bifacial tools were hampered by a convoluted plethora of competing terms, types and regional entities. This often obscured the assessment of genuine similarities and led to the current disjointed view on this bifacial phenomenon. This paper presents the first, large-scale comparative study of this tool type, bridging typo-technological and spatio-temporal data from across Western Europe (Britain, Belgium, the Netherlands, France and Germany). A threefold methodological framework was applied: 1. A new classificatory scheme for Late Middle Palaeolithic bifacial tools was developed, defining five bifacial tool concepts based on least common typo-technological denominators, overcoming past epistemological issues and facilitating inter-assemblage comparisons. 2. A total of 1,303 bifacial tools from 14 case study assemblages formed part of a detailed attribute analysis, recording information on artefact condition, metrics and typo-technological features. 3. The bifacial tools from an additional 67 comparison sites were also reclassified according to the new scheme, culminating in comparative bifacial tool data from 81 assemblages. Results indicate a high level of variation between individual bifacial tools and assemblages. Each bifacial tool concept is correlated with various production methods, resulting in large amounts of morphological variation. Despite such variation, a distinct three-fold typo-technological pattern was identified that correlates to three macro-regional entities; the *Mousterian of Acheulean Tradition (MTA)* in the southwest dominated by handaxes; the *Keilmessergruppen (KMG)* in the northeast typified by backed and leaf-shaped bifacial tools; and, finally a new unit, the *Mousterian with Bifacial Tools (MBT)*, geographically situated between these two major entities, and characterised by a wider variety of bifacial tools. Differing local conditions, such as raw material or function, are not sufficient to explain this observed macro-regional tripartite. Instead, it is argued that the MTA and KMG can be viewed as two distinct cultural traditions, where the production of a specific bifacial tool concept was passed on over generations. Conversely, the MBT is viewed as a border zone where highly mobile groups of Neanderthals from both the east (KMG) and west (MTA) interacted. Principally, this study presents an archaeological contribution to behavioural concepts such as regionality, culture, social transmission and population dynamics. It illustrates the interpretive potential of large-scale lithic studies, and more specifically the presence of regionalised cultural behaviour among late Neanderthal groups in Western Europe. Acknowledgements: This study was funded through a doctoral grant from the Arts and Humanities Research Council (AHRC) and conducted at the University of Southampton (supervisor: Dr John McNabb, advisor: Dr William Davies).

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Podium Presentation: Session 2, Fr (10:30)

Earliest Human Occupation of North Africa: New Evidence from Ain Boucherit Early Pleistocene Deposits, Algeria

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Archaeological investigations at Ain Hanech and El-Kherba (Algeria) have shown the significance of this research area for understanding the expansion of ancestral hominins to North Africa circa 1.8 million years ago (Ma). Recent fieldwork at the nearby Ain Boucherit locality has resulted in the recovery of stone tools and animal fossils spanning from 2.3 to 2.0 Ma, much older than those already known at Ain Hanech. The new archaeological materials come from two stratigraphic units: Unit P/Q and Unit R. The Unit P/Q is stratigraphically situated 13m below the Ain Hanech and El-Kherba Oldowan bearing deposits, which also corresponds to the Ain Boucherit fossil bearing stratum from which both Pomel (1895) and Arambourg (1931) collected fossil bones. Within this same unit, in addition to fossil animal bones, we also collected in situ Mode I stone artifacts encased in a fine silty matrix. A diverse fauna including gastropods, fish, turtle, rodent, carnivores, proboscidian, equids, rhino, suid, hippo, giraffes, and bovids were associated with the artifacts. The artifacts include core-tools, flakes, and retouched pieces. Furthermore, fragments of a large bovid upper limb bone with evidence of hominin-inflicted cutmarks were recovered. Excavations in the Unit R, stratigraphically located 7m above the Ain Boucherit stratum (Unit P/Q) and 6m below Ain Hanech and El-Kherba Oldowan localities (Unit T), yielded animal fossils associated with a rich Mode I lithic assemblage encased in a floodplain deposit. The fauna collection shows more affinities with Unit P/Q and comprises frog, proboscidian, equid, suid, hippo, and bovids. The lithic assemblage includes core-tools, flakes, and fragments. The mammalian fauna preserves several cutmarked and hammerstone-percussed bones. A 22m thick magnetostratigraphic section was studied beginning just below Unit P/Q from the bottom all the way up to the calcrete deposit which caps the formation. Both normal and reversed polarities were documented allowing a solid correlation of the local magnetic polarity stratigraphy to the Global Polarity Time Scale, using temporally associated vertebrate faunal biochronology. The successive archaeological localities at Ain Hanech are placed along the magnetostratigraphic sequence, from bottom to top, as follows: 1) Unit P/Q, located 7m below the base of the Unit R in Matuyama Reverse Chron; 2) Unit R, situated at the base of the normal polarity, at the onset of Olduvai Normal Subchron, 3) Ain Hanech and El-Kherba in Unit T at the Olduvai Subchron to Matuyama polarity reversal, and the calcrete deposit (with Acheulean artifacts) below the Jaramillo Subchron. Based on the biochronological evidence, the age of these localities is estimated to 2.3 Ma for Ain Boucherit (Unit P/Q), 2.0 Ma for Ain Boucherit (Unit R), 1.8 Ma for Ain Hanech and El-Kherba, and >1.0 Ma for the calcrete deposit. To tighten up the dating, sediment and fossil tooth samples were collected for Electron Spin Resonance (ESR). Thus, Ain Boucherit currently represents the oldest archaeological occurrences in North Africa with evidence of cut marks slightly younger than, but roughly contemporary with, the earliest evidence in East Africa, showing that ancestral hominins inhabited the Mediterranean fringe much earlier than previously thought. Acknowledgements: The authors are grateful to several institutions for supporting their research at Ain Boucherit, including Centro Nacional de Investigación sobre la Evolución Humana (CENIEH, Spain), Algerian Ministry of Culture (Algeria), Wenner-Gren Foundation (New York, USA), Centre National de Recherches Préhistoriques, Anthropologiques et Historiques (CNRPAH, Algeria), The L.S.B. Leakey Foundation (San Francisco, USA), National Science Foundation (Washington DC, USA), Stone Age Institute & Indiana University (Bloomington, USA), Institute of Archaeology of the University of Algiers2 (Algeria), Department of Archaeology, University of Sétif (Algeria), and Municipality of the Guelta Zergua village (Algeria).

Poster Presentation Number 123, Sa (17:00-19:00)

Taphonomical analysis of the carnivore modification in Sima de los Huesos (Atapuerca, Spain) human sample

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The study of carnivore activity on bones is crucial to understand the role of the carnivores in the site formation since some carnivores are able to accumulate bones in cave dens. The Sima de los Huesos site is the largest accumulation of human remains from the Middle Pleistocene known up to date. Together with the human bones, thousands of remains of carnivores, mainly bears (*Ursus deningeri*), have been recovered (García et al., 1997). Studies in the last two decades have proposed different hypotheses to explain carnivore activity in the SH human sample (Arsuaga et al., 1990, 1997, Andrews and Fernández Jalvo, 1997). This study provides new data in order to test these different interpretations, and therefore to understand the role of the carnivores in site formation at SH. In order to establish coherent and testable hypotheses we have approached this study through actualistic research with living carnivores. The results show that marks of carnivore activity in the SH sample appear in very low frequency, which we interpret as indicating that carnivore activity was very sporadic at the site. This is in stark contrast with previous studies (Andrews and Fernández Jalvo, 1997). The comparison of bone modification patterns at SH to actualistic carnivore data allows us to suggest that bears were likely to have been the carnivore responsible for the modification observed on human fossils. Due to the fact that bears do not transport carcasses into cave dens (Sala and Arsuaga, 2013) the origin of the accumulation of human bodies must have a different explanation. Other possibilities for the origin of the human corpses accumulation in SH will be analysed in forthcoming studies, but until now, we can discard the carnivores as taphonomical agents in the SH bones accumulation. Acknowledgements: This study was possible thanks to the Atapuerca excavation team, especially those involved in the excavations at the Sima de los Huesos site. The research was funded by the MICINN project CGL2009-12703-C03-03. Ana Gracia-Téllez has a Contract-Grant from the Ramón y Cajal Program, RYC-2010-06152.

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Poster Presentation Number 116, Sa (17:00-19:00)

### Integrating multiple lines of Neanderthal dietary evidence. A case study from eastern and southeastern Iberia

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Neanderthal diet has been the subject of significant research in recent decades, in part due to the maturation of analytical techniques that have produced abundant new information. However, these methods are often applied in isolation, preventing clear comparisons and interpretations. Furthermore, most of the dietary studies have been performed on specimens that come from cold and open environments. Though these samples do not represent the entire Neanderthal temporal and chronological range, they have been the basis for dietary models that have been applied to all Neanderthals, when in fact Neanderthal dietary strategies may have been as variable as the regions they inhabited. In this paper we integrate different dietary approaches (zooarchaeological, isotopic, and plant remain studies) from southeastern Iberia to develop a broader and more complex picture of Neanderthal diet from the varied Mediterranean environmental conditions. Overall, these results suggest that Neanderthals living in eastern and southeastern Iberia were predominantly hunters of medium and large-bodied prey. Although this is similar to the patterns seen in other areas of Europe, that they consumed some small game, aquatic resources and plant foods could mean that Neanderthal dietary behaviour was to a certain degree influenced by environmental factors and therefore not as rigid as previously considered.

Poster Presentation Number 149, Sa (17:00-19:00)

### Modern human dispersal into Eurasia: Preliminary results of the multi-disciplinary project on the replacement of Neanderthals by modern humans (RNMH)

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The RNMH (Replacement of Neanderthals by Modern Humans) project attempts to better understand the replacement process of archaic hominins by modern humans. This multidisciplinary project incorporates archaeology, palaeoanthropology, cultural anthropology, population biology, human genetics, chronology, paleoclimatology, neurosciences, biomechanics, and paleontology (Akazawa, 2012). Since 2010, the Archaeology Division of the RNMH project has been compiling an extensive archaeological database (Neander DB) to reconstruct the processes underlying modern human dispersal and the demise of archaic populations on a global scale (Nishiaki, 2012). The Neander DB covers the chronological period between c. 200 and 20 ka, spanning from Africa and across Europe, to Siberia, West, South and East Asia, and into Oceania. Toward a quantitative and qualitative comparison of the archaeological record left by different hominin species, the Neander DB establishes a comprehensive archive of site information [country, geo-coordinates, site type (cave, rock shelter, or open-air site), archaeological layer, archaeological entity, oxygene isotope stage, paleoenvironmental information, hominin fossils, organic artefacts, ochre, painting, ornaments, portable arts, radiometric dates, lab code, dating method, dating sample type, and sample taxon] (Kondo et al., 2012). A total of 2,082 sites have been registered in the database so far (as of May 28, 2013): 139 sites from Africa, 216 from West Asia, 720 from Europe, 468 from the former USSR and Central Asia, 492 from East Asia, 26 from South Asia, and 21 from Oceania. Altogether, these sites are represented by 4,567 cultural horizons and 5,605 radiometric dates. As the scientific approach underlying Neander DB addresses a long temporal range, it allows for a diachronic documentation of cultural changes, representing different hominin species through time. The database also encompasses a broad geographic region, enabling for great detail in tracing the process of modern human dispersal out of Africa. Both the chronometric dating and the geographic distribution of archaeological entities indicate that modern human populations equipped themselves with blade products based on the Levallois method, a technology that emerged in North Africa (Taramsan) around 60 ka and then dispersed into the Eastern Mediterranean Levant (Emiran) between 49 and 48 ka. Blade technology further expanded into Eastern and Central Europe (Bachokirian and Bohunician) between 48 and 45 ka and into Southern Siberia (Kara-Bom horizons 6 and 5) at around 47 ka. The rapid expansion of modern humans into Western and Eastern Eurasia followed by the demise of archaic populations in these regions may imply technological and cognitive advantages of modern humans. We investigate whether archaeological records from broader geographic contexts indeed demonstrate similar technological changes when modern humans encountered archaic populations, and attempt to reconstruct precise chronologies linked to paleoenvironmental proxies within the respective regions. This paper presents the preliminary results of the RNMH project.

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Podium Presentation: Session 9, Sa (14:20)

## A fine scale survey of the worldwide similarity between humans and archaic hominids and its implication on the proposed admixture scenario

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Since the publications of Green et al. 2010 and Reich et al. 2010, several investigations have followed suit addressing the question regarding anatomically modern human and archaic hominin admixture. The genetic analyses of the Neanderthal draft genome and the Denisova genome concluded that these archaic hominins made a 1-4% contribution to non-African populations and 4-6% contribution to Melanesian populations, respectively. The argument of whether the observed genetic similarity is consistent with admixture or ancient substructure is still under debate. While observations have been consistent with an admixture scenario of Neanderthals and the ancestors of non-Africans coming into contact 50 – 80 kya in the Middle East, the lack of power in these experiments falter in providing reliable results. Here we look at the relationship between AMH and these archaic hominins on a fine-scale level by using several methods (including revised D-statistic) on the Neanderthal draft genome, Denisova high-coverage genome, and a collection of published and unpublished genotype and sequence data. We use our findings to clarify the proposed admixture scenario as well as discuss new findings in newly analyzed comparisons of African, South Asian and American populations with archaic hominins, Neanderthal and Denisova. Our results shed light on understanding the observed genetic similarity within and between humans (African and non-African) and archaic hominins, particularly in relevance to the admixture versus ancient substructure scenarios.

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Podium Presentation: Session 8, Sa (11:20)

## Patterns of change in Nenet landscape: Ethnoarchaeological study at Yangana Pe, Polar Ural Mts. Russia

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Actual nomadic societies of Siberia are frequently being used as analogies to reconstruct Upper Paleolithic hunter-gatherer social systems. However ethnology only provides us with general models to map the variability of human behaviors and to postulate concepts of social and symbolic dynamics. The questions posed in this paper are derived from archaeological studies of Upper Paleolithic settlements in Europe such as site formation processes, aspects of seasonality, and usage of the landscape to control animals (Binford 1987; Kroll and Price, 1991; Van Reybrouck 2000). The favorable area at the southern foot of the limestone ridge Yangana Pe (359 m. a. s.) at Polar Ural Mts (Yamalo-Nenet autonomous region, Russia) is the northernmost boundary where more than 100 Nenet families yearly switch with their herds of several ten thousands reindeer, from their winter and spring pastures located mainly around Labytnangi-Kharp railway to summer ones at Yamal Peninsula or Kara sea. Likewise, it is the southernmost boundary when people come back with their herds from the summer pastures during fall and winter. The Nenet sites are settled in this landscape repeatedly during shorter time-spans within the double-year cycle of migrations with their reindeer (cf. Haakason, 2000; Golovnev, 2004; Dwyer, 2008; Stammer, 2007). Our pilot study in 2009 was oriented on inner-site spatial organization within two large, temporarily abandoned campsites (Svoboda et al. 2011). Our second study in 2012 was primarily based on mapping a complex system of more than 20 abandoned campsites and positions (including sacred places) within an area of 10 x 10 km. Inside each settlement, we documented the location of hearths and other features and objects, their structuration into discrete zones, and dating. We collected more than 150 dates from imported objects, based on the expired date chronology, and supported by additional chronological/seasonal evidence (such as bone weathering, presence of new-born reindeer bones, presence/absence of hearts, presence of ngali, etc.). Majority of the summer Nenet campsites are concentrated around the lakes, in areas suitable for fishing, while the winter and early spring campsites are situated higher on the slopes. The seasonal pattern could also be recorded in the presence of reindeer newborns bones at final winter/early spring sites, as the reindeer start calving and the herders are waiting until the new-borns are strong enough for migration. However the basic structure of the campsites remains the same regardless of season and duration of occupation. In terms of chronology, we separated the sites in five stages (1965-1980; 1981-1994; 1995-2000; 2001-2006 and 2007-2012) and compared the patterns of change, especially as the road and railroad connecting the Yamal gas mining fields further north were build nearby. Termination of these construction works in 1995/1997 affected the increase of imported goods at our sites. Whereas our first study in 2009 enriched the Upper Paleolithic evidence from central European sites by displaying a basically similar camp structure and zonality (of course with different types of objects and activities), the second study in 2012 added a broader regional and chronological insight into this settlement system.

Acknowledgements: The research presentation was supported by EU grant CZ.1.07/2.3.00/20.0181. We thank colleagues from the Institute of Ecology of Plants and Animals, Russian Academy of Sciences in Ekaterinburg and Settlement Administration in Panaevsk at Yamalo-Nenet Autonomous Region for consultation and collaboration.

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Poster Presentation Number 13, Fr (18:00-20:00)

### Digit ratio, physical strength and facial shape: A lesson from ontogeny

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Prenatal testosterone exposure affects both facial shape and physical characteristics such as body strength. A retrospective marker of this hormonal environment in utero is the relative length of the ring finger compared to the index finger of the same hand (2D:4D). We will identify the facial shape patterns associated with digit ratio in men and women, and compare them to facial characteristics that are associated with physical strength, body height, body fat as well as to their social perception. Data was collected and analysed in several subsamples totalling about 40 subadults and 60 men and women (20–35 years) from Austria and Germany. Lengths of the second and fourth digit were measured with a vernier calliper, handgrip strength (highly correlated with overall body strength) was measured with a hand dynamometer, and facial shapes were assessed by geometric morphometrics. More than 50 somatometric landmarks were digitised on frontal facial photographs and subjected to shape regressions upon the anthropometrics variables as well as upon opposite sex ratings (perceived dominance, masculinity, and attractiveness). The corresponding shape patterns were visualised using thin-plate spline deformation grids, as well as image unwarping and image averaging. Consistent facial correlates of 2D:4D were identified in boys as in adults: lower digit ratios corresponded to a relatively shorter forehead, smaller eyes, thinner lips, and a much more prominent lower jaw. Thus facial robustness associated with low 2D:4D can be observed years before puberty. A highly similar facial pattern was found to covary with perceived masculinity and dominance that somewhat differed from the facial correlates of attractiveness and also from physical strength. The Spearman correlation coefficient, however, showed a negative association of 2D:4D with handgrip strength, i.e. the higher the prenatal testosterone exposure the physically stronger was the adult individual. The effect was somewhat stronger in men ( $r = -0.349$ ,  $p = 0.048$ ,  $n = 24$ , one-sided) than in women ( $r = -0.302$ ,  $p = 0.046$ ,  $n = 32$ , one-sided). In conclusion, we related prenatal testosterone exposure (via 2D:4D ratio) to physical strength, facial shape and its appearance, and found strong associations in the predicted directions: the higher the prenatal testosterone exposure the stronger the individual and the more robust the face. Digit ratio as a correlate for physical strength might be of interest to the paleoanthropological community.

Poster Presentation Number 46, Fr (18:00-20:00)

### Burning the land: an ethnographic study of non-domestic fire use by recent and sub-recent foragers and implications for the interpretation of past fire practices in the landscape

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Archaeological indications for off-site burning by late Pleistocene and early Holocene hunter-gatherers present difficult interpretive problems; by contrast, burning practices by recent hunter-gatherers are well-documented. This poster presents the first systematic global inventory of extant burning practices, including the reasons for burning and the environmental setting of firing activities. We also discuss the visibility of such practices in the archaeological record. This cross-cultural inventory is based on ethnographic and historical texts and aims to identify widespread patterns. We show that in historical times, off-site fire was used for a wide range of purposes, irrespective of age and gender, with significant advantages for its producers. While the reasons given for burning can vary between individuals, in the longer term, many hunter-gatherer firing practices created more mosaic types of environments than would have occurred naturally. Off-site fire is used in a wide range of environments, including those in which the vegetation is hard to ignite, such as deciduous and tropical forests. While there are few cases of burning from tundra vegetation, this may be because of the negative effect of large-scale burning on food supplies for a species that is central to traditional subsistence strategies in this habitat. The 'historical visibility' of hunter-gatherer burning activities contrasts with the relative 'invisibility' of such practices in the contemporary archaeological record, highlighting the difficulty of analyzing the ephemeral traces of off-site fire usage in the past. We illustrate this by discussing the interpretation of the anthropogenic signal in past fire records, focusing on case studies from a number of regions and time periods. It is shown that the signal left by hunter-gatherers, unless they live at a relatively high population density, is generally drowned by the natural fire regime or by fire practices of contemporaneous agriculturalists. Based on the ethnographic importance and global distribution of off-site fire usage, we suggest that the first hominin interactions with fire may have occurred in non-domestic contexts, a process which culminated in the omnipresent use of fire as reviewed in this study. New multi-proxy data from well-sampled sequences, analyzed at a local scale, is needed to optimize the visibility of the anthropogenic signal in the record for fire and to test this hypothesis.

Acknowledgements: We would like to acknowledge the support of this research by the Koninklijk Nederlandse Academie van Wetenschappen (Netherlands Royal Academy of Sciences) as part of the Academy assistant programme.



Poster Presentation Number 136, Sa (17:00-19:00)

### Long-term stability in raw material economic strategies: the case of Dealul Guran, Romania

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The site of Dealul Guran is a collapsed rockshelter located 40 km west of the Black Sea coast and a similar distance from the modern Danube river. The site was discovered in 2010 during a systematic survey (Iovita et al., in press) and excavated in 2011 and 2012. The stratigraphy is composed of a sequence of Cretaceous-Tertiary flint-bearing sandstone-limestones and clays which were redeposited during the Quaternary, when the rockshelter was formed through differential erosion of the clays. A small loess component is also present in the layers, and was used to date the sequence using a variety of luminescence methods (Iovita et al., 2012). The archaeological stratigraphy comprises three units: unit 1, (17.1±1.1 ka), and units 2 (392±23 ka) and 3 (388±36/320±21 ka) (Iovita et al., 2012). The lower units represent the only currently dated Lower Paleolithic assemblages in Romania, and one of the few Middle Pleistocene lithic assemblages in Eastern Europe. There are no faunal remains preserved, but the lithic assemblages have been unusually well-conserved, with very little surface alteration or edge damage. Moreover, despite lying on a slope, an abundance of small (<2.5cm) flakes in all sieved material, accompanied by exclusively horizontally-distributed refits demonstrate the integrity of the archaeological layers. All three lithic assemblages reflect typical quarrying activities in much the same way, despite the great difference in age. Using the 19 refit sets and attribute analysis of the lithic assemblages, including Cortex Ratios (cf. Dibble et al., 2005), we show that hominins repeatedly visited the site, most likely depositing exhausted cores prepared elsewhere, and testing cobbles, and carrying new material out of the site. These data suggest that economic strategies and land-use patterns were fixed, at least with respect to raw material extraction, from a very early time, and reflect an efficient management of natural resources.

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Podium Presentation: Session 1, Fr (9:20)

### *Australopithecus sediba* and the earliest origins of the genus *Homo*

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Discovered in 2008, the site of Malapa has yielded a remarkable assemblage of early hominine remains attributed to the species *Australopithecus sediba*. Several commentators have questioned the specific status of *Au. sediba* arguing that it does not exceed the variation of *Au. africanus*. This opinion however, does not take into account that *Au. sediba* differs from *Au. africanus* in both craniodental and postcranial characters to a greater degree than *Au. africanus* differs from *Au. afarensis* in these same characters. The species shows unexpected and unpredicted mosaicism in its anatomy. A modern looking face lacking the zygomatic reinforcement typical for australopiths as well as a reorganized frontal brain underlined by a modern looking trace of the temporal lines are combined with a very small brain size. The ape-like shoulder girdle and upper thorax is mixed with a modern looking hand with a strong thumb. The pelvic girdle is clearly *Homo*-like, it differs from all other australopiths whereas the contrary is true for the heel morphology. *Au. sediba* has also been questioned as a potential ancestor of the genus *Homo* due to the perception that earlier specimens of the genus have been found than the 1.98 Ma date of the Malapa sample. This opinion however, does not take into account either the poor condition of these fossils, as well as the numerous problems with both the criteria used to associate them with the genus *Homo*, nor the questionable provenance of each of these specimens. Here we will present arguments why *Au. sediba* should be considered a strong potential candidate ancestor of the genus *Homo* until better-preserved specimens are discovered that would refute such a hypothesis.

Poster Presentation Number 129, Sa (17:00-19:00)

## Negligible effect of cooking on nutritional value of Hadza tubers

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Tubers are high quality food resources but their use by hominins is often assumed to be dependent on the control of fire for cooking. Cooking works as a form of externalized digestion, greatly improving the accessibility of calories in starchy tubers by breaking down the semi-crystalline starch structure in a process called gelatinization. Cooking can also disable toxic plant substrates, such as alkaloids, saponins and glycosides that are often present in tubers. Because of the benefits of cooking, several researchers have proposed that cooking conferred a powerful advantage to hominins by increasing the quality of a potential food resource, and was therefore a necessary part of the hominin toolkit in Pleistocene East Africa. However, we question whether hominins required cooking technology in order to increase the nutritive benefits of wild tubers in that region. One modern hunter-gatherer population living in Northwestern Tanzania, the Hadza, maintain a subsistence-based lifestyle that is heavily reliant on wild tubers foraged year-round. These tubers are consumed both raw and briefly roasted. Raw, these tubers have high moisture (70-90%), are non-toxic, and contain high amounts of non-starch polysaccharides (NSPs), prompting us to question the purpose of cooking at all. To answer this question, we collected four species of regularly-consumed Hadza tubers, and tested their digestibility *in-vitro* in both raw and briefly roasted forms. Roasting was replicated on a high-flame open fire for five minutes, following the well documented Hadza cooking strategy. Glucose and amino acids were analyzed to quantify accessibility of nutrients. The results show brief roasting caused little change on nutrient availability for both glucose and amino acids. In fact, in one species (shumuko), glucose absorption from the raw tuber was significantly higher than from the roasted tuber ( $p = 0.026$ ), indicating that cooking somehow reduced available glucose. Amino acid absorption remained unchanged between raw and roasted specimens. Overall, the influence of roasting on glucose availability in particular seems far less important than the inherent variation in glucose within species. Our results suggest there is a non-nutritive reason for brief roasting in Hadza tubers. These include ease of consumption due to mechanical changes (faster peeling and food softening), improved taste, benefits to the gut microbiome via the pre-biotic effect of NSPs, or increased food sharing and socialization of a central place provisioning system. These results suggest that there may have been many different causes for the appearance of cooking in human evolution.

Acknowledgements: We thank the following people for their invaluable contribution to this work: The Hadza, Mika Peterson, Shabaan, Audax Mabulla, Tom Gorisson, Wendy Borst, Mark Jelier, Nick van Biezen, and Dorobo Safaris

Podium Presentation: Session 9, Sa (14 :00)

## Systematics and *Homo erectus*: a reassessment of the Asian material

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In 1950 and unfamiliar with the fossil record Ernst Mayr (1950) declared that human evolution was characterized not by taxic diversity but by gradual transformation within the single genus *Homo* of three time-successive species – *transvaalensis*, *erectus*, *sapiens* – wherein “erectus” was a highly variable Asian species from which a similarly conceived, but more widespread “sapiens” gradually emerged. Washburn’s (1951) embrace of this non-morphological scenario focused paleoanthropology on first situating and then explaining the morphology of newly discovered fossils within it. After Mayr (1963) recognized genus *Australopithecus* (but with few species) and conceded *habilis* as the earliest species of transforming *Homo*, notion “erectus-as-sapiens’-ancestor” came to engulf an amazing array of morphologically disparate and geographically far-flung specimens. Consequently, while in keeping with this scheme “erectus” has been defended and morphological differences between specimens explained as variation (e.g. Antón 2003: Rightmire et al. 2006), the species has never been properly diagnosed. That Mayr was so influential is remarkable philosophically since, in his configuring of human evolution, he rejected the foundation of his taxonomic work on birds: comparative morphology. Further, in contradiction of being the Synthesis’ self-proclaimed systematist, Mayr’s portrayal of human evolution made meaningless not only any concept of “species” but also the cornerstone of systematics itself: the type specimen. Given this history, I have advocated approaching the human fossil record as even Mayr (1969), especially in recognizing the type as the basis for referring other specimens to the taxon that, according to the ICZN, only it represents. [This is not, as Winsor (2006) points out contra Mayr (and I suggest Simpson and White), essentialism or typological thinking.] But before considering species, specimens are first hypothesized to different “morphs” via (aut)apomorphy and morph interrelatedness via other (syn)apomorphy. A morph that subsumes a type specimen bears the species name, but not all morphs or hypothetically related morphs need be deemed species. Further, allocation of specimens to any morph/taxon depends on what can be compared. Jaws, teeth, and/or postcranials from the same site but not linked by indisputable depositional association cannot justifiably be referred to the same morph/taxon. Specimens such as AL 288 are rare indeed. From this perspective, I reanalyzed Asian “erectus” vis-à-vis the type – the Trinil 2 calotte – and delineated various morphs of obscure relationship, viz. the Sangiran assemblage: e.g. cranial/dental (Trinil 2/*erectus* + S2, 4 cranial, 10, 12, 26, 41; S4 maxillary + S7-3a-d, -9, -10, -14a, -31, -32, -35, -37, -58, -59, 27, Ng1989, Bpg 2001.4; S10 + Pf/S22; S17 + S7-6, -59, -73, 71, Ng1996); mandibular/dental (S1b + S7-69, ¿-25, ¿-26, BK7905, Sb8103, Pe/S21; S9 + S5, 6, 7-20, -61, -62, -65, 8, Pf/S22, Ng8503, JA7801); and single specimen (SIX; S7-64; S7-76). Expanding the analysis to Ngandong, Sambungmaçan, Ngawi, and Zhoukoudian underscores the need to rethink “erectus” even as a pan-Asian species. Finally, if “species” are hypotheses and hypotheses are to be tested, not just defended, the philosophy of science requires revisiting long-held evolutionary scenarios and letting the systematic cards fall as they may.

Acknowledgements: I especially thank Drs F Aziz and H Widiyanto for recent access to specimens in their charge.

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Podium Presentation: Session 10, Sa (14:20)

## New Views and Dating Results on the Neanderthal Occupation at La Cotte de St Brelade, Jersey

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La Cotte de St Brelade provides the key sequence for long term human occupation and climate change records in North West Europe from MIS 7 through to MIS 6. During a period between 1950 and 1979 a series of Saalian (MIS 6) deposits containing an exceptionally rich lithic artefact assemblage was excavated successively by Burdo and McBurney. The combined collection of almost a quarter of a million artefacts from successive stratigraphic units forms the largest database of Neanderthal activity from a single site in northern Europe. Alongside the stone tools faunal remains were recovered including two bone heaps comprising elements of mega-fauna including mammoth and woolly rhinoceros. The latter were interpreted by Kate Scott as possibly representing the remains of two game drive events which involved the mass herding of animals into the ravine system at the site. The archaeology of the Saalian deposits at La Cotte de St Brelade has been readdressed during the past three years through a process of archive review and reorganisation, occurring alongside bathymetric survey and the NERC-sponsored investigation of deposits at the site. Through a review of stratigraphic context, reconstruction of the wider landscape context of the site through bathymetric survey, and technological analysis of stone tool assemblages, the team have acquired a new and developing perspective on its archaeology and on the bone heaps. This new view sees the La Cotte sequence as being a rhythmic, discontinuous record of Neanderthal occupation with apparent intensive use of the site as an occupation locale, separated by sterile loess layers indicative of abandonment, in apparent response to climatic cooling. The occurrence of the bone heaps at the interface between occupation levels and sterile horizons brings back into focus the interpretation choices considered by Callow, Scott and Cornford during the 1986 publication of the site. An OSL dating programme funded by NERC and AHOB has also, for the first time brought the chronology of the last phase of Neanderthal occupation into sharper focus, indicating that the Late Middle Palaeolithic occupation horizons, hearts and human remains date to a period significantly after 47k years B.P. This perspective has brought consideration of the wider topography of the La Cotte headland, submerged adjacent valleys and variations in lithic technology to the fore. It is the starting point for full reconsideration of the site and the window it provides on Neanderthal adaptive behaviour over a 200k year time-span, now planned for the immediate future.

Acknowledgements: Grateful thanks are extended to Jersey Heritage, the Société Jersiaise, the States of Jersey Department of Planning and Environment, and Jersey Digimap; to the NERC, AHOB 3 and CAHO for excavation funding. Dr Scott's contribution forms part of the AHOB 3 and Calleva projects, funded by the Leverhulme Trust and the Calleva foundation. Personal thanks are extended to Professor Chris Stringer, Professor Clive Gamble, Dr John McNabb, Olga Finch, Neil Mahrer, Jon Carter, John Clarkes, Dr John Renouf and Anne Best.

Poster Presentation Number 84, Sa (17:00-19:00)

## A conserved pattern of postnatal endocranial development in extant hominoids

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By comparing species-specific developmental patterns, we can approach the question of how development shapes adult morphology. We focus here on shape change trajectories of the primate endocranium, an integrated system that arises as the result of a complex interplay between bone, meninx and the expanding brain. Previously, we have shown that the pattern of endocranial development in modern humans deviates from that of chimpanzees (Neubauer et al., 2010) and Neanderthals during the first year of life (Gunz et al., 2010; 2012), but subsequently reverts to an ontogenetic pathway shared by all three groups. To explore whether this ontogenetic pattern is shared among extant hominoid species, we characterised and compared shape changes of the endocranium from infancy (erupted deciduous dentition) to adulthood in a cross-sectional sample of modern humans (n=87), chimpanzees (n=59), gorillas (n=67), orangutans (n=75) and gibbons (n=21). On virtual endocasts generated by segmenting computed tomographic scans of dried crania, we measured 29 three-dimensional endocranial landmarks as well as several hundred semilandmarks on curves and the endocranial surface. Following sliding of semilandmarks, Procrustes superimposition was used to standardize location, orientation and scale. We compared developmental trajectories using two approaches: (1) ontogenetic allometric trajectories were estimated by regressing the Procrustes shape coordinates on the logarithm of centroid size and then compared using multivariate statistics. (2) We used developmental simulations based on the differences between average shapes of dental age groups (Neubauer et al., 2010). This approach accounts for the non-linearity of the developmental trajectories. We then determined the similarities of ontogenetic patterns between species by interchanging their ontogenetic trajectories. The results of our developmental simulations indicate that, from the eruption of complete deciduous dentition, the patterns of endocranial development are so similar among hominoids that the respective ontogenetic trajectories are interchangeable between all hominoid species. However, our results suggest that many endocranial species differences among hominoids might occur only as slight variations in the amount of shape change produced. Together, our findings support the idea that extant hominoid species share a common pattern of endocranial development for some extent of postnatal ontogeny. It is likely that adult endocranial shape differences among hominoids can largely be related to differences of growth rate and timing along a conserved developmental pattern.

Acknowledgements: The authors thank Frieder Mayer and Nora Lange of Museum für Naturkunde (Berlin) for access to specimens (*Gorilla gorilla*, *Pan troglodytes*, *Pongo spp.* and *Hylobates spp.*); Christoph Boesch and Uta Schwartz of the Max Planck Institute for Evolutionary Anthropology and the Ivorian authorities, especially the Ministry of the Environment and Forests and the Ministry of Research, for access to the Tai chimpanzee collection; and Patrick Schöfeld and Heiko Temming for CT scanning. This research was supported by the Max Planck Society and by the Natural Sciences and Engineering Research Council of Canada.

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Podium Presentation: Session 2, Fr (10:50)

Early Acheulian stone assemblages 1.7-1.6 million years ago from Gona, Afar, Ethiopia

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The earliest Acheulian stone technology, dated to 1.75 million years ago (Ma), is documented in East Africa at Kokiselei in Kenya (Lepre et al 2011), and at Konso in Ethiopia (Beyene et al 2013). Three archaeological sites, DAN-5, BSN-12, -17 and OGS-12 from Gona, Ethiopia, have yielded Early Acheulian artifacts dated to 1.7-1.6 Ma (Quade et al. 2004; Semaw et al. 2009). Extensive field survey and excavations at BSN-17 and OGS-12 have yielded *in situ* artifacts which consisted of ‘large cutting tools’ including unifacially and bifacially shaped crude handaxes and picks, as well as Mode I (Oldowan) cores, and débitage. Technologically, the Gona Early Acheulian assemblages appear to be similar to those recently reported from Konso and Kokiselei. At Konso a majority of the large cutting specimens were made on flakes, whereas at Gona they were made equally on cobbles as well as large flakes (>10 cm). A variety of locally available raw materials including trachyte, basalt, rhyolite, etc, have been used for making these artifacts, though the sources for OGS-12 have yet to be identified. The emergence of the Acheulian coincides with the appearance of early *Homo erectus/ergaster*, a large-brained hominin responsible for crafting purposefully-shaped large cutting tools that are unknown during the preceding Oldowan (2.6-1.76 Ma). Currently, Palaeolithic archaeologists have a better understanding of the technology and the function of the stone artifacts known during the preceding Oldowan (e.g., Semaw et al. 2003; Roche et al., 1999), and small windows are now opening at Kokiselei, Konso and Gona to investigate the nature and characteristics of the early Acheulian 1.75-1.6 Ma. However, our understanding of the Oldowan – Acheulian transition is still very limited. Our investigations have shown that emergent *Homo erectus/ergaster* use of this new technology was already in place in East Africa by 1.75-1.6 Ma. The Gona team will continue survey and excavations to document sites with potential to yield traces of archaeological materials critical for understanding the emergence and the adaptive significance of these large cutting tools in *Homo erectus/ergaster* life ways. Further, we are also investigating the paleoenvironmental background for understanding the nature of the emergence of Acheulian technology and the appearance of the large-brained hominin that expanded its niche to Eurasia.

Acknowledgements: We would like to thank the Authority for Research and Conservation of Cultural Heritage (ARCCCH) of the Ministry of Culture and Tourism of Ethiopia for the Gona research permit, and the National Museum for cooperation for the laboratory work. We are grateful for the permission and assistance provided by the Afar administration at Semera and the hard work in the field by our Afar colleagues. The Gona research was funded by the European Union Marie Curie Career Integration Grant (CIG), continuous generous support from the L.S.B. Leakey Foundation, the National Science Foundation (grant to RHOI, Co-Pis the late Professor F. C. Howell and Professor Tim White), the National Geographic Society and the Wenner-Gren Foundation.

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Podium Presentation: Session 12, Sa (15:20)

Humeral Biomechanics and Habitual Behavior: Is the Humeral Rigidity of Neandertals and Upper Palaeolithic Moderns Unique?

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The humeral morphology of male Neandertal and Early Upper Palaeolithic *Homo sapiens* (EUP) combines high anteroposterior (A-P) cross-sectional diaphyseal shape ( $Ix/Iy > 1.20$ ) with pronounced bilateral rigidity (J) asymmetry (median 50%). Late Upper Palaeolithic *Homo sapiens* (LUP) males also display comparable rigidity asymmetry, yet this is paired with comparatively circular diaphyses ( $Ix/Iy = 1.15$ ). By contrast, although sample size limits interpretation, Neandertal, EUP & LUP females display low to moderate humeral rigidity asymmetry (median <18%), yet highly A-P strengthened cross-sectional diaphyseal shape. Explanations for these morphological patterns are contentious and remain equivocal. We present a comparison of humeral rigidity (J) asymmetry and shape ( $Ix/Iy$ ), at 35% of bone length, among Late Pleistocene humans and a large sample (18 groups, n > 400) of behaviourally, temporally and geographically distinct Holocene foragers. Two straightforward questions are asked: 1. Compared against a global sample of Holocene foragers, does the humeral morphology of Pleistocene humans still appear unique? 2. Do temporal and eco-geographic factors explain patterns of humeral morphology in the Holocene, and inform interpretations of Pleistocene human morphology? Comparisons reveal that the mid-distal humeral morphology of the Pleistocene human is indeed unique, and that ecogeographic and temporal factors do not explain variation found in the Holocene. None of the Holocene forager populations display the combination of high levels of asymmetry for humeral rigidity and high A-P strengthening associated with male Neandertals and EUP *Homo sapiens*. However, humeral cross-sectional shape and percent bilateral rigidity asymmetry do appear to delineate males from females in the Holocene. Analyses of bilateral rigidity asymmetry reveal that males in only 1 of 18 Holocene populations display ‘high’ asymmetry (46%), 5 other groups display moderate (20-30%) asymmetry, and the remaining 12 populations display ‘low’ asymmetry (< 20%). In contrast, females from all Holocene forager groups display ‘low’ levels of bilateral asymmetry. Analyses of humeral shape reveal an additional sexually dimorphic trend. Only two groups of male Holocene foragers display ‘high’ ( $Ix/Iy > 1.20$ ) humeral shape (1 group unilaterally, 1 bilaterally), while females in 9 of 18 Holocene groups display this same ‘high’ level of A-P strengthening (5/9 bilaterally, 4/9 unilaterally). Moderate to high bilateral strength asymmetry and high diaphyseal shape indices likely reflect adaptation to different types of highly intense or repetitive behaviours. The two sexually dimorphic patterns found in various Holocene forager groups suggest the performance of more unilaterally intensive upper limb activities in males and, conversely, less asymmetric, yet more anteroposteriorly focused loading of the upper limbs (both unilaterally and bilaterally) among females. The fact that Neandertal and EUP males display both high humeral strength asymmetry and high anteroposterior rigidity suggests that Late Pleistocene males were performing tasks involving the upper limbs that were not performed to such an extent by later males during the Holocene. If this morphological patterning reflects the Late Pleistocene and Holocene patterns of the sexual division of labour, it appears to have shifted after the Neandertal and EUP moderns, during the transition from the EUP to the LUP.

Poster Presentation Number 146, Sa (17:00-19:00)

### The Silver Age - Neanderthal Foraging and Social Behaviour in MIS-3

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The debate on Neanderthal social and symbolic capabilities is one of the fundamental issues of Palaeolithic archaeology, with the archaeological record suggesting that Neanderthals did not display the same range and variability of behaviours as anatomically modern humans (AMH). This lack of evidence has often been attributed to the cognitive superiority of AMH over Neanderthals. The reliance on the material record alone, however, neglects a range of behaviours that are arguably of equal importance to understanding the cognitive abilities of this species, but which leave no visible traces in the archaeological record. This paper employs a range of ethnographic and archaeological data that relate to a range of material and non-material social and symbolic behavioural expressions, such a rites of passage, cooperative hunting, care for the elderly, and prestige hierarchies that are not typically inferred from the archaeological record. The ethnographic record allows for the quantification of such behaviours so that correlations can be made between social expressions (cohesion, control etc) that can then be inferred from the material record. Statistical tests, including General Linear Modelling, were employed to determine the robustness of these correlations. The ethnographic model was applied to the archaeological record of the Early Upper Palaeolithic prior to its being applied to the Neanderthal record of OIS-3 to determine the suitability of applying it to prehistoric contexts. Results show that both Neanderthals and AMH employed similar mechanisms for coping with resource stress in relation to social cohesion, though individual expressions varied between the two species depending on their environmental contexts. Interpretations suggest that the Neanderthal capacity for spiritual and material expression where hindered by demographic and physiological constraints rather than any differences in cognitive capacity. Further, analysis shows that Neanderthals employed optimal behavioural capacities throughout the Middle Palaeolithic that suggests they were a more behaviourally variable hominid than previous interpretations of the archaeological record have suggested, with the result that the Middle Palaeolithic period can be referred to as a ‘Silver Age’ of human foraging and behavioural capacity. This paper concludes that behavioural terminology such as ‘modern’ and ‘archaic’ is now out dated and should no longer be used when discussing the behavioural and social capacities of Neanderthals and Anatomically Modern Humans. Instead, we should recognise that human behavioural responses to variables such as environmental variation have remained relatively consistent for the past 60,000 years. To explain the differences between ourselves and out closest extinct cousin we must therefore look to other variables, notably those of demography and energetics, to understand why Neanderthals were different and why they went extinct.

Podium Presentation: Session 12, Sa (15:40)

### Land-sea correlation of the Last Interglacial via the Blake palaeomagnetic Event: implications for Neandertal occupation history of north western Europe

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This study contributes to the long running debate on Neandertal environmental tolerances, focused on the issue of the Last Interglacial (or: Eemian) occupation of Europe (e.g. Gamble, 1986; Roebroeks et al., 1992). In order to further precise the timing and character of this occupation, detailed palaeomagnetic and environmental studies were carried out at the interglacial sites of Neumark Nord 2 (Germany) (Sier and Dekkers, 2013; Sier et al., 2011), Rutten (The Netherlands), and Caours (France) (Sier et al., submitted). During the Last Interglacial, we can find a global stratigraphic marker, the Blake Event. This palaeomagnetic event is recorded in both marine and terrestrial sediments (e.g. Bourne et al., 2012; Osete et al., 2012) and has been found in settings which allow direct correlation with the MIS curve (e.g. Bourne et al., 2012; Tucholka et al., 1987). Our palaeomagnetic studies at Neumark Nord 2, Rutten and Caours have provided a strong indication for the presence of a palaeomagnetic event which we have identified as the Blake. We were able to correlate this Blake Event to the pollenzones of the Eemian sensu stricto (as defined by Zagwijn (1961)) at Rutten and at Neumark Nord 2. The observed position of the Blake Event in relation to the Eemian in north western and central Europe supports a time lag of 5000 years between the onset of the Eemian in the south (see Sánchez-Goni et al.,(1999) and the northern-central parts of Europe. Our results have consequences for views of the chronological and geographical limits of the Neanderthal range. As an example, our correlation indicates that both Neumark Nord 2 and Caours were occupied well after the MIS 5e global high sea level stand. This implies that during these occupations, easy access to the British Isles was blocked by the fully developed English Channel, possibly explaining the absence of hominins in Great Britain at that period (e.g. Ashton, 2002).

Acknowledgements: The research of Mark Sier has been funded by the N.W.O. Spinoza Prize awarded to Wil Roebroeks.

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Podium Presentation: Session 4, Fr (14:40)

## Continuities and discontinuities in the East European Early Upper Palaeolithic: the Kostenki model

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The identification at Kostenki of Upper Palaeolithic assemblages more ancient than the Aurignacian and local "transitional" cultures (in Eastern Europe, the Streletskian) brings up a series of new issues which have not arisen before. Thanks to the 1998-2013 excavations at Kostenki 14 (Markina Gora), the site has become a key section for regional geological and cultural sequences with a complete series of 9 cultural layers relating to late MIS 3, or, in chronometric terms, to 42-27 cal ka BP. Of particular significance are the high-resolution chronological markers. These are the layer of volcanic ash connected with the Campanian Ignimbrite (CI) eruption at the Phlegraean Fields Caldera in southern Italy dated to 39.3-40 calendrical ka BP, and the Laschamp-Kargopolovo paleomagnetic excursion (41 ka BP) recorded in the sediments of a fossil soil beneath the tephra layer. The cultural layer of Aurignacian attribution in the volcanic ash, with radiocarbon dates of 35 14C ka BP (40 cal ka BP), and the lowermost cultural layer (IVb), which provided a new previously unknown cultural tradition with radiocarbon series of 36-37 14C ka BP (41-42 cal ka BP), give the basis for modification of the traditional model of the evolution and differentiation of the Early Upper Palaeolithic of the area. In its classical form the Kostenki model was first developed in the 1950-60s by A.N. Rogachev in cooperation with G.I. Lazukov and A.A. Velichko. It is a tripartite sequence based on the triple subdivision of the sedimentary sequence. Sites of the late (III) chronological group are related to the loess-like silts of the colluvial deposit on the first and second river terraces. The ancient (I) and middle (II) groups are associated with two humic beds separated by volcanic ash. Their chronological brackets were established as 36-33 ka BP for the oldest group, 32-27 ka BP for the middle group, and 23-20 ka BP for the most recent group by a series of radiocarbon dates obtained in the 1980s through the joint efforts of N.D. Praslov and L.D. Sulerzhitsky. According to this model, sites of the Last Glacial Maximum are absent at Kostenki due to the lack of a sedimentary record for that time. The proposed model has four parts: - Initial Upper Palaeolithic stratum (42-40 cal ka BP) as an association of the Spitsyean and the cultural tradition of cultural layer IVb at Kostenki 14; - Early Upper Palaeolithic (40-36 cal ka BP) showing the pan-European bimodal structure with the coexistence of the Aurignacian and "transitional" Streletskian; - Early Middle Upper Palaeolithic (34-32 cal ka BP) connected with the appearance of the Gravettian, but in association with the Gorodtsovian – a particular East European cultural unity; - Recent Middle Upper Palaeolithic (27-25 cal ka BP) as an association of a number of Gravettian varieties in coexistence with assemblages of non-Gravettian affiliation. Two chronological gaps are attested: between the EUP and early MUP (34-35 cal ka BP), and between the early and recent MUP (31-28 cal ka BP). Grants: Presidium RAS; RGNF-13-01-18038.

Podium Presentation: Session 5, Fr (16:00)

## La Cotte de St Brelade (Jersey): Re-evaluating Neanderthal subsistence behaviour and landscape use

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La Cotte de St Brelade (CSB, Jersey) is one of the most prolific Middle Palaeolithic localities in Western Europe (ca. 96,000 lithic and 1,500 faunal remains). Extensive fieldwork (1890-1980) exposed deposits representing 250,000 years of shifting climates and environments. Since publication of the CSB monograph (Callow and Cornford, 1986), the interpretation of the site as a mammoth drive locality (Scott, 1980; 1986) has remained a unique, if untested, hypothesis regarding Neanderthal subsistence strategies and landscape use. This interpretation is based on the analyses of two distinct "bone heap" levels (Units 3 and 6), composed almost entirely of megafaunal remains. Presently, such structured and repetitive subsistence behaviour has been suggested, but never concisely argued, for any other European Middle Palaeolithic site, calling for a re-evaluation of the CSB fauna. This paper presents results of new faunal and contextual analyses from the McBurney excavations (1961-78). 1,494 faunal remains were recorded from all horizons, placing the two bone heaps within context. Zooarchaeological techniques, such as species and body part identification, were allied with a range of attributes (weathering, abrasion and root-etching) to fully understand the site formation processes. Furthermore, an oblique light source and hand lens (20xmagnification) allowed for a detailed assessment of bone surface modifications. Results confirm the dominance of mammoth and woolly rhino with smaller quantities of horse, wolf and bear. Overall, per layer, Minimum Number of Individuals (MNI) are very low, usually 1 or 2. Only within the "bone heaps" of Units 3 and 6 do mammoths dominate with MNIs of 7 and 11, respectively. Further data, however, indicates complex site formation and preservation. Bone weathering throughout all horizons, including the bone heaps, suggests more prolonged exposure, repeated input of faunal material and differential preservation, potentially related to shelter from the granite walls. Neanderthal presence was identified within all deposits by burnt bone and butchery modifications. New cut marks identified on mammoth, rhino and carnivores such as wolf and bear, suggest a more complex Neanderthal subsistence pattern than previously acknowledged. Importantly, new carnivore modifications were also recognised. Overall, all horizons show little faunal variation with equal quantities and distributions of hominin and carnivore modifications, suggesting repeated return, re-use and input by carnivores, interrupted by discontinuous Neanderthal occupational events. Whilst CSB remains exceptional, this paper presents a more complex scenario for site formation and use, illustrating the complexity of Neanderthal subsistence and carnivore interactions. Both Neanderthal and carnivore populations regularly utilised the CSB landscape exploiting various species, particularly megafauna. The CSB ravine system could have helped both species to track and hunt animals, whilst the enclosed site structure provided protection and shelter for butchery and processing. Identifying such regular exploitation can also help provide better insight into the approximate time required for the accumulation of individual CSB horizons. Finally, placing CSB within the broader European Middle Palaeolithic context suggests that rather than Neanderthal occupation, punctuated by large-scale game drives, the site is similar to other cave faunas from Europe, with an accumulative role for both hominins and carnivores.

Acknowledgements: This work was partly funded by the Quaternary Research Association and MONREPOS. It formed part of the Quaternary Archaeology and Environments of Jersey (QAEJ) Project. I would like to thank Olga Finch and Neil Mahrer at Jersey Heritage for access and support throughout.

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Podium Presentation: Session 5, Fr (17:20)

## The earliest fishhook tradition in Europe

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Prehistoric fishhooks have previously been described in northern Europe as being common since the Mesolithic. Here we present a Final Palaeolithic mammoth ivory fishhook from the site Wustermark 22 (north-eastern Germany), the raw material of which is about 19,000 years old. Five further fishhooks were discovered in situ at the same site one of which has a calibrated radiocarbon age of about 12,300 years. The tool industries of flint artefacts and bone/antler tools of the site are associated with descendants of the Federmesser-culture and the palynological context indicates a Younger Dryas environment. The pollen diagram further shows a continuous presence of swamp- and aquatic plants as well as green algae, indicating a shallow standing water body. This is a favourable habitat for pike, consumption of which was identified on the basis of numerous bone remains in the investigated sediments. It supports the fact that fishing could have been an important activity in the Final Palaeolithic, which required the manufacture of fishhooks and thus could explain the existence of large numbers of fishhooks in layers of this age. The time span of about 7,000 years between the death of the individual mammoth and the production of the one fishhook made of ivory shows that humans were able to use subfossil ivory for the manufacture of fishhooks respectively fishing equipment. Wustermark 22 represents the largest collection of Palaeolithic fishhooks so far found at a single European site. A comparison with other sites in Europe, containing Palaeolithic fishhooks suggests that the appearance and development of fishhooks may be associated with a general change in resource availability during the Greenland Interstadial 1 (Bølling/Allerød warming), which is also connected with a change from late Upper Palaeolithic to Final Palaeolithic industries in Northern Central Europe. We conclude that Mesolithic fishhook tradition has its roots in the Final Palaeolithic.

Acknowledgements: We are grateful to Susanne Jahns (Zossen, Germany) for pollen analysis from the sediment cores. Special thanks to the Archaeological State Museum of Brandenburg for the kindly permission for investigating the fishhooks from Wustermark 22.

Poster Presentation Number 48, Fr (18:00-20:00)

## Fire production in the deep past? The expedient strike-a-light model

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Clear examples of tools used to artificially ignite fire are absent in the archaeological record until the mid- to late Upper Palaeolithic. One explanation for this is that hominin groups up to this point were simply fire users, dependent on the environment to provide conflagrations for exploitation, as opposed to fire producers. An alternate scenario is that the tools they used to perform this task have not been recognised or properly identified in artefact assemblages. We propose the 'expedient strike-a-light model', a concept that draws inspiration from the apparent ad hoc nature of many prehistoric lithic technologies, especially those of the Middle Palaeolithic—the period when fire use appears to become a common phenomenon. The model contends early flint strike-a-lights were not formalised or specialised tools used to kindle multiple fires, of the kind recovered from later Neolithic and Bronze Age contexts. Instead, we postulate that flakes, retouched implements or other fragments made of flint (or other siliceous raw materials) were utilised on a very short-term basis in conjunction with the minerals marcasite or pyrite (sulphuric iron) to generate fire. We establish criteria to identify expedient fire-lighting tools based on experimental data and microwear analytical techniques, and discuss the testing of our research model on three Middle Palaeolithic lithic assemblages (Neumark Nord 2/2 in eastern Germany, eight volcano infill sites in the Eifel region of western Germany, and La Cotte à la Chèvre, Jersey, UK). Although results were negative from this limited data set, this research provides a new approach for recognising early strike-a-light fire production technology. Acknowledgements: Part of this research was funded by a SPINOZA-grant from the Netherlands Organisation for Scientific Research (N.W.O.). We thank Dick Stapert (Groningen, The Netherlands) and Jürgen Weiner (Bonn, Germany) for feedback and various forms of support.

Poster Presentation Number 6, Fr (18:00-20:00)

## Morphological integration of upper and lower jaws in extant hominids

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In the course of hominin evolution, jaw shape was subject to major morphological change. Overall the canine size was reduced, the jaw underwent gracilization and postcanine dental reduction in the *Homo* lineage, and increased robusticity and postcanine dental enlargement in the *Paranthropus* lineage. Yet, it is the large canine in primates that guides but also constrains masticatory movements. Since the mandible and the maxilla are morphologically and functionally tightly integrated structures, it is probable that the decrease in size of the canine had an impact on the pattern of integration. However, the pattern and degree of morphological integration as well as intraspecific variability in dental arcade shape are mostly unknown. Here we use three-dimensional landmark-based geometric morphometrics to analyse CT-scans of matching upper and lower jaws of adult extant *Homo* (pre-industrial), *Pan*, *Gorilla*, and *Pongo* and use partial least squares (PLS) analysis (Bookstein et al., 2003) to evaluate the pattern and degree of integration and variation among these extant species. We show that there is a high level of integration in the examined groups. In *Pongo*, for the first PLS axis, that explains 53.3% of the covariation, the correlation between the PLS scores of the mandible and the maxilla is  $r=0.92$ , and the Escoufier coefficient (Escoufier, 1973)  $RV=0.75$ . *Gorilla* and *Pan* show similar results. For the first PLS axis, that explains 50.1%, or 37.6% respectively of the covariation, the correlation between the PLS scores is  $r=0.92$  and  $r=0.93$ , and  $RV=0.64$ , or  $RV=0.64$  respectively. In *Homo*, for the first PLS axis, explaining 35.9% of the covariation, the correlation between the PLS scores is  $r=0.79$ , and the  $RV=0.54$ . Our results confirm a strong species-specific relationship not only between the antagonistic jaws but also between the anterior and postcanine arcade shape within a dental arch. The results also quantify the intraspecific variability of extant hominids which offers two main applications when interpreting the hominin fossil record. First, it can provide a baseline for attributing isolated mandibles and maxillae to a single taxon; and second, these data may be used in restricted fossil sites to find matching pairs of specific individuals.

Acknowledgements: We thank the following curators and museums for access to their specimens: Frieder Mayer and Nora Lange, Museum für Naturkunde, Berlin; Christine Feja, University of Leipzig, Leipzig; Ottmar Kullmer, Senckenberg Museum, Frankfurt/Main; and Christophe Boesch, MPI-EVA, Leipzig. We also want to thank Jean-Jacques Hublin for providing access to the CT-Scans.

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Poster Presentation Number 35, Fr (18:00-20:00)

## Trabecular bone architecture in the thumb of *Homo* and *Pan*: handedness and evidence for taxonomic differences

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The evolution of species-level handedness is believed to be specific to *Homo sapiens* and, because of its absence in non-human primates, is thought to have coevolved with increasingly sophisticated stone tool manufacture and use (Steel and Uomini, 2005; Stout et al., 2008). This position remains contentious however, largely due to the sparse or ambiguous evidence for hand preference in the archaeological record. Direct methods of discerning handedness rely on skeletal asymmetries that result from repeated mechanical loading on the dominant side of the body (Trinkaus et al., 1994; Steele 2000). Although these methods may be applied to fossil taxa, large portions of a given bone or skeleton must be preserved to ensure accurate and comparable measurements. As such, techniques that are capable of detecting asymmetrical loading with smaller or fragmented remains are required (Ubelaker and Zarenko, 2012). Because trabecular bone has been shown to remodel in response to in vivo mechanical loading (Barak et al., 2011), it is meaningful to measure internal asymmetries as a proxy for handedness. To investigate trabecular asymmetries and their relationship to handedness we quantify the trabecular structure in the first metacarpal (MC1) using micro-CT scans ( $\leq 30$  microns) of paired (left/right) metacarpals of *Pan troglodytes* (n=7), *P. paniscus* (n=2), modern *H. sapiens* (n=14) *H. neanderthalensis* (n=1) and Late Pleistocene *H. sapiens* (n=1). The relative bone volume (BV/TV), anisotropy (DA) and elastic modulus (EM) of the complete trabecular structure in the metacarpal head and base were quantified and statistically analyzed with SPSS. The results were then used to investigate asymmetry within each taxa along with species differences between *Pan* and *Homo*. Our results indicate that trabecular rightward asymmetry in recent and Late Pleistocene *Homo sapiens* reaches levels that are consistent with population level right handedness. The most frequent rightward asymmetries were BV/TV (12:14, 85.7%) and EM (12:14, 85.7%) at the base of the MC1. Of note is the tendency for a BV/TV leftward bias in the Pan MC1 (8:9, 88.9%), which may be related to a locomotor preference for left leading descent from high places. The results for Kebara 2 indicate a leftward bias in the MC1, which contradicts previous research that suggest a right hand preference for this individual. Our results also demonstrate that the MC1 of *Pan* is more robust in measures of BV/TV and EM, which suggests higher magnitude loading, while a significantly decreased DA indicates a more varied loading regime (Lazenby et al., 2011). In regards to these measures, Late Pleistocene *Homo sapiens* and *Homo neanderthalensis* are encompassed by the ranges found in the recent *Homo sapiens* sample.

Acknowledgements: This research was supported by the Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany and The Max Planck Society. For scanning assistance we thank Patrick Schoenfeld and Heiko Temming. For access to specimens in their care we thank Frieder Mayer (Berlin Museum für Naturkunde), Virginie Volpato (Frankfurt Senckenberg Museum), Christophe Boesch (Max Planck Institute for Evolutionary Anthropology), Emmanuel Gilissen and Wim Wendelen (Royal Museum for Central Africa), Maria Teschler-Nicola and Ronald Muehl (Vienna Natural History Museum), Jacopo Moggi Cecchi and Sylvia Bortoluzzi (University of Florence), Yoel Rak and Israel Hershkovitz (Tel Aviv University).

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Podium Presentation: Session 8, Sa (10:00)

## The paradox of cold adaptation among modern humans and Neandertals: Developmental variation in the ontogeny of the crural index

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It is well accepted that modern humans exhibit clinal variation in crural indices (tibial/femoral length ratios) which are best explained as adaptation to cold via Allen's rule, and that the Neandertal limb fits patterns predicted by adaptation to extreme cold (Trinkaus, 1981). Analyses of variation in intra-limb proportions among Late Pleistocene humans during the colonization of Europe demonstrate that there may have been a considerable time lag between occupation of an environment and the expression of adaptation in limb proportions (Holliday, 1999). This adaptive 'lag' has been supported by more recent studies in other regions, and suggests that there may be a weak correspondence between intra-limb proportions and climate, which can be interpreted as evidence for genetic conservatism in intra-limb proportions. This genetic conservatism also appears to be reflected in limb proportions during growth (Cowgill et al., 2012). This evidence for long-term adaptation in limb proportions sits at odds with evidence from human and developmental biology, including: recent trends towards a lower correspondence between human physique and temperature (Katzmarzyk and Leonard; 1999); the demonstration of rapid changes in limb proportions among migrant populations (Bogin, 2002); and the identification of underlying mechanisms of developmental plasticity which could underpin limb segment variation (Serrat et al., 2008; Pomeroy et al., 2012). These studies leave a 'paradox' between evidence for genetic conservatism of limb proportions in the fossil record, and phenotypic plasticity observable among living humans. This paper investigates the ontogeny of intra-limb indices derived from skeletal remains of archaeological and protohistoric populations of hunter-gatherers ranging from 55 degrees South to 63 degrees North latitude. Skeletal dimensions were measured directly using calipers or an osteometric board, with subadult age estimated by dental formation and development or femur length, and grouped into the following age ranges: 0-2, 2-4, 4-7, 7-12, 12-18, and adult. Comparisons demonstrate that: a. there is little correspondence between intra-limb indices and latitude below 50 degrees latitude despite considerable within population variation during ontogeny b. adult populations above 50 degrees latitude show convergence in phenotype with shortened distal limb segments, as predicted by Allen's Rule c. the youngest subadults (0-2 years) in high latitude groups have proportionately longer tibiae than other age groups, indicating that high latitude populations are born with more 'tropical' limb proportions, and that shorter intra-limb indices develop post-natally. d. Neandertals show a reduction in crural index through development, similar to high latitude modern humans, although early post-natal and adult crural indices are lower than average indices of all modern human foragers. These results suggest the relationship between crural index and climate among humans is driven by the phenotype of high latitude populations. Crural indices of these populations during the early post-natal (0-2) period, however, are broadly similar to populations of lower latitudes, with adult proportions achieve during subsequent growth. These observations do not directly resolve the 'paradox', but suggest that developmental accommodation of environmental stress may be an important factor in explaining variation in the fossil record.

Acknowledgements: This research was supported by funding from Natural Environment Research Council, U.K.

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Poster Presentation Number 90, Sa (17:00-19:00)

## Geometric morphometric analysis of ear ossicles in African apes and modern humans

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There is a growing interest in the comparative anatomy of the ossicular chain of the middle ear formed by the malleus, the incus and the stapes. Research in primates has shown that metric and angular measurements of these bones correlate to parameters of sound perception and bear taxonomic differences (Coleman & Ross, 2004; Masali & Cremasco, 2006; Quam & Rak, 2008; Quam et al, in press). When applied to the Hominidae, both holds great potential for reconstructing aspects of hominin evolution (Spoor, 2006; Quam & Rak, 2008; Quam et al, in press). Owing to their minute size and complex three-dimensional shape two-dimensional measurements of the ossicles are prone to error. Inaccuracies are introduced by differences in positioning of the specimens or parallax error when measurements are based on photographs (Flohr et al., 2010). As an alternative method, avoiding these problems, distances between landmarks can be measured based on high-resolution CT (Schmidt et al., 2011). However, complex three-dimensional shape characteristics - like the curvature of the manubrium of the malleus, the form of the mallear head, the curvature of the surface of the incus or the shape and orientation of the joint surfaces – are not captured in such analyses. Here, we study the size and shape of the malleus and incus of *Gorilla gorilla*, *Pan troglodytes* and *Homo sapiens* using a novel geometric morphometric (GM) measurement protocol based on 3D landmarks and semilandmarks obtained from high resolution CT images. GM captures the complex three-dimensional morphology and preserves the geometric relationships among the points throughout the statistical analysis. Previous work on the bony labyrinth (Gunz et al., 2012) has shown that GM methods can capture not only morphological differences between humans and chimpanzees but even subtle shape differences among subspecies of chimpanzees. The surfaces of the ossicles were extracted from the CT data, and used to calculate linear distances, areas and volumes, as well as a comprehensive set of 3D landmarks and semilandmarks. The latter were analysed using principal component analysis after standardizing for position, orientation, and scale using Procrustes superimposition. Our results of bivariate and GM analyses reveal in detail the distinct differences in shape of the malleus and incus between gorillas, chimpanzees, and modern humans. The differentiation between species is promising for interpreting the scarce fossil record of hominin ear ossicles with respect to hearing capabilities and taxonomic relationships.

Acknowledgements: We thank the Institut für Anatomie of the Universität Leipzig and Christophe Boesch (MPI EVA) for access to specimens.

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Poster Presentation Number 77, Sa (17:00-19:00)

### Late juvenile cranial growth and the diagnosis of *Australopithecus sediba*

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Recently, a new species of *Australopithecus* has been described based on, among others features, its gracile cranial morphology (Berger et al 2010). The type specimen MH-1 is a late juvenile, but the authors judged that additional growth would not have appreciably altered the morphology on which the species diagnosis is based (ibid.). However, little is actually known about the later phase of growth and development of the hominid skull, with a marked absence of comprehensive quantitative studies specifically mapping morphological changes from late juveniles into adulthood. In the wider context of an ongoing study which examines late juvenile growth to inform morphological interpretation of immature hominin fossils we present a quantitative analysis of cranial shape changes after M2 eruption. The sample includes five australopiths, 71 humans, 187 chimpanzees, 101 gorillas and 81 orangs. Cranial morphology was quantified using 27 3D landmarks and 547 semilandmarks on curves. Data were collected in a virtual environment, from high-resolution CT-scans and surface scans. Changes in size and shape were analyzed using geometric morphometric techniques. Data were converted to shape variables using Procrustes superimposition and visualized using principal component analysis in Mathematica. Multivariate regressions of shape on logarithm of centroid size and dental age category were used to assess ontogenetic allometry; comparisons of mean shapes computed for dental age groups further illustrate the shape changes in late juveniles. Confirming previous findings, the results show that the crania of all hominids show little change in overall size after the eruption of the M2. However, local shape changes can be discerned, which are mostly associated with ongoing pneumatization of the frontal and temporal bones, as well as the development of the masticatory musculature. More specifically, late juveniles present a weaker antero-medial incursion of temporal lines on frontal bone, a wider position of temporal lines on parietal bones, a slighter postorbital constriction and reduced pneumatization of temporal squama. In the specific case of MH-1 these developmental changes are of particular relevance since five out of the six vault characters used to distinguish *A. sediba* from *A. africanus* were found to change in the direction of greater robusticity in adulthood. Therefore, at least to some extent, the gracilization observed in the MH-1 cranium can be attributed to ontogeny rather than phylogeny.

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Poster Presentation Number 126, Sa (17:00-19:00)

### “Surf’n’ Turf”: Evidence from the German Rhineland for long range movement of Magdalenian individuals between inland and coastal environments

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Magdalenian occupation of the Martinsberg site at Andernach, German Central Rhineland is dated to around 13,000 14C BP by AMS results for bones of hunted horses. This equates to approximately 13,800 calibrated years BC, towards the end of Greenland Stadial 2 and some 1,000 years before the sudden onset of Greenland Interstadial GI 1e. The artefacts of bone, reindeer antler and mammoth ivory from Andernach-Martinsberg are typical for the later Magdalenian, including eyed needles, spalls and projectile points, batons percés and baguettes demi-rondes and much waste debitage from their manufacture at the site. However, a re-examination of the osseous assemblage identified one implement as cetacean bone (most likely whale), demonstrating the use of this marine raw material at least as far inland as the German Rhineland. The artefact is identified as the proximal section of a projectile foreshaft, an artefact category previously unrecognized in the Andernach Magdalenian material. In conjunction with previously documented perforated marine mollusc shells probably used for ornamentation the find of whale bone confirms that the Central Rhineland formed part of a wide-ranging late Magdalenian social network extending as far as the Atlantic or Mediterranean coast. Some lithic assemblages at Andernach and the neighbouring site of Gönnersdorf are dominated by exogenous Cretaceous flint, a material probably collected with forethought from sources lying between the two regions. Such regional networks not only show the movement of Magdalenian people and ideas across the landscape but also indicate how these groups may have made use of raw materials, as well as reflecting their potential economic and social value in different regions. Lithic raw materials and marine shells have long been accepted as proxies for long distance movement or interaction between groups. More recently, the manufacture of whale bone projectile weapons was identified by Jean-Marc Pétillon at the cave of Isturitz, some 50 – 60km from the probable source of this rare material, the Atlantic Ocean. Moreover, finished products were subsequently transported over several hundred kilometres to sites such as Mas d’Azil located at the opposite end of the Pyrenees. The Andernach specimen now significantly increases the distance over which cetacean bone was transported. Until now it has remained unclear whether long-range movement of objects across the Magdalenian landscape can best be explained by their transport by separate individuals or groups or by their exchange between different individuals or groups. In the case of the Andernach whale bone artefact detailed examination of the contextual evidence suggests that it owes its presence far inland to transport by an individual person who had previously spent time at the continental coastal margin.

Poster Presentation Number 150, Sa (17:00-19:00)

## Dispersal of Early Humans: adaptations, frontiers and new territories (The Ancient Human Occupation of Britain Project 3)

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The third phase of the Ancient Human Occupation of Britain project has run from 2009-2013, funded by the Leverhulme Trust (<http://www.ahobproject.org>). For the majority of the last million years, human populations have endured a precarious existence in northern latitudes, with short and episodic periods of occupation in the face of sustained and dramatic climate change. The work of AHOB has produced a wealth of new data about the occupation of northern Europe and has identified sites which show human survival in marginal and sometimes challenging environments. This work is forcing a revolution in thinking, and new research agendas have emerged about the technologies, abilities and survival strategies of early humans. Three areas of interest have been developed during the work of AHOB3: Module 1: First pioneers in northern Europe: 1.0 – 0.5 million years ago. AHOB has identified the earliest known sites in northern Europe, with Happisburgh Site 3 (Norfolk, UK) dating back to nearly 1 million years. Equally importantly, this work has shown that humans were periodically surviving in new, more challenging, environments. Module 2: Neanderthals and the North Sea Basin: 420,000 – 40,000 years ago. North-west Europe provides an ideal geographical zone in which to test Neanderthal tolerances and capabilities at the limits of their range. At times cold northern winters, the North Sea Basin and the English Channel all provided challenges to occupation. Module 3: Modern migrants: 50,000 – 12,000 years ago. AHOB has been closely involved with the Oxford Radiocarbon Accelerator Unit (ORAU) in testing and applying new methods of radiocarbon dating. Reliable dates have now been obtained as far back as 55,000 radiocarbon years ago. With other advances in dating, this allows a reassessment of the timing of Neanderthal extinction and the dispersals of anatomically modern humans into and across Europe. We present here key sites for each of the three time frames: 1. Happisburgh ( 0.9 Ma; Norfolk, UK): New archaeological evidence from Happisburgh demonstrates that early Pleistocene hominins were present in northern Europe more than 0.78 million years ago, when they were able to survive at the southern edge of the boreal zone. 2. La Cotte de St. Brelade ( 250 - 0.40ka; Jersey, UK): La Cotte de St. Brelade is a deep, cross-shaped fissure which demonstrates repeated Neanderthal occupation during variable environmental conditions, as well as long periods of abandonment. AHOB, in collaboration with the Centre for the Archaeology of Human Origins (Southampton University), University College London, the Société Jersiaise and Jersey Heritage, is undertaking a re-analysis of the La Cotte de St Brelade collections, and the first new fieldwork at the site for over 20 years. 3. Kent's Cavern ( 42.0 ka; Devon, UK): The Kent's Cavern maxilla (KC4), excavated in 1927, was initially diagnosed as an Upper Palaeolithic modern human and directly dated by AMS radiocarbon to 35 ka in 1989. A new Bayesian analysis of ultrafiltered bone collagen dates in an ordered stratigraphic sequence at the site showed that KC4 more likely dates to 44.2–41.5 kyr cal BP. In 13 newly studied dental traits KC4 showed clear modern human rather than Neanderthal characteristics, 3 traits showed Neanderthal affinities, and 7 were ambiguous, indicating that KC4 represents the oldest known anatomically modern human fossil in north-western Europe. 4. Gough's Cave ( 14.7 ka; Somerset, UK): New radiocarbon dating of the faunal and human assemblages shows that they accumulated at the very beginning of the Lateglacial Interstadial. Re-analysis of the Magdalenian ('Creswellian') human remains has identified cut-marks, human tooth-marks and deliberate breakage on most of the post-cranial bones, but the cranial vaults were modified to produce skull-cups. The combination of these two types of evidence strongly suggests the occurrence of cannibalism as part of a ritualistic practice within this population.

Acknowledgements: The AHOB Projects (2001-2013) have been funded by the Leverhulme Trust.

**References:** <http://www.ahobproject.org/>

Poster Presentation Number 64, Fr (18:00-20:00)

## All in one go? — Modes of blade and bladelet production and their implications for the Proto- and Early Aurignacian distinction. New insights from the Aurignacian of Labeko Koba (Basque Country, Spain)

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Although bladelet production has occasionally been documented in Middle Palaeolithic assemblages this blank type can without doubt be seen as a characteristic for the Upper Palaeolithic. Especially in the Aurignacian the different modes of bladelet production and the resulting, morphologically different products are used to differentiate between the distinct phases. Besides differences in the lithic and organic tool kit the Protoaurignacian (Aurignacien 0, Aurignacien archaïque) is said to differ from the early Aurignacian (Aurignacien I) blades and bladelets are produced via separate reduction sequences (e.g. Bon 2002, Teyssandier et al. 2010). Moreover, this technological shift is proposed to be accompanied by an expansion of inhabited eco-cultural niches towards the Early Aurignacian (Banks et al. 2013). In this context the site of Labeko Koba (Basque Country, Spain) is of special interest as it yields a stratigraphic succession of Châtelperronian (level IX), Protoaurignacian (level VII) and Early Aurignacian (levels VI, V & IV), which is rarely documented on the Iberian Peninsula (e.g. Arrizabalaga & Altuna 2000; Arrizabalaga 2009), but undeniably of special importance for developing models on the transition from the Middle to the Upper Palaeolithic. In the course of my ongoing PhD project, which is concerned with regional variability in the early Upper Palaeolithic of the Iberian Peninsula, the blank production systems with special focus on blade and bladelet production of the early Upper Palaeolithic levels of Labeko Koba have been analysed. Within the Protoaurignacian assemblage (level VII) both intertwined but also separate operational sequences for the production of blades and bladelets can be observed. Independent bladelet production is also documented within other assemblages attributed to the Protoaurignacian (see e.g. Talamo et al. 2012). Against this background the question arises whether this observation challenges the validity of the differentiation of the initial phases of the Aurignacian on the basis of technological differences in blade and bladelet production as proposed by Bon (2002) and Teyssandier et al. (2010). Thus the poster presents some preliminary results of the technological analysis of the early Upper Palaeolithic assemblages of Labeko Koba in relation to the above-mentioned issue and gives first ideas of functional aspects of the occupational events by relating the lithic with faunal data (Altuna & Mariezkurrena 2000). Acknowledgements: Thanks to Gerd-Christian Weniger, Andreas Pastoors (both Neanderthal Museum, Mettmann), Jesús Altuna, Koro Mariezkurrena and their team (GOAZ, Donostia), Álvaro Arrizabalaga (University of the Basque Country, Vittoria) and Guido Bataille (University of Cologne). This work is supported by the DFG and is conducted in the framework of the CRC 806 "Our way to Europe".

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Podium Presentation: Session 2, Fr (11:10)

## Insights about the effect of X-ray imaging on recent fossils: facts, deductions, speculations and phantasms

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X-ray imaging using conventional or synchrotron sources is generally considered as a non-destructive approach to study fossils. It is nowadays widely used in palaeoanthropology to give access to internal anatomy or even microstructures of bones and teeth. These imaging techniques also allow creating digital copies of fossil specimens (including recording their internal structures), especially when they have to undergo destructive sampling as for ancient DNA (aDNA) analyses. It has been recently stated that synchrotron imaging may induce permanent darkening of fossil teeth (Richards et al., 2012), when using high beam power (typically for sub-micron investigations). Nevertheless, as originally stated by Tafforeau and Smith (2008), and after dozens of experiments performed over years at the ESRF, on thousands of fossil and modern teeth, it is demonstrated that when this darkening occurs, it can be easily and totally removed using low energy UV light ( $\lambda=370$  nm). Only scanning parameters not adapted to high quality imaging of fossils (i.e. very high dose at too low energy) can induce permanent color change or even structural defects of fossils. Darkening cannot be observed for fossils entirely scanned with resolutions larger than 10 microns. It concerns only those that are scanned with synchrotrons for microstructural analysis. Even if X-ray imaging can be considered as structurally non-destructive for fossils, it is well known that irradiation can have strong effects on DNA of living organisms. One could then expect similar effects on aDNA preserved in recent fossils and museum collections. Contradictory results and assessments have been published, ranging from no effect on aDNA (Parades et al., 2012), to extremely alarmist statement (not based on experimental results) suggesting that nearly any X-ray irradiation would compromise future aDNA analysis (Richards et al., 2012). The physical and chemical conditions in fossils are very different from those of living organisms (e.g., water presence, reparation mechanisms). Therefore, simple extrapolations are not sufficient to understand the effect of irradiation on aDNA. It is crucial to bring clear experimental answers to assess to the legitimate interrogations about aDNA degradation. Therefore we conducted a series of experiments, using state-of-the-art protocols for aDNA extraction, to test the effects of X-rays using both conventional CT and synchrotron beams. We tested classical setups used to image complete specimens, as well as extremely high dose setups even more powerful than those used for sub-micron virtual palaeohistology applications. The results show that important losses of aDNA can indeed occur, but only when using extreme irradiation conditions that are never used for complete specimen scanning. The consequences of common scanning conditions using both conventional and synchrotron X-ray are very limited or even non-detectable, and should be considered as acceptable in the vast majority of cases. Ongoing technical improvements will rapidly lead to important dose reductions that would make X-ray scanning totally safe for aDNA studies, even when high resolutions are performed. To ensure that CT imaging does not alleviate aDNA studies, we propose to respect good scanning practices and common sense to avoid unjustified or unnecessary irradiation of fossils.

Acknowledgements: We are grateful for the ID19 and BM5 beamlines teams from the ESRF for their help and support of this project. Funding: ESRF, MPI-EVA, Tübingen University.

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Podium Presentation: Session 3, Fr (14:00)

## Adaptation to bipedalism from *Ardipithecus* to *Homo erectus*. What did genes ? What did gravity ? The evolutionary relevance of the hidden link between both

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Since reaching bipedal balance is a very demanding constraint in the face of gravity, we described numerous “epigenetic” characters which develop in association with learning to walk. In addition to their functional relevance, our aim is to show their evolutionary importance by decrypting the often hidden link between these epigenetic features and anterior genetic features which permitted their formation. We think that this sequence of genetic and epigenetic features played an important role in hominid evolution. We highlight the importance of two “epigenetic” characters. The first one, the angle of femoral obliquity, was studied on x-rays and osteological collections of newborns, juveniles and adults. This angular remodelling of the femoral diaphysis which develops on the distal physis by more metaphyseal apposition on its internal side, necessitates, for mechanical reasons, a flat physeal plane. This character is absent in all extant non human primates, since their diaphysis is tightly fitted into the distal epiphysis by deep grooves on the diaphysis and acute crests on the epiphysis, mechanism preventing epiphyseal separation in the context of an arboreal life (Tardieu et al. 1994, 1995, 1997, 1999). Thus an important genetic change, the simplification of the epiphyseal suture, was first acquired in hominid evolution. We show that it is absent in pre-australopithecine hominid fossils (*Ardipithecus ramidus*, *Ororin*) but appears in two australopithecine unfused femora (AL 333-110 and AL 333-111) which are moreover oblique. Obliquity is present in all the australopithecine femora. We argue that the presence of this sequence of derived features is a strong evidence, dictated by parsimony, of the tight and direct phylogenetic relationships between these last hominids and *Homo sapiens*. The second epigenetic feature is the formation of the lumbar lordosis with learning to walk. Using x-rays of spine and pelvis, we show that, while erecting the trunk, the formation of lumbar curvature is established in tight correlation with the increase in the angle of sacral incidence of the pelvis, which represents a key factor of the sagittal balance (Boulay et al. 2006). The growth of this angle was obtained through the 3D reconstruction of 100 newborn, juvenile and adult pelves. We show that the angle of incidence was genetically determined during hominid evolution, yet is also plastic during growth (Tardieu et al. 2006, under press). We argue that this crucial functional link between spine and pelvis, absent in *Ardipithecus ramidus* in spite of its possible occasional lumbar lordosis, was emergent in the australopithecines and present in *Homo erectus*. If lumbar curvature is an epigenetic feature, the underlying derived morphology of the human lumbar vertebrae was genetically determined. We conclude that gravity was as critical to the development of the skeleton of hominid bipeds as it is to day and natural selection paved its way by promoting adequate genetic modifications permitting the formation of these performant epigenetic characters. Finally, quadrupedal children discovered in Turkey are currently being studied. We hypothesize that the epigenetic modifications specific to bipedalism will be absent on their skeletons, since gravity has not imprinted its mark.

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Poster Presentation Number 119, Sa (17:00-19:00)

Evidences of fur procurement by Neandertals from the Mousterian deposits of Riparo Tagliente in the Lessini Mountains (Verona, Italy)

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The site of Riparo Tagliente lies on the left side of the Valpantena at 250 metres above sea-level. The stratigraphic series, which was deposited in the Upper Pleistocene, can be divided into two main units separated by an erosion surface: deposits with Mousterian (MIS 3) and Aurignacian industries and deposits with Epigravettian industries. The archaeozoological study carried out on the faunal assemblages has pointed out the importance of Neandertal agency in the accumulation and modification of bone remains. The majority of bone remains, both for NISP and MNI, can be attributed to ungulates (roe deer, red deer, ibex and chamois) while carnivores (wolf, fox and bear) are less represented; among rodents a number of marmot remains have been identified (Thun Hohenstein, 2006; Thun Hohenstein, Peretto, 2005). The taphonomical analysis, carried out through stereomicroscopy and SEM analyses, revealed that several marks of human activity have been observed on bone fragments belonging to ungulates all over the sequence. These marks can be attributed to the exploitation of the animal carcass both for food procurement and for using bone fragments as retouchers (Thun Hohenstein, 2006; Thun Hohenstein, Peretto, 2005). Carnivore and rodent marks are relatively rare but more frequent in the lower layers, suggesting an irregular occupation of the site by these animals when Neanderthals were absent. In the uppermost levels cutmarks have been found even on some marmot, fox and bear bones, revealing the interest to fur procurement. All these data testify an intensive occupation of the site by Neandertals during some phases of the Mousterian, enabling us to define human behaviour and the strategies adopted in relation to the environment surrounding the rockshelter.

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Poster Presentation Number 25, Fr (18:00-20:00)

Asymmetry and Cephalopelvic Disproportion

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The propensity for human difficulty with birth has long been ascribed to an “obstetric dilemma,” which juxtaposes competing selection for a narrow pelvis suited to bipedal locomotion and a broad pelvis suited to birthing large-brained young. Research attempting to link external body morphology to internal pelvic capacity has been conducted to isolate which living women might be at highest risk for complications during birth. The strongest known correlation links short maternal height to a restricted pelvic canal. However, the correlation is often problematic and recent research indicates this might be due to a high degree of inter-populational variance in both pelvic size and shape. This suggests that the relative measures of height, canal size, and canal shape compared to a population mean are of greater importance than absolute measures. Bilateral asymmetry in the human body is common, due to the effects of biomechanical forces or developmental instability during ontogeny. Asymmetry has been correlated with lower fitness and fecundity in a variety of human populations, affecting both males and females. Short maternal stature is often attributed to developmental instability. This study examines: a) if absolute asymmetry in the long bones of the upper or lower limbs of the skeleton correlated with asymmetry in the bony pelvis, b) if absolute asymmetry in the long bones of the upper or lower limbs or in the bony pelvis correlated with pelvic capacity, and c) if these relationships are stable across both populations and sexes. Eighty bilaterally paired measurements and six measures of the obstetric capacity of the pelvis were taken from 128 skeletons from five continents. Regression and PCA analyses were used to explore the relationship between skeletal asymmetry and pelvic capacity. Results show that: 1. Asymmetry in the length of the pubic bone is negatively correlated with measures of pelvic capacity and pelvic breadth. 2. Asymmetry in the length of the pelvic rim is positively correlated with measures of pelvic capacity. 3. Asymmetry in femoral breadth and length is positively correlated with measures of pelvic capacity. 4. The medio-lateral dimension of the pelvic midplane (MDML) is the most constricted dimension of pelvic capacity, and bears the strongest correlations to the above variables of all dimensions of pelvic capacity. These results suggest that skeletal asymmetry, whether due to developmental instability or biomechanical factors, may impose constraints upon pelvic morphology and obstetric dimensions. This suggests that environmental stress may lead to increasing obstetric complications. Implications for further research and its application to anthropometric measurements for medical use in living populations are discussed.

Acknowledgements: We would like to thank Maggie Bellatti in conjunction with the Duckworth Laboratory as well as Robert Kruszynski and Margaret Clegg in conjunction with the Natural History Museum in London for their kind access to skeletal populations used for this study.

Poster Presentation Number 5, Fr (18:00-20:00)

## Cranial form and masticatory biomechanics: finite element simulations of biting among normal and artificially deformed modern humans

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We know almost nothing about how variations in cranial form within one species translate into variations in masticatory system functional capacity and cranial skeletal performance. Most studies have assessed and compared these among individuals representing different taxa. Here we present a study that looks at the range of bite forces and cranial skeletal responses to biting loads among modern and ancient, artificially deformed crania. Finite element analysis (FEA) is an engineering technique that simulates and so predicts the mechanical performance of a structure under loads, computing deformations and strains. FEA is used here to predict parameters of mechanical performance during incisor and molar biting: force, strain magnitude and distribution, and overall cranial deformation. FE models of six crania were built, four of which represent extremes of normal variation among a modern Chilean adult sample (clinical imaging in life for medical reasons in the Clinical Hospital of the University of Chile). The remaining two represent artificially deformed crania from an archaeological population from the Atacama Desert, Northern Chile. The six adult crania were reconstructed from CTs following an approach validated and subjected to sensitivity analyses in a cadaveric human specimen. The models of living humans were loaded using maximum muscle forces estimated from their cross-sectional areas, and in the archaeological sample using average values. Kinematic constraints were applied on both mandibular fossae and bilaterally at the incisal borders of both I1, and on the occlusal face of left M1. Bite forces were calculated from reaction forces at bite points, and strain magnitudes and distributions were assessed using strain contour plots. Resulting overall cranial deformation was assessed through principal components analysis (PCA) of size-and-shape variables based on 43 landmarks. To ensure comparability among FE simulations, strains and overall cranial deformation were scaled to the values they would have with an incisor and molar bite force of 350N and 700 N respectively. The results show that the general pattern of strain distribution and magnitude, as well as large scale deformation, is very similar among all individuals, irrespective of if they were artificially deformed or not. Strains are greatest in the face near muscle attachments and bite points. The greatest bite forces were achieved by two crania in the non-deformed group, both with a narrow and less prognathic maxilla. These individuals also showed lower strain magnitudes and smaller regions of high strain. The deformed crania performed very like the other two non-deformed crania. These results show that despite considerable deformation during childhood which has resulted in quite large differences from normal in cranial form, masticatory system functioning in terms of bite force production and cranial response to loads, is remarkably consistent. This suggests that mechanisms exist during development, probably associated with masticatory function, allowing the craniofacial skeleton to maintain functional integrity despite quite severe modifications of normal developmental pathways for form.

Acknowledgements: The authors would like to thank the Calama City Council Archaeological Laboratory and to his curator Mr Manuel A Torres for facilitating the scanning of the archaeological sample; the Clinical Hospital of the University of Chile and the administrator of the Medical Imaging Centre Mr Victor Zapata for providing the medical CTs from where the non-deformed FE models were built. This work was funded by Becas Chile Grant and Anillo ACT-96 Project (both from Comisión Nacional de Investigación Científica y Tecnológica, Chile).

Poster Presentation Number 34, Fr (18:00-20:00)

## Trabecular bone distribution in the hominoid third metacarpal head reflects predicted loaded joint position

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The internal structure of bones – cortical and trabecular bone - can remodel during life in response to loading. The hand is the direct contact between the environment and the individual and thus the trabecular structure of hand bones may reflect different locomotor or manipulative behaviours across extant hominoids. Compared with complex joints, such as the humeral or femoral head, on which trabecular analyses have traditionally focused, loading directions in some joints of the hand are constrained. This, combined with variation in hominoid hand position during peak loading, indicates that a functionally relevant behavioural signal may be more easily identified in trabecular bone structure of the hand. Here we apply a novel method (MedTool) to microcomputed tomographic (microCT) scans of the hominoid third metacarpal head to identify functional differences in trabecular bone structure between three behavioural groups: knuckle-walking (*Gorilla*, *Pan*), suspension (*Pongo*, *Hylobates*, *Symphalangus*), and manual manipulation (*Homo*). The position of the metacarpophalangeal joint differs during predicted point of peak loading in these locomotor and manipulative behaviours. Results demonstrate that localisations of trabecular bone volume and regions of greatest stiffness, which are located at the articular surface, correspond with predicted loaded joint position in each behavioural group. In knuckle-walking taxa, where the metacarpophalangeal joint is extended during locomotion, concentrations of trabecular bone volume and regions of greatest stiffness are located at the dorsal surface in contrast to the palmar or distopalmar concentration of trabecular bone and greatest stiffness in suspensory taxa, reflecting a flexed joint during suspensory locomotion. In *Homo*, a palmodistal concentration of trabecular bone and greatest stiffness corresponds with the flexed positions associated with manipulative behaviour. The trabecular architecture of knuckle-walking taxa is characterised by high bone volume fraction and high degree of anisotropy in contrast to low bone volume fraction and low degree of anisotropy in the suspensory brachiators. In *Homo*, a low bone volume fraction is combined with variability in preferential orientation and in suspensory *Pongo* trabecular parameters are extremely variable. Trabecular bone distribution in the hominoid third metacarpal head clearly corresponds with the predicted loaded joint position during locomotor and manipulative behaviours. Thus, this method has potential for reconstructing loaded joint position in fossil hominoids, including hominins.

Acknowledgements: This research was supported by Jean-Jacques Hublin and the Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany and The Max Planck Society. For scanning assistance we thank Patrick Schoenfeld and Heiko Temming. For access to specimens in their care we thank Frieder Mayer (Berlin Museum für Naturkunde), Virginie Volpato (Frankfurt Senckenberg Museum), Christophe Boesch (Max Planck Institute for Evolutionary Anthropology), Emmanuel Gilissen and Wim Wendelen (Royal Museum for Central Africa), and Maria Teschler-Nicola, Ronald Muehl (Vienna Natural History Museum).

Poster Presentation Number 83, Sa (17:00-19:00)

New neonatal brain size estimation in hominin lineage

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The encephalization is considered as one of the pillars of the human evolution. To understand the complex process of encephalization it is necessary to have not only knowledge of the adult brain size in fossils but also the data concerning the non-adult specimens. The offspring brain volume is very important for the study of the relationship between maternal pelvic dimensions and the birth mechanism. However the lack of fossil material concerning to newborns in hominin lineage requires estimation from adult endocranial brain volume. The aim of this study is the newborn brain volume estimation in hominines based on the new equations based on the regressions and resampling techniques (Tuma, 2012) derived from DeSilva & Lesnik (2008) data and recent anatomically modern human sample (n=566). This approach was tested for Neanderthals (Tuma and Bruzek, 2013) and is consistent with CT-based virtual reconstructions of Neanderthal newborns. Material for this study consisted of the collected adult brain volumes of fossil specimens (Holloway et al., 2004). According to our estimations neonatal brain size varied in australopithecines (n=29) from 148 to 174 cm<sup>3</sup>, for early *Homo* (n=13) from 193 to 247 cm<sup>3</sup> and for *Homo erectus* (n=28) from 257 to 333 cm<sup>3</sup>. For European fossils of *Homo heidelbergensis* (n=12) we estimated their neonatal brain volume in the range of from 349 to 394, for Neanderthal group (n=23) from 366 to 450 cm<sup>3</sup> and for fossil anatomically modern *Homo sapiens*(n=56) from 383 to 453 cm<sup>3</sup>. These estimations were slightly lower in comparison of the previous published data. We discussed possible implications for the study of human evolution.

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Poster Presentation Number 95, Sa (17:00-19:00)

A reassessment of the Middle Pleistocene human dental remains from Visogliano (Trieste, Italy) based on high-resolution phase contrast microtomography

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The Middle Pleistocene human dentognathic assemblage from Visogliano, northeastern Italy, was discovered between 1983 and 1996 during excavations of two distinct loci of a karstic doline originated by the collapse of a cave: a rock shelter (locus A) and an outcrop of well-cemented breccia (locus B) located ca. 30 m W of the shelter (Boschian, 1999). According to the biostratigraphic and archaeological evidence, these loci are considered penecontemporaneous and have been recently dated by ESR/U series to ca. 400-500 ka (Falguères et al., 2008). The assemblage includes a right mandibular fragment (V2) still preserving the roots of the P4 and the M1, and of five isolated maxillary teeth identified as a LP3 (V4), a LP4 (V5), a RM1 (V6), a RM2 (V3), and a RM3 (V1) (Mallegni et al., 2002). Noteworthy, V1 had been originally recognized as an upper left third premolar (Mallegni and Tozzi, 1986). In 2012, these fossil specimens have been imaged using X-ray microtomography at the Multidisciplinary laboratory of the ICTP (Tuniz et al., 2013) and at the Tomolab station of the Elettra Synchrotron light source, both in Trieste, according to the following parameters: 100 to 130 kV voltage, 61 to 90 µA current, and a projection each 0.15°. The final volumes were reconstructed with an isotropic voxel size ranging from 10.0 to 13.6 µm, for the isolated teeth, and of 32.8 µm for the mandibular fragment. While the occlusal surface of the five isolated teeth is extensively worn, the 3D virtual imaging and analysis allows the investigation of their inner structural morphology. The V1's enamel-dentine junction (EDJ) shows two main cusps, a circular mesial fovea enclosed by the complete mesial marginal and transversal crests, a large triangular distal fovea, and multiple accessory crests, which recall the mirrored inner structural morphology of V4 (ULP3). The ULP3 V4 and the ULP4 V5, whose interproximal wear facets match together, display a similar EDJ morphology, the latter only being smaller and more symmetric. The upper molars V3 (URM2) and V6 (URM1), whose interproximal wear facets fit, show: four cusps; a weak expression of the Carabelli's trait; a mesially shifted mesial marginal ridge bearing three accessory cuspules; a small, buccally located, mesial fovea; an interrupted transverse ridge but a complete oblique crest; a low distal marginal ridge with two to three accessory cuspules; dense wrinkling. The fragmentary root of the LRP4 still preserved in V2 display a single restricted pulp canal with three apical canalicules, while the residual roots of the adjacent M1 exhibit two mesial canals and a larger, mesiodistally flattened distal one. Based on this new record, we reassess the serial position of V1 as more likely an URP3. Accordingly, as no available element rejects the possibility that these isolated teeth sample a single adult and that nothing can be stated about the links between the maxillary elements and the mandibular fragment, we parsimoniously evaluate at one the MNI represented in the human fossil assemblage from Visogliano. Acknowledgements: Soprintendenza per i Beni Ambientali, Architettonici, Archeologici, Artistici e Storici del Friuli-Venezia Giulia, Trieste; Nespos Society; ICTP/Elettra. EXACT Project funded by the Regione Friuli-Venezia Giulia.

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Podium Presentation: Session 5, Fr (17:40)

## “Fur and feathers / tooth and claw” – Magdalenian exploitation of small game and birds at Gönnersdorf und Andernach

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Our concept of Magdalenian faunal exploitation is greatly influenced by the masses of remains of large game, often horse and reindeer, recovered at many sites. More recent emphasis on the smaller faunal taxa shows that procurement of small game was also an important economical and social facet of Magdalenian life. Our contribution examines arctic fox, arctic hare and birds from the Rhineland Magdalenian open sites Gönnersdorf and Andernach. At Gönnersdorf by far the largest number of small game remains derives from arctic fox, representing a minimum of 33 individuals; 16 individuals of arctic hare were also represented. A holistic approach to zooarchaeological analysis, allowed detailed reconstruction not only of individual stages of processing carcasses, but of their specific location within features often interpreted as dwellings, revealing insights into Magdalenian social organisation at a household level. Although cut marks attributable to skinning, dismembering and filleting were observed on the carcasses of both species, regular patterns of damage to robust limb bones were only recorded for hare. Probably mainly a technique of carcass dismemberment, breakage was also employed to produce regular bone tubes, demonstrated by clear traces of cutting and sawing on several specimens. While only a single arctic fox bone showed traces of working, numerous teeth had been deliberately curated /collected and modified to “jewellery”. Most Gönnersdorf fox remains were recovered from concentration K I, where the butchering of fox carcasses was also carried out in the central area of paving and pits. K I is generally interpreted as a dwelling occupied in the colder part of the year and the large numbers of fox remains suggest that trapping and processing these animals for (winter?) pelts, but also meat, was a main activity of the inhabitants. Arctic hare remains show a more diffuse distribution across the Gönnersdorf site, located predominantly in K II, but also spread throughout K I and K III. The absence of discrete zones of activities associated with trapping and processing of hare is difficult to explain, particularly as evidence suggests long-term co-existence by people in the different dwellings. The partly differentiated treatment of fox and hare may have been determined by decisions pertaining to the end-products of trapping (e.g. pelts v meat v raw materials). Birds were represented at Gönnersdorf by 249 bones representing several species, including swan, goose, snowy owl, gull and raven, but dominated by ptarmigan / willow grouse whose remains seem to have been brought to the site as more or less complete carcasses. Bird remains were recovered in all major concentrations K I, K II and K III, but much more interesting is the distribution of specific combinations of elements in pits. A complete maxilla and mandible of a raven, found centrally in K II were presumably incorporated into a pit as an intact head and may represent simple waste disposal or perhaps a different act of (“ritual”?) deposition.

Podium Presentation: Session 7, Sa (8:00)

## New Excavations at La Ferrassie: Preliminary Results on some of the Lithic Industries

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La Ferrassie, which was originally excavated by Capitan and Peyrony at the beginning of the last century, is one of the most important Middle and Upper Paleolithic sites. Here, in the lower Mousterian layers, were found the remains of two adult Neandertals (LAF 1 and 2) and five other young individuals of varying ages. Associated with the eponymous Ferrassie Mousterian, these remains still constitute some of the best evidence for the practice of ritual burial of Neandertals. Overlaying the Middle Paleolithic layers are several layers representing the first half of the Upper Paleolithic. Renewed excavations at the site, which are located at the extreme western edge of the site, in close proximity to the two adult Neandertals, provide an important opportunity (a) to re-evaluate the nature of the industries and to assess the degree of original excavator bias; (b) to provide numerical chronology for the sequence; and (c) to understand the processes of site formation that operated both during and after the original deposition of the sediments and archaeological materials. After only two full seasons of excavations, the results presented here are still preliminary, but provide some important insights on the nature of the industries. The Mousterian industry at the base of the deposits is based on a Levallois and discoid technology and typologically consists of some bifaces and bifaces thinning flakes, denticulates and scrapers, but lacks backed knives. OSL ages place it at the end of MIS 5 and until the end of MIS 4. The morphology of the few bifaces recovered so far falls within the so-called industrie à biface from Barbas (MIS 6) and the MTA (MIS 3). This kind of industry at this date is rare in this region, and it is still unclear that it is representative of a true MTA. If it were, it would have major implications for the succession of Mousterian industries as it is currently understood. Immediately overlying this is an industry more attributable to the Ferrassie Mousterian, though certain issues are again apparent. Although generally the Ferrassie Mousterian is considered as dating to MIS 4, at La Ferrassie it is at the top of the MP sequence and dated to around 45-55 ka with OSL (MIS 3). While there is a dominance of Levallois technology and the existence of some scraper types that can be considered typical for the Ferrassie Mousterian (such as double and convergent scrapers), the flake tools are both few and diverse (including some truncated-faceted pieces), and fall within the range of what is seen at late Charentian industries such as at Villeneuve. Given the propensity of earlier prehistorians to save predominantly the more “diagnostic” pieces, and given recent studies elsewhere that fail to show any real conceptual differences between the Ferrassie and Typical Mousterian, our preliminary studies are beginning to cast doubt on the reality of this particular facies. Again, this would have considerable implications for French Middle Paleolithic systematics. Above the Mousterian, in very distinct and discrete a red clayey layer, is an industry that has yielded no Middle Paleolithic elements but is instead a blade-based industry with numerous bladelets. At the moment it is impossible to say whether it is representative of a Quincay-type Châtelperronian, Protoaurignacian, or a mixture of the two.

Poster Presentation Number 58, Fr (18:00-20:00)

Evolution, Cultural Influences or the Migrations in Paleolithic of Georgia

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The territory of Georgia (South Caucasus) is a crossroads between Europe and Asia, which is surrounded by the Great and Lesser Caucasian Ranges and the Black and the Caspian Seas. The most of the territories of Georgia were intensively occupied by the humans during the Middle Pleistocene and Late Pleistocene. The region was a geographic “deadlock” during the Paleolithic, where due to small area, different cultures were obliged to contact each other against the background of these cultures being one another’s competitors in mastering and using living resources More than 480 Paleolithic sites discovered on this small area (about 70000 sq.km). The territory of Georgia is divided into 6 regions by the dispersal of Paleolithic sites. More than 200 sites are represented in the Rioni-Kvirila basin (South Osetia, Western Georgia). Some Late Acheulean and Mousterian assemblages characterized by Levallois, proportion of blades and the use of bifacial retouches. In general the industry from artifacts caves and open sites from Rioni-Kvirila Basin resemble the “Tabun D-type” and Hummalian entities in the Levant. If the origin of these characters leads of think to a possible link with the Near-East, another hypothesis, developed in the 1960s–1970s by Georgian researchers, proposes a relationship between the Caucasian Acheulian and the Early Middle Paleolithic. The aim of our work is to determine and of the beginning of the Middle Paleolithic in southern Caucasus trying to find the part of local technical behaviors and influences born from contacts or population movements from neighboring areas. The most of the Acheulean materials are represented on the surface by the complexes or isolated finds. Unfortunately, we have stratigraphy only in several Lower Paleolithic sites: most of them are un-stratified. Only in several Paleolithic sites: 1. Dmanisi (1, 8 MA); 2. Akhalkalaki I (1 MA); 3. Kudaro I, III (Middle Pleistocene): Kudaro I and III (360-350000; 252000; 560000) A series of new TL dates from Djruchula Cave indicate at least two distinct human occupation phases. The dates from Middle Paleolithic Layers of Djruchula Cave are close to the dates of Acheulean layers from Kudaro Caves. All of these sites are located in the same, Rioni-Kvirila Basin. We suppose that some kind of cultural influences from the Near East have been started in Lower Paleolithic (Acheulean). Later, a local evolution of Paleolithic culture, cultural influences from the Near East (Zagros) and Northern Caucasus, the merging of these different features and a local development of the culture took a place in Middle Paleolithic. Some kind of continuation of several traditions, some links between Middle and Upper Paleolithic, merging of different culture features also have been observed in Upper Paleolithic of Georgia

Acknowledgements: The authors wish to thank their colleagues O.Bar-Yosef (Harvard University, Department of Anthropology, Peabody Museum), D. Adler (University of Connecticut, Department of Anthropology), L. Meignen (Centre d’Etudes, Préhistoire, Antiquité), N. Mercier (Institut de recherche sur les Archéomatériaux), H. Valladas (Laboratoire des Sciences du Climat et de l’Environnement, Domaine du CNRS), Marie-Hélène Moncel (CNRS et Département de Préhistoire du Muséum National d’Histoire Naturelle, Paris, France), David Pleurdeau (CNRS et Département de Préhistoire du Muséum National d’Histoire Naturelle, Paris, France) for many years of fruitful collaboration. The works were carried out in the framework of a research program conducted by O. Bar-Yosef and supported by the American School of Prehistoric Research (Peabody Museum, Harvard University). The dating program was supported by CNRS and CEA (France). The works were possible through research projects supported by the French Ministry of Foreign Affairs, “Qartu” Foundation (Georgia) and Ilia State University (Tbilisi, Georgia)

Podium Presentation: Session 9, Sa (13:40)

The *Homo erectus* from Turkey. New results from the anthropological study of the Kocabaş reconstructed skull and the chronological framework on the Denizli Basin

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Biochronological estimations regarding the fragmentary cranium of the only known Turkish *Homo erectus*, the Kocabaş (South-West of Turkey) hominid, are conflicting. First estimated at 0.5 Ma, the partial skull presents however archaic features similar to that of the Chinese Zhoukoudian specimens dated at 0.8 Ma and, furthermore, the associated fauna evidences the occurrence of species significant of the Middle Pleistocene. Firstly, using CT scan and 3D imaging techniques, we conducted a more complete reconstruction of this specimen fossil. Morphological and metric comparisons were done as well as morphometrics. According to these analyses, Kocabaş clearly belongs to the *Homo erectus s.l.* group including fossils from Africa, China and Georgia (*Homo georgicus*). It is different from the Indonesian *Homo erectus* and Middle and Upper Pleistocene specimens (*Homo heidelbergensis*, Neandertals and Upper Palaeolithic *Homo sapiens*). The Turkish Kocabaş fossil matches closely to African specimens such as ER3733 and OH9. Secondly, a multidisciplinary study combining sedimentological, paleomagnetic, paleontological, paleoanthropological studies and cosmogenic nuclide concentration measurements (26Al/10Be) and aiming to provide an absolute chronological framework to the Kocabaş hominid and its associated fauna was performed. The inverse polarity recorded in the conglomeratic levels that frame the fossiliferous travertine unit associated to the 26Al/10Be burial ages determined on pebbles from the same conglomeratic levels constrain the fossiliferous travertine unit deposition before the Cobb Mountain subchron starting at 1.22 Ma. The study of the collection of large mammal from travertine deposits reveals that this association generically resembles those from Late Villafranchian of South and Eastern Europe, and, partly, from Western Asia, i.e. older than 1 Ma.. Remarkably agreeing, the biochronological estimation, cosmogenic nuclide burial dating and associated paleomagnetic stratigraphy attest of the antiquity of the human occupation of the Anatolian Peninsula and challenge the current knowledge of the *Homo erectus* dispersal over Eurasia. Interestingly, the obtained chronology implies synchronicity with the initial peopling of Europe and provides the strongest evidence of *Homo erectus* in western Asia.

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Podium Presentation: Session 11, Sa (15:20)

## The Qesem Cave dental material: A first morphometric analysis based on $\mu$ CT images of mandibular teeth

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Background: Qesem Cave in Israel has yielded ten Middle Pleistocene hominin teeth. Classic description and linear measurements have been published for eight of them [1], pointing out the ambiguous morphological affinities to the Skhul/Qafzeh population and Neanderthals (NEA). The teeth were associated with a blade-dominated industry of the Acheulo-Yabrudian Cultural Complex (AYCC) dated to 420-200ka [2,3]. Of particular interest are the mandibular P<sub>3</sub> and P<sub>4</sub>, coming from the lower sequence of Qesem Cave dated to 350ka, most likely from the same individual, and the newly discovered lower M<sub>1/2</sub> from the upper sequence of Qesem Cave post-dating 300ka. Significance of research: The Qesem hominins are roughly contemporary with *Homo heidelbergensis* and Proto-Neanderthals from Spain. Since the Levant is a corridor for migration between Africa and Eurasia, the material can potentially inform about morphological diversification and geographic dispersal in the crucial time before NEA and anatomically modern humans (AMH) appeared. Material and Methods: For the morphometric analysis, we established research collaboration between Tel Aviv University and Vienna University. The Qesem teeth were  $\mu$ CT scanned at the Vienna Micro-CT Lab with a VIS-COM X8060II (resolution 9-14 $\mu$ m). Fossil material from Qafzeh, Skhul, Amud, Tabun, Kebara, and Ohalo, as well as comparable modern human teeth were also scanned.  $\mu$ CT scans for Neanderthals and *H. heidelbergensis* were obtained from other institutions. Cervical and crown outlines were collected from the 3D surface models (P<sub>3</sub>=21; P<sub>4</sub>=20; M<sub>1/2</sub>=25) of the dental crowns oriented according to the buccal crest of the enamel-dentine junction (P<sub>3</sub>, P<sub>4</sub>) resp. the enamel fissure pattern (M<sub>1/2</sub>). 24 pseudolandmarks were sampled along each outline and analysed through Geometric Morphometric methods [4]. Results: The results for the premolars show a dominance of size in form space. LnCentroidSize accounts for 83-90% of total variance for both crown and cervical outlines. PC1s show loadings of 0.99 for size, meaning there is almost no allometry present (shape is virtually independent from size). AMH and NEA are almost perfectly distinguished by size, and Qesem P<sub>3</sub> and P<sub>4</sub> are in the mid to lower range of AMH. The three nearest specimens to Qesem in form space are always recent humans for all outlines. In shape space, the results are less definite, where the Qesem specimens plot within AMH and NEA, which overlap greatly. The M<sub>1/2</sub> shows a degree of expression of the EDJ trigonid crest that was described as absent in modern humans [5] (Mauer has only a weak crest and Jebel Irhoud 3 lacks it completely). Its LnCentroidSize lies outside the AMH interquartile range and at the upper NEA range. Conclusion: In form space, the Qesem premolars are closer to AMH than to Neandertals. Shape analyses are less conclusive. Our preliminary results also indicate an interesting dissociation between size and shape for premolars, in contrast to molars featuring higher occlusal complexity [6]. The preliminary data from the M<sub>1/2</sub> analysis are less indicative and may suggest Neanderthal affinity. This has implications for the taxonomical assessment of the Qesem material and for the behavioural changes in the Middle Pleistocene.

Acknowledgements: We are grateful to Martin Dockner for support during  $\mu$ CT scanning, Roman Ginner for taking photographs, Vivian Slon, Hila May, and Aviad Agam for transport. We thank the Tel Aviv University Anthropological Collection, the Croatian Natural History Museum in Zagreb, the Muséum National d'Histoire Naturelle in Paris, The Ruprecht Karls Universität Heidelberg, the Max-Planck Institute Leipzig, and NESPOS for access to fossils resp. for scanning fossils, and María Martínón-Torres and José María Bermúdez de Castro for discussion. Research was supported by A.E.R.S. Dental Medicine Organisations GmbH, Vienna, Austria, and the Dan David Foundation.

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Poster Presentation Number 20, Fr (18:00-20:00)

## Spatial and temporal variation in the body size of early *Homo*

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The estimated body sizes of the earliest members of the genus *Homo* (2.4–1.5 Myr) are central to interpretations of their evolutionary origin, taxonomy, adaptive strategies, and dispersals. It is widely accepted that *Homo ergaster* possessed increased body size, compared to *Homo habilis* and *Homo rudolfensis*, and that this may have been a factor involved with the earliest dispersal of *Homo* out of Africa. The study of taxonomic differences in body size, however, is problematic. Postcranial remains are often fragmented and not associated with craniodental remains on which species are defined, and taxonomic attributions are frequently based upon the size of skeletal elements. There is also no consensus on the attribution of individual specimens to a hypodigm within early *Homo*. Previous body size estimates have thus been based upon the most well-preserved specimens with a more reliable species attribution, resulting in small sample sizes ( $n < 5$ ). Since these samples are disparate in space and time, little is known about geographic and chronological variation in body size within early *Homo*. This study takes a different approach in focussing on two parameters which are easier to control than taxonomy: Geography and chronology. We investigate temporal and spatial variation in body size among fossils purported to represent early *Homo* by considering evidence for size variation from isolated and fragmentary postcranial remains ( $n = 42$ ). We assigned specimens to five spatiotemporal groups and compiled metric data from a broad literature search, resulting in a database of >400 individual measurements. To render the size of disparate fossil elements comparable, we derived new regression equations from a globally representative sample of hunter-gatherers ( $n = 828$ ; 17 populations), and applied them to the available postcranial measurements from the fossils. This approach provided new body size estimates for twelve early *Homo* specimens for which body size has not been estimated before. The results suggest that there are no constant unilinear temporal or geographical trends for the evolution of body size within early *Homo*, despite abundant chronological and spatial variation. The eastern African specimens comprise the two groups with the largest body sizes at 1.9 Myr and <1.7 Myr (both Koobi Fora) but also the one with the lowest (Olduvai Gorge). The observed size differences support the cranial evidence for at least two separate and co-existing species in the Early Pleistocene of east Africa. The Dmanisi hominins fall in the lower range for body size variation within early *Homo*, lying closest in stature and body mass to Olduvai specimens at 1.8 Myr. Pronounced body size increases in early *Homo* within Africa appear to take place after hominin populations were established at Dmanisi (1.77 Myr). Taken together, the temporal variation that we identify suggests that body size increases were not established in the African fossil record prior to dispersals out of Africa. Our results also indicate that the primary evidence for body size increase among early *Homo* is based upon material from Koobi Fora, which suggests that there was regional variation in size.



Poster Presentation Number 80, Sa (17:00-19:00)

### Ontogenetic and static allometry in contemporary human male faces, and why it matters

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Physical anthropology has investigated the association of body height with patterns of intra- and intersexual selection in humans and their closest relatives. Research was mainly concerned with either sexual dimorphism in stature and/or with skull shape. Another field, evolutionary psychology, has related the attribution of masculinity, dominance, and attractiveness to distinct features in the human face. The conceptual and empirical missing link between these two approaches might be facial allometry, i.e. facial shape characteristics correlated with overall body size. This aspect of facial shape variation has been widely neglected in the recent literature. Thus, to begin with, this study was designed to identify size cues in male faces. We hypothesized that being taller is associated with facial shape features of extended postnatal growth and maturity. Nineteen boys (6–11 years) and 25 men (17–33 years) were instructed to directly face the camera approximating the Frankfort Horizontal with a neutral facial expression. The camera with a 200 mm lens was positioned at eye height and 3.55 m away from the face. Data collection took place in Austria and included the measurement of body height and other anthropometric data. Thereafter, sixty-nine predefined landmarks and sliding semi-landmarks were digitized on each frontal portrait. Geometric morphometrics was used for the analysis of facial shape and form. We assessed allometry by regressing facial shape coordinates on age, on log centroid size, and body height in the full sample (ontogenetic allometry) and within adults (static allometry). All three ontogenetic regressions yielded highly similar results and explained between 20% and 24% of facial shape variation ( $p < 0.001$ ; 1,000 permutations). In adult men, facial size is no longer significantly associated with facial shape in our sample (3% expl. var.,  $p = 0.76$ ), whereas body height and age account for 8% and 7% of their shape variation, respectively ( $p < 0.001$  each). In both (ontogenetic and adult) samples, increasing body height is associated with a relatively larger lower face, thinner lips, a longer nose and decreasing relative eye size. The eyes are framed by lower and flatter eyebrows. The static regression on age, however, seems to reflect another pattern: aging as opposed to facial growth. These results suggest that there are reliable shape cues to body height in contemporary human male faces with taller individuals exhibiting more mature facial features. This has several implications for leading-edge face research. Most of all, stimuli were often isometrically “standardized” for facial size, yet, we showed, that same-sized faces still encode size information through their shapes. This way, allometry might be a hidden dimension in the interpretation of evolutionary aesthetics in general, and facial masculinity and mate preferences in particular. Geometric morphometrics has the potential to disentangle biological factors underlying facial shape variation, relate them to interpersonal perceptions, and thus to add a piece to an evolutionary understanding of how intra- and intersexual selection might have shaped hominid faces.

Acknowledgements: This work was partly funded by a fellowship of the Konrad Lorenz Institute for Evolution and Cognition Research, Altenberg, Austria to S. Windhager.

Poster Presentation Number 142, Sa (17:00-19:00)

### Exploration, Isolation, or Seasonal Migration? Idiosyncratic technological organization in the Late Middle Palaeolithic re-colonization of Britain, MIS 3

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The British late Neandertal archaeological record has frequently suffered from a ‘bad press’, and it is indeed numerically sparse in comparison to that found across the Channel, lacking deeply stratified sites and very large lithic assemblages. However, its geographical and temporal situation offer a unique circumstance for examining questions about this highly flexible hominin species’ techno-economic adaptations during its later development. The British Late Middle Palaeolithic (LMP) is the north-westernmost Neandertal occupation in Europe, and represents the only defined context where we can distinguish this species moving into unfamiliar regions, that had been abandoned for over 100,000 years following sea-level rise during early Marine Isotope Stage (MIS) 5. Furthermore, this colonization occurred during the greatly fluctuating climate and environments at the end of the MIS 4 glacial and through the early-mid Stage 3 ‘failed’ interglacial. This situation, of hominins inhabiting new landscapes at the edge of their range during extreme climate change, might be expected to stimulate novel behavioural responses. Detailed analysis of the best-dated lithic assemblages from Britain during this period permits consideration of these questions for the first time. The results of both inter- and intra-assemblage analysis show that the British LMP does in fact present a quite distinctive and persistent lithic technological strategy in comparison to the Continental record. This includes a focus on particular tool production and maintenance trajectories (dominance of bifaces and absence of Levallois), exploitation of raw materials according to landscape-scale geological context, and apparent uni-directional tool transport. This paper presents the lithic evidence in detail, and considers the possible factors underlying this idiosyncratic techno-economic adaptation including cultural isolation, strategies of mobility and colonization itself.

Acknowledgements: The majority of the original analysis was carried out 2004-2010 as doctoral research at University of Sheffield. It was funded by a University Research Scholarship. I thank all the museums and institutions for access to collections. I am especially indebted to the late Roger Jacobi for his detailed knowledge on the history of the collections which he generously shared.

Podium Presentation: Session 6, Fr (16:00)

The Expert Cognition Model in Human Evolutionary Studies

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The modern mind is not a single cognitive phenomenon. It consists of many interconnected networks, each of which has its own evolutionary history. One such system that has been underappreciated in evolutionary studies, but which governs many skilled activities such as craft production, is expert cognition or expertise. Cognitive psychologists have identified several salient features of an expert performance: • Rapid problem assessment • Rapid switching from one solution/tactic to another • Virtually error-free performance • Attention switching without loss of information • Narrow range of applicability • Learning based on repeated practice (with mastery averaging 10 years) Expertise is best represented by high-level performances such as chess and music, but it is also a style of thinking that all of us use in every-day life. Of particular evolutionary interest is that expertise is largely non-verbal. The most explicit cognitive model for expertise is that developed by Anders Ericsson (K. Ericsson & Delaney, 1999; K. A. Ericsson & Kintsch, 1995; K. A. Ericsson, Patel, & Kintsch, 2000). It incorporates the interaction of two well-known cognitive systems – working memory and long-term memory. According to this model expertise relies on retrieval structures, which are sets of linked procedures and knowledge, learned through repetition, stored in long-term memory, and activated as needed in working memory. Here we illustrate the power of Ericsson’s model by applying it to several examples of prehistoric expertise. As reconstructed by Haidle and Lombard (Lombard & Haidle, 2012), bow-and-arrow technology is a complex set of activities that requires organization at several different temporal scales. The overall technology is broken up into a number of discrete modules, and each of these modules is governed by expert cognition. All of the components of expertise are here and, indeed, their internal organization resembles that of any modern craft such as blacksmithing (Keller & Keller, 1996). This picture of modern expertise can be contrasted with earlier chaines operatoires such as Levallois and biface production. The picture that emerges is quite telling – the overall structure of expertise has been in place for hundreds of thousands of years, but the capacities of individual components – working memory and long-term memory in particular – have evolved.

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Podium Presentation: Session 11, Sa (16:00)

Middle Pleistocene hominin teeth from China and implications for our understanding of human evolution in Eurasia

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Among the hominin fossils that have been found so far in China, there are several and rich dental collections from the Middle Pleistocene such as Zhoukoudian, Hexian, Yiyuan, Chaoxian, Panxian Dadong, Jinniushan and others. These fossils have been classically attributed to either *Homo erectus* or archaic *Homo sapiens*. Recently, new and more detailed morphological descriptions and comparisons have been carried out on these teeth, providing further morphological information about the Chinese Middle Pleistocene hominins and shedding new light on our understanding of the human evolution in Eurasia. Here, we present the dental evidence from some of these localities as well as some of the conclusions achieved from the reevaluation of these fossils. 1) The metric and morphological variability of the Chinese Middle Pleistocene teeth is wide. 2) Although the ages of the hominin fossil bearing deposits at Zhoukoudian cover a period of at least 300 ka, the dental morphological patterns remain relatively stable throughout the sequence. In addition, Zhoukoudian fossils present some derived features with regard to Early Pleistocene Asian populations like those from Sangiran. 3) Some late Middle Pleistocene hominin teeth from China, like those recovered at Panxian Dadong, display derived morphological features that make them more similar to early modern humans than to other contemporaneous populations from Asia and Africa. 4) The Chinese hominin teeth share some features with the European Middle and Upper Pleistocene hominin fossils. However, no typical Neanderthal features have been identified in these collections. So far, our knowledge and understanding on the exact relationship between the European and the Chinese hominins are still limited. Growing evidence suggest that primitive-derived gradients are not satisfactorily fitted within a chronological frame and suggest more complex evolutionary scenarios with the coexistence and/or survival of different lineages in Eurasia. Our dental studies provide new data on this topic and emphasize the necessity of building a new model to explain the evolution in Asia and Europe in the following years.

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

## Hominid paleobiodiversity at Java during the Early-Middle Pleistocene. New insights from the inner tooth structural morphology

Clément Zanolli<sup>1</sup>, Anne-Marie Bacon<sup>2</sup>, Luca Bondioli<sup>3</sup>, José Braga<sup>4</sup>, Fabrice Demeter<sup>5</sup>, Jean Dumoncel<sup>4</sup>, Claudio Tuniz<sup>1,6,7</sup>, Virginie Volpato<sup>8</sup>, Roberto Macchiarelli<sup>9,10</sup>

1 - Multidisciplinary Laboratory, The 'Abdus Salam' International Centre for Theoretical Physics, Trieste · 2 - UPR 2147 CNRS, Paris · 3 - Sezione di Antropologia, Museo Nazionale Preistorico Etnografico "L. Pigorini", Roma · 4 - UMR 5288 CNRS, U. Toulouse · 5 - Muséum National d'Histoire Naturelle, Paris · 6 - Dipartimento di Biologia Ambientale, U. Roma "La Sapienza" · 7 – Centre for Archaeological Science, U. Wollongong · 8 – Dept. of Paleoanthropology & Messel Research, Senckenberg Research Institute · 9 – UMR 7194 CNRS, MNHN, Paris · 10 – Département Géosciences, U. Poitiers

Since the first discovery of *Homo* (*Pithecanthropus*) *erectus* by E. Dubois at Trinil in 1891, over 200 hominid tooth specimens were recovered in the Pleistocene deposits of the Sangiran Dome, in Central Java. However, while most of this material is commonly attributed to *H. erectus*, due to the wide morpho-dimensional variation characterizing the Southeast Asian and Indonesian fossil hominid record, some robust specimens have been tentatively allocated to other nonhuman taxa (*e.g.*, *Meganthropus paleojavanicus*, *Pithecanthropus dubius*, or even to *Pongo sp.*). Besides the impact at regional scale of the intermittent glacio-eustatic fluctuations occurred during the Pleistocene on the evolutionary dynamics and variation patterns, this taxonomic uncertainty is due to the convergence in molar crown size and morphology between *Homo* and the Ponginae, notably in the case of worn specimens (Smith et al., 2009; Zanolli et al., 2012). In this context, the debate on a still unrecognized "mysterious fossil ape" has been recently re-launched (Ciochon, 2009). In order to contribute the assessment of the hominid paleobiodiversity at Java during the Early-Middle Pleistocene, we have used the 3D tooth structural morphology as virtually revealed by X-ray microtomography. We firstly characterized the inner pattern of five indisputably human permanent molars from the Kabuh Formation of the Sangiran Dome attributed to *H. erectus* (Zanolli, 2013). Then, we comparatively detailed the condition displayed by the M2 and M3 from the mandibular fragment Arjuna 9 ('Grenzbank Zone' of Sangiran), a specimen originally compared to *M. paleojavanicus* because of its large dimensions and primitive morphology, and later allocated to *H. erectus* (Grimaud-Hervé and Widiyanto, 2001). The microtomographic record made available for the two upper molars from Trinil (<http://paleo.esrf.eu>) has been also used for quantitative assessment. We preliminary performed a semi-automatic segmentation (using image tonal range modifications and inter-slices interpolations) allowing the 3D modelling of the enamel-dentine junction (EDJ) surfaces. In the case of Trinil, the protocone dentine horn apex of Trinil 11621 has been reconstructed on the base of the morphology of its paracone and the preserved mesial dentine horns of Trinil 11620. Geometric morphometric analyses were performed on two sets of landmarks placed on the EDJ of all the investigated specimens. A new method of fitting deformation-based models has been also applied on the entire EDJ surface (Durrleman et al., 2012). We comparatively used similar evidence from upper and lower permanent molars representing extant and fossil humans (North African *H. heidelbergensis* and Neanderthals) as well as extant and fossil *Pongo*. The results reveal two distinct patterns of molar dentine horn height and position, the human one being associated to a higher EDJ topography. While the 2D investigation of the Trinil molars (re)attributed both specimens to *H. erectus* (Smith et al., 2009), following our 3D analyses their taxonomic assessment remains contentious. More strikingly, the specimen Arjuna 9 clearly sets apart from the human pattern, including *H. erectus*, and more closely fits the pongine condition, thus pointing to a more complex Early to Middle Pleistocene hominid paleobiodiversity at Java than previously thought.

[ Zanolli et al. cont. ]

Acknowledgements: F Sémah, D Grimaud-Hervé and H Widiyanto made possible the analysis of most fossil specimens from Sangiran within the framework of a collaboration between the French MNHN, the Pusat Penelitian Arkeologi of Jakarta, and the Balai Pelestarian Situs Manusia Purba of Sangiran. The Centre de Microtomographie at the U. Poitiers for analytical facilities. The ESRF for having made available the microtomographic record of the Trinil molars. The Senckenberg Museum of Frankfurt, the Musée Zoologique of Strasbourg, the U. Florence, the Museo di Storia Naturale of Trieste, the NESPOS Society for access to comparative material. D Arbuta, C Argot, F Bernardini, N Bressi, A Coppa, MC Dean, A Froment, FE Grine, C Hertler, O Kullmer, C Lefèvre, H Lelièvre, B Maureille, A Mazurier, P Mennecier, L Rook, F Schrenk, MD Wandhammer for collaboration.

**References:** Ciochon RL, 2009. The mystery ape of Pleistocene Asia. *Nature* 459, 910-911. Durrleman S et al. 2012. Comparison of the endocranial ontogenies between chimpanzees and bonobos via temporal regression and spatiotemporal registration. *J. Hum. Evol.* 62, 74-88. Grimaud-Hervé D, Widiyanto H, 2001. Les fossiles humains découverts à Java depuis les années 1980. In: Sémah F et al.(Eds.), *Origine des peuplements et chronologie des cultures paléolithiques dans le Sud-Est asiatique*. Artcom', Paris, pp. 331-358. Smith TM et al. 2009. Taxonomic assessment of the Trinil molars using non-destructive 3D structural and development analysis. *PaleoAnthropol.* 2009, 117-129. Zanolli C, 2013. Additional evidence for morpho-dimensional tooth crown variation in a new Indonesian *H. erectus* sample from the Sangiran Dome (Central Java). *PLoS ONE* (in press). Zanolli C et al. 2012. Two human fossil deciduous molars from the Sangiran Dome (Java, Indonesia): outer and inner morphology. *Am. J. Phys. Anthropol.* 147, 472-481.



Podium Presentation: Session 2, Fr (12:10)

## New Discovery of Middle Pleistocene Hominin fossils from the cave site “Sunjiadong” at Luanchuan County of Henan Province in Central China

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The Sunjiadong Cave-deposit site (111°41’38.0”E,33°47’50.0”N) is located in central China at the eastern end of Qinling mountains which are the geological boundary mountains of the north China from the south. The fossil site was discovered by the local farmers and excavated by Luoyang Cultural Relics and Archaeology Institute and Luanchuan Heritage Management Centre in May to October 2012. From the site, a large number of Pleistocene mammal fossils and several stone artifacts and human fossils were discovered [1]. Up to now there are 6 human teeth fossils found , including one lower lateral incisor with complete crown and root, two lower molars and one upper molars with slight-worn crown and uncompleted root, and also one upper premolar P4 and one lower third molar both are crown germs without any root developed. The author suggested it is possible these teeth might belong to one individual, who was a juvenile at death and its dental developmental condition is comparable with 7-8 years old of modern humans. The tooth sizes are within the range of *Homo erectus* teeth from Zhoukoudian Locality 1 and also within the range of archaic *Homo sapiens* found in China. The general sizes are larger than that of modern humans. Moreover their morphological traits present the typical primitive characters of human teeth from Zhoukoudian Locality 1, such as the abundant accessory wrinkles in the occlusal surface of premolar and molar, cingulum and traces of styler cusps in molar, *Dryopithecus* cusps pattern of lower molar, taurodontism of the larger roominess of pulp cavity in molar, robust root. The typical trait of mid-trigonid crest (MTC) of lower molar in Neandertals is absent in Luanchuan’s specimen. The enamel thickness of upper and lower molar is thicker than that of Neandertals both in absolute and relative values based on the Micro-CT technique, and it is comparable to Asian *Homo erectus*. The mammal fauna indicates the geological age should be Middle Pleistocene, because it include the typical members of Middle Pleistocene fauna in North China, such as *Megaloceros pachyosteus*, *Pachycrocuta sinensis* *Sus lydekkeri*,et al. The complex of hominin fossils of Middle Pleistocene need to be interpreted properly for understanding the phylogeny of different species of the genus *Homo* found in Asia, Europe and Africa from the Early Pleistocene to Late Pleistocene, and it is also a hard work for explaining how our own species *Homo sapiens* evolved.

Acknowledgements: The authors are very grategul that Luoyang Cultural Relics and Archaeology Institute of China invite us to do the research on the hominin fossils. We are thankful that Prof. Dr Jean-Jacques Hublin and European Society for the Study of Human Evolution invite us to join in the 3rd Annual ESHE(2013) Conference.

**References:**[1] Luoyang Cultural Relics and Archaeology Institute, Luanchuan Heritage Management Centre. 2013. A Report on the 2012 Excavation of the Sunjia Cave Site in Luanchuan of Henan province. Communication Bulletin of Luoyang Cultural Relics and Archaeology Institute, 2013.

Poster Presentation Number 56, Fr (18:00-20:00)

## The Upper Paleolithic of the Ikh Tulberin Gol (Northern Mongolia): new excavations at the Tolbor 16 open-air site

Nicolas Zwyns<sup>1,2</sup>, Sergei A. Gladyshev<sup>3</sup>, Biamba Gunchinsuren<sup>4</sup>, Tsendendorj Bolorbat<sup>4</sup>, Andrei V. Tabarev<sup>3</sup>, Tamara Dogandzic<sup>2</sup>, Nina Dörschner<sup>2</sup>, Kathryn Fitzsimmons<sup>2</sup>, Damien Flas<sup>5</sup>, J. Christopher Gillam<sup>6</sup>, Arina M. Khatsenovich<sup>3</sup>, Shannon P. McPherron<sup>2</sup>, Davakhuu Odsuren<sup>4</sup>, Cleantha Paine<sup>7</sup>, Khovor-Erdene Purevjal<sup>4</sup>, Michael Richards<sup>2,8</sup>, John Stewart<sup>9</sup>, Sahra Talamo<sup>2</sup>

1 - University of California, Davis, · 2 – Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology · 3 - Insititute of Archeology and Ethnography, SBRAS Novosibirsk, Russia · 4 - Institute of Archeology, MAS, Ulaanbaatar, Mongolia · 5 – FNRS Belgium · 6 – University of South Carolina · 7 – University of Cambridge · 8 – University of British Columbia · 9 – Bournemouth University

Numerous questions remain regarding the timing and the context of Upper Paleolithic emergence in Northeast Asia. Available data allow the recognition of a form of Initial Upper Paleolithic (IUP) (Brantingham et al, 2001) documented in the Altai circa 45-40 ka uncal BP (Goebel et al., 1993, Derevianko et al, 2000, Zwyns et al., 2012), in the Cis- and Transbaikal around 40 ka uncal BP (Lbova, 2008). In Northern Mongolia, a series of assemblages show intriguing similarities with IUP laminar assemblages from Siberia and suggest long distance contact/movements of population during the first half of MIS3 (Zwyns, 2012). These contacts are potentially favored by to the proximity of a main inflowing river that drains into the Lake Baikal, the Selenga. By cutting through the Sayan and the Yablonoi mountain ranges, the Selenga drainage system stands as one of the most convincing corridor that would connect Siberia with the plains of Mongolia. The site of Tolbor 16 is located in the Ikh Tulberiin Gol (the Tolbor Valley), circa 7 km away from the confluence with the Selenga. Discovered and tested in 2010, this open-air site is excavated since 2011. The preliminary results of the 2011-2013 campaigns suggest that the T16 sequence documents successive human occupations associated with the early stages of UP in the region. Based on the preliminary analysis, a possible succession of two distinct complexes can be recognized, similar to the one described at the neighboring site of Tolbor-4 (Derevianko et al, 2007, Rybin et al., 2007, Gladyshev et al., 2010). The lower layers show a first occurrence of IUP around 40 ka uncal BP followed by an Early UP complex around 34-33 ka uncal BP. The primary goal of this project is to obtain a better understanding of the processes involved in this shift by generating high-resolution contextual data. Ultimately, the archeological, chronological and environmental sequence of T16 will be used to test predictions derived from the proposed model, such as the existence of a united IUP between Southern Siberia and Northern Mongolia or the ‘Selenga corridor hypothesis’. Hence, a fine-grained reconstruction of the chrono-cultural sequence of the Tolbor Valley could have a significant impact on the current understanding of Late Pleistocene peopling dynamic in Northeast Asia. Acknowledgements: We are grateful to the Leakey Foundation, the Max Planck Society and the Russian Found for Science and Humanities for their financial and logistical support since the earliest stage of this project. Our gratitude goes to all the people who took part in the excavationthe local authorities from the Bulgan Aimag for supporting this research project

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Co-authors’ names are listed alphabetically below, and indicate the session of their presentation. Podium presentations list the time of the talk and posters list the poster number. Sessions are listed in the following format:

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Alcicek, Mehmet Cihat: S9- Sa (13:40)  
Aldeias, Vera: S7- Sa (8:00)  
al-Ghazzi, Abdulaziz: Post- Fr (67)  
Alt, Kurt: Post- Sa (125)  
Anikovich, Mikhail: S5- Fr (16:40);  
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Ankjaergaard, Christina: Post- Fr (49)  
Antunes, Nicolas: Post- Fr (75)  
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Bakels, Corrie C.: Post- Fr (46)  
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Bertolini, Marco: Post- Sa (118), (119)  
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Blinkhorn, James: S4- Fr (14:00)  
Boeckx, Cedric: Post- Sa (91), (92)  
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Bolton, Lucie: Post- Sa (133)  
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 Edwards, Ceiridwen: Post- Fr (12)  
 Egeland, Charles P.: S1- Fr (9:40);  
   Post- Sa (145)  
 Estalrrich, Almudena: Post- Fr (30), Sa (110)

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   S12- Sa (16:20)  
 Feibel, Craig: S1- Fr (8:40)  
 Fink, Bernhard: Post- Fr (13)  
 Firsov, Aleksey: Post- Fr (55)  
 Fitton, Laura C.: Post- Fr (2), (3), (11)  
 Fitzsimmons, Kathryn E.: S8- Sa (10:40);  
   Post- Fr (52), (56)  
 Flas, Damien: Post- Fr (56)  
 Foley, Robert A.: S10- Sa (13:00);  
   Post- Sa (105)  
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   S11- Sa (15:20)  
 Frater, Nakita: Post- Fr (26)  
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 Gopher, Avi: S11- Sa (15:20)  
 Goswami, Anjali: Post- Fr (1)  
 Gracia-Téllez, Ana: S11- Sa (15:00);  
   Post- Fr (40), (41), Sa (109), (123)  
 Gramsch, Bernhard: S5- Fr (17:20)  
 Gravina, Brad: Post- Sa (140)  
 Grimaud-Herve, Dominique:  
   Post- Sa (89), (98), (100)  
 Gross, Thomas: Post- Fr (33), (34), (35)  
 Groucutt, Huw: S10- Sa (13:40)  
 Grunstra, Nicole: Post- Sa (105)  
 Guérin, Guillaume: S7- Sa (8:00);  
   Post- Fr (51)  
 Guipert, Gaspard: S9- Sa (13:40)  
 Gunchinsuren, Biamba: Post- Fr (56)  
 Gunz, Philipp: S2- Fr (11:50); Post- Fr (6),  
   Sa (77), (79), (84), (85), (90), (106)

## H

Haesaerts, Paul: S4- Fr (14:20); Post- Fr (60)  
 Haeusler, Martin: Post- Fr (18), (28)  
 Haidle, Miriam: S6- Fr (16:00)  
 Hambach, Ulrich: S8- Sa (10:40)  
 Hanik, Susanne: S5- Fr (17:20)  
 Harcourt-Smith, William: Post- Fr (19)  
 Hardy, Bruce: S12- Sa (16:20)  
 Hardy, Karen: S5- Fr (16:20)  
 Harichane, Zoheir: S2- Fr (10:30)  
 Harmand, Sonia: S1- Fr (8:40); Post- Fr (14)  
 Harvati, Katerina: S2- Fr (11:10);  
   Post- Fr (10), Sa (100)  
 Haslam, Michael: S1- Fr (8:20)  
 Hedges, Robert E.M.: S4- Fr (15:20)  
 Henry, Amanda G.: Post- Sa (116), (128), (129)  
 Henry-Gambier, Dominique: Post- Sa (115)  
 Hernandez, Marion: Post- Fr (50), Sa (139)  
 Hershkovitz, Israel: S11- Sa (15:20)  
 Higham, Thomas F.G.: S4- Fr (15:20),  
   S7- Sa (8:40), S8- Sa (10:20)  
 Hilbert, Yamandú Hieronymus: Post- Fr (67)  
 Hodgson, Derek: S6- Fr (17:40)  
 Hoffecker, John Frank: S5- Fr (16:40)  
 Holliday, Trenton W.: Post- Fr (17)  
 Holub, Martin: S8- Sa (11:20); Post- Fr (63)  
 Hora, Martin: Post- Fr (42)  
 Horacek, Ivan: Post- Fr (63)  
 Hoyka, Markus: S2- Fr (11:50)  
 Hublin, Jean-Jacques: S2- Fr (11:10), (11:50),  
   S7- Sa (9:20), S8- Sa (11:00),  
   S11- Sa (16:20); Post- Fr (35), (52), (60),  
   Sa (79), (84), (85), (106)  
 Huguet, Rosa: Post- Fr (30), Sa (110), (122)  
 Hutson, Jarod: Post- Sa (125)

## I

Iovita, Radu: S8- Sa (10:40);Post- Fr (72),  
   Sa (136)

## J

Jacobs, Zenobia: S7- Sa (8:20)  
 Jäger, Frank: Post- Fr (72)  
 Jain, Mayank: Post- Fr (49)  
 Jennings, Richard: S10- Sa (13:40)  
 Jéquier, Camille: S4- Fr (15:00); Post- Sa (120)  
 Jones, Eppie R.: Post- Fr (12)  
 Jones, Martin: S5- Fr (17:00)  
 Joordens, Josephine: Post- Sa (104)  
 Jöris, Olaf: Post- Sa (149)  
 Julien, María: S7- Sa (9:00)

## K

Kadowaki, Seiji: Post- Sa (149)  
 Kandel, Andrew W.: Post- Sa (138)  
 Kandi, Nadia: S2- Fr (10:30)  
 Karakostis, Fotios-Alexandros: Post- Fr (37)  
 Kato, Hirofumi: Post- Sa (149)  
 Katz, David: Post- Fr (9)  
 Kellberg Nielsen, Trine: Post- Sa (145)  
 Kelso, Janet: S2- Fr (11:30)  
 Kennedy, Brett: Post- Sa (104)  
 Khatib, Samir: S9- Sa (13:40)  
 Khatsenovich, Arina M.: Post- Fr (56)  
 Khreisheh, Nada: Post- Fr (74)  
 Kindler, Lutz: Post- Sa (124)  
 Kivell, Tracy L.: Post- Fr (33), (34), (35)  
 Kivisild, Toomas: S9- Sa (14:20)  
 Kondo, Yasuhisa: Post- Sa (149)  
 Kosintsev, Pavel A.: S8- Sa (11:20)  
 Koulakovska, Larissa: Post- Fr (60)  
 Krause, Johannes: S2- Fr (11:10)  
 Kuhrig, Melanie: S2- Fr (11:50)  
 Kuiper, Klaudia: Post- Fr (49)  
 Kuipers, Remko: Post- Sa (104)  
 Kulakov, Sergey: Post- Fr (61)  
 Kullmer, Ottmar: Post- Sa (106)  
 Kurki, Helen: Post- Fr (25)  
 Kuźmiński, Łukasz: Post- Fr (7)

## L

Lahaye, Christelle: Post- Fr (51), Sa (139)  
 Landis, Sabine: Post- Fr (18)  
 Langley, Michelle C.: Post- Fr (71), Sa (126)  
 Larbey, Cynthia: S5- Fr (17:00)  
 Laukhin, Stanislav: Post- Fr (53), (54), (55)  
 Lavi, Etain: S2- Fr (11:30)  
 Lawrence, Julie: S10- Sa (13:00)  
 Lazar, Catalin: Post- Fr (12)  
 Le Cabec, Adeline: S2- Fr (11:10);  
   Post- Sa (107)  
 Le Luyer, Mona: Post- Sa (115)  
 Leakey, Louise: S1- Fr (8:40); Post- Sa (85)  
 Leakey, Meave: Post- Sa (85)  
 Lebatard, Anne-Elisabeth: S9- Sa (13:40)  
 Lee-Thorp, Julia: Post- Sa (137)  
 Legaye, Jean: S3- Fr (14:00)  
 Leivada, Evelina: Post- Sa (92), (93)  
 Lembo, Giuseppe: Post- Sa (118)  
 Lenoble, Arnaud: S1- Fr (8:40)  
 Lenoir, Michel: S7- Sa (8:20)  
 Leonard, Chelsea: Post- Sa (128)  
 Lepre, Christopher: S1- Fr (8:40)  
 Lequin, Mathilde: Post- Fr (44)  
 Levkovskaya, Galina: S5- Fr (16:40);  
   Post- Fr (61)

Lewis, Jason: S1- Fr (8:40); Post- Fr (14)  
 Lewton, Kristi L.: S3- Fr (14:20)  
 Lisa, Lenka: Post- Fr (63)  
 Lisitsyn, Sergey: S5- Fr (16:40)  
 Liu, Wu: S11- Sa (16:00)  
 Lokorody, Sammy: Post- Fr (14)  
 Lombard, Marlize: S6- Fr (16:00)  
 Lombera-Hermida, Arturo: Post- Sa (122)  
 Lorenzo, Carlos: Post- Fr (40)  
 Louryan, Stéphane: Post- Fr (39)  
 Luxwolda, Martine: Post- Sa (104)  
 Lycett, Stephen J.: Post- Fr (24)  
 Lyubin, Vasilii: Post- Fr (61)

## M

Mabulla, Audax: S1- Fr (9:40)  
 Macchiarelli, Roberto: S11- Sa (15:40);  
   Post- Fr (43), Sa (95), (108), (111)  
 MacDonald, Katharine: Post- Fr (21), (46)  
 Macho, Gabriele: S3- Fr (14:40)  
 Madelaine, Stéphane: Post- Sa (97)  
 Maigrot, Yolaine: S7- Sa (8:20)  
 Maillo Fernandez, Jose Manuel:  
   S10- Sa (13:00)  
 Malafouris, Lambros: S6- Fr (16:40)  
 Mancini, Lucia: Post- Sa (95), (108), (111)  
 Manica, Andrea: Post- Fr (24)  
 Mann, Alan: Post- Fr (51)  
 Mannino, Marcello: S8- Sa (11:00)  
 Manriquez Soto, German Raul: Post- Fr (5)  
 Manzi, Giorgio: Post- Fr (4), (29)  
 Marín-Arroyo, Ana Belen: Post- Sa (132)  
 Marlowe, Frank: Post- Sa (129)  
 Marston, Christopher: Post- Fr (76)  
 Martelli, Sandra A.: Post- Sa (82)  
 Martinez Alvarez, Anna: Post- Sa (92)  
 Martínez de Pinillos, Marina:  
   S11- Sa (15:00); Post- Sa (109)  
 Martínez, Ignacio: S11- Sa (15:00);  
   Post- Fr (40), Sa (109), (123)  
 Martín-Francés, Laura: S11- Sa (15:00);  
   Post- Fr (41), Sa (109)  
 Martín-Loeches, Manuel: S6- Fr (17:20)  
 Martínón-Torres, María : S9- Sa (13:20),  
   S11- Sa (15:00), (16:00);  
   Post- Fr (41), Sa (109)  
 Martins, Pedro Tiago: Post- Sa (92), (93)  
 Martisius, Naomi: S7- Sa (8:20)  
 Mathews, Sandra: Post- Fr (28)  
 Maureille, Bruno: Post- Fr (51), (97), (99)  
 Mayda, Serdar: S9- Sa (13:40)  
 Mazurier, Arnaud: Post- Fr (43)  
 McLaren, Sue J.: Post- Fr (52)  
 McLaughlin, Russell L.: Post- Fr (12)  
 McPherron, Shannon P.:  
   S7- Sa (8:00), (8:20); Post- Fr (52), (56)  
 Medig, Mohamed: S2- Fr (10:30)  
 Mednikova, Maria: Post- Fr (12), (36)  
 Meladze, Tamar: Post- Fr (58)  
 Mellars, Paul: Post- Sa (151)  
 Menter, Colin G.: Post- Fr (15)  
 Mercier, Norbert: Post- Fr (50), (51), Sa (139)  
 Meshorer, Eran: S2- Fr (11:30)  
 Micheli, Mario: Post- Fr (29)  
 Miller, Christopher E.: S7- Sa (8:20)  
 Mirazon Lahr, Marta : S10- Sa (13:00)  
 Mitteroecker, Philipp: Post- Sa (80), (81)

Moggi-Cecchi, Jacopo: Post- Fr (15)  
 Moiseev, Fedor: Post- Fr (39)  
 Moncel, Marie-Hélène: S12- Sa (16:20)  
 Moraitis, Konstantinos: Post- Fr (37)  
 Morales, Juan Ignacio: Post- Sa (122)  
 Moreau, Luc: Post- Fr (62)  
 Moreno, Davinia: S9- Sa (13:00)  
 Mori, Tommaso: Post- Fr (15)  
 Moscler, Frank: Post- Fr (45)  
 Mosquera, Marina: Post- Sa (122)  
 Mounier, Aurelian: S10- Sa (13:00)  
 Murillo-Gonzales, Jorge Alfonso:  
   Post- Sa (81)  
 Muskiet, Frits: Post- Sa (104)  
 Musso, Fabio: Post- Sa (86)

## N

Nagai, Kenji: Post- Sa (149)  
 Naganuma, Masaki: Post- Sa (149)  
 Nakata, Hiroto: Post- Sa (149)  
 Nannini, Nicola: Post- Sa (117), (120)  
 Nejman, Ladislav: Post- Fr (63)  
 Neubauer, Simon: S2- Fr (11:50);  
   Post- Sa (84), (85)  
 Neugebauer-Maresch, Christine: Post- Fr (62)  
 Nevo, Eviatar: Post- Fr (73)  
 Nguyen, N. Huynh: Post- Fr (33), (34), (35)  
 Nigst, Philip R.: S4- Fr (14:20); Post- Fr (60)  
 Nishiaki, Yoshihiro: Post- Sa (149)  
 Noback, Marlijn Lisanne: Post- Fr (10)  
 Novak, Jan: Post- Fr (63)  
 Novák, Martin: S8- Sa (11:20)  
 Nowaczewska, Wioletta: Post- Fr (7)  
 Nyvltova Fisakova, Miriam: Post- Fr (63)

## O

O’Connell, James: Post- Sa (128)  
 O’Connell, Tamsin: S8- Sa (11:00)  
 Odsuren, Davakhuu: Post- Fr (56)  
 O’Higgins, Paul: S3- Fr (15:00);  
   Post- Fr (2), (3), (5), (11)  
 Ollé, Andreu: Post- Fr (69), Sa (122)  
 Otori, Takayuki: Post- Sa (149)  
 Ono, Akira: Post- Sa (149)  
 O’Regan, Hannah: Post- Fr (76)  
 Ortega, Iluminada: Post- Sa (139)  
 Overmann, Karenleigh A.: S6- Fr (17:00)

## P

Pääbo, Svante: S2- Fr (11:10), (11:30)  
 Pablos, Adrián: Post- Fr (40)  
 Pacher, Martina: Post- Fr (63)  
 Pagani, Luca: S9- Sa (14:20)  
 Pahr, Dieter H.: Post- Fr (33), (34), (35)  
 Paine, Cleantha: Post- Fr (56)  
 Parés, Josep M.: S2- Fr (10:30),  
   S12- Sa (15:40)  
 Pedergnana, Antonella: Post- Fr (69), Sa (122)  
 Peña-Melián, Angel: Post- Sa (87)  
 Peresani, Marco: S4- Fr (15:00);  
   Post- Sa (117), (120)  
 Peretto, Carlo: Post- Sa (98), (118), (134)  
 Perez-Gonzalez, Alfredo: S1- Fr (9:40),  
   S2- Fr (10:30)  
 Petraglia, Michael: S10- Sa (13:40)

Pezhemskiy, Denis: Post- Sa (101)  
 Pickering, Travis Rayne: Post- Fr (15)  
 Pinhasi, Ron: S8- Sa (10:00); Post- Fr (12)  
 Piperno, Marcello: Post- Fr (29)  
 Piras, Paolo: Post- Fr (4)  
 Pirson, Stéphane: Post- Fr (60), Sa (121)  
 Platonova, Nadezhda: S5- Fr (16:40)  
 Pope, Matt: S10- Sa (14:20)  
 Popov, Viktor: S5- Fr (16:40)  
 Porat, Naomi: Post- Fr (49)  
 Porraz, Guillaume: S10- Sa (13:20);  
   Post- Fr (65)  
 Poti, Alessandro: Post- Sa (135)  
 Power, Robert C.: Post- Sa (116)  
 Poza-Rey, Eva María: Post- Sa (78)  
 Prados-Frutos, Juan Carlos: Post- Sa (81)  
 Prat, Sandrine: S1- Fr (8:40); Post- Fr (14)  
 Prendergast, Amy: S8- Sa (11:00)  
 Price, Gemma: Post- Fr (1)  
 Prichystal, Antonin: Post- Fr (63)  
 Prôa, Miguel: Post- Fr (11)  
 Proctor, Chris: S8- Sa (10:20)  
 Proctor, Janet: S8- Sa (10:20)  
 Profico, Antonio: Post- Fr (4), (29)  
 Prufer, Kai: S2- Fr (11:30)  
 Pryor, Alexander: S5- Fr (17:00)  
 Purevjal, Khovor-Erdene: Post- Fr (56)  
 Puymeraul, Laurent: S3- Fr (15:00)

## Q

Quinn, Rhonda: S1- Fr (8:40)

## R

Radovićić, Davorka: Post- Fr (43)  
 Radovićić, Jakov: Post- Fr (43)  
 Rak, Yoel: Post- Fr (22)  
 Raviv Zilka, Lisa: Post- Fr (22)  
 Recheis, Wolfgang: Post- Fr (30)  
 Reeves, Jonathan: Post- Fr (68)  
 Rendu, William: S7- Sa (8:20)  
 Reyes-Centeno, Hugo: Post- Sa (100)  
 Reynolds, Natasha: Post- Fr (57)  
 Reynolds, Sally: Post- Fr (76)  
 Richard, Frederic: Post- Sa (82)  
 Richards, Michael P.: S7- Sa (8:20);  
   Post- Fr (56), Sa (116)  
 Richter, Daniel: S12- Sa (16:00)  
 Riede, Felix: Post- Sa (145)  
 Rigaud, Solange: Post- Fr (75)  
 Rivals, Florent: Post- Sa (131), (148), (153)  
 Rivera, Frances: S10- Sa (13:00); Post- Fr (8)  
 Robson Brown, Kate: Post- Fr (27)  
 Roche, Hélène: S1- Fr (8:40); Post- Fr (14)  
 Rochette, Pierre: S9- Sa (13:40)  
 Rodríguez, Xosé Pedro: Post- Sa (122)  
 Rodríguez-Hidalgo, Antonio: Post- Sa (122)  
 Roebrocks, Wil: S12- Sa (15:40); Post- Fr (46)  
 Roffman, Itai: Post- Fr (73)  
 Rogers, Michael: S2- Fr (10:50)  
 Rojo, Rosa: Post- Sa (81)  
 Romandini, Matteo: S4- Fr (15:00);  
   Post- Sa (117), (120)  
 Ronen, Avraham: Post- Fr (73)  
 Rooze, Marcel: Post- Fr (39)  
 Rosas, Antonio: Sa (87), (110); Post- Fr (30)  
 Rosell, Jordi: S9- Sa (13:20)



Rossello, Joana: Post- Sa (92)  
Rossouw, Lloyd: Post- Sa (137)  
Rottier, Stéphane: Post- Sa (115)  
Rubert-Pugh, Elizabeth: Post- Fr (73)  
Ruebens, Karen: Post- Sa (141)  
Rufo, Ettore: Post- Sa (118)  
Rushlau, Xavier: Post- Sa (94)

S

Sahnouni, Mohamed: S2- Fr (10:30)  
Sala, Benedetto: Post- Sa (118)  
Sala, Nohemi: Post- Sa (123)  
Saladić, Palmira: Post- Sa (122)  
Salazar-García, Domingo C.: Post- Sa (116)  
Sanchis, Alfred: Post- Sa (116)  
Sandgathe, Dennis: S7- Sa (8:00)  
Sano, Katsuhiko: Post- Sa (149)  
Santander, Cindy: S9- Sa (14:20)  
Sarig, Rachel: S11- Sa (15:20)  
Savage-Rumbaugh, Sue: Post- Fr (73)  
Sazelova, Sandra: S8- Sa (11:20); Post- Fr (63)  
Schaefer, Katrin: Post- Fr (13), SA (80)  
Scherjon, Fulco: Post- Fr (46)  
Schiefenhövel, Wulf: Post- Fr (75)  
Schiettecatté, Jérémie: Post- Fr (67)  
Schlösser, Nina-Maria: Post- Sa (136)  
Schmid, Peter: S1- Fr (9:20);  
Post- Fr (26), (28)  
Schmid, Viola C.: S10- Sa (13:20)  
Schmitsberger, Oliver: Post- Fr (62)  
Schnorr, Stephanie: Post- Sa (129)  
Schönekeß, Holger: Post- Fr (72)  
Schünemann, Verena: S2- Fr (11:10)  
Schwartz, Jeffrey: S9- Sa (14:00)  
Schweninger, Jean-Luc: S10- Sa (14:20)  
Scott, Beccy: S10- Sa (14:20)  
Scott, Louis: Post- Sa (137)  
Scott, Nadia: Post- Sa (84)  
Semal, Patrick: Post- Fr (39)  
Semaw, Sileshi: S2- Fr (10:50)  
Seringe, Raphael: S3- Fr (14:00)  
Shaw, Andrew: S10- Sa (14:20)  
Shaw, Colin: S12- Sa (15:20); Post- Fr (25)  
Shefi, Sara: Post- Fr (22)  
Shi, Junfen: Post- Fr (3)  
Shimelmitz, Ron: Post- Sa (138)  
Shimogama, Kazuya: Post- Sa (149)  
Shipton, Ceri: S10- Sa (13:40)  
Sholukha, Victor: Post- Fr (39)  
Shunkov, Michail: Post- Fr (36)  
Shuttleworth, Andy: Post- Sa (146)  
Sier, Mark J.: S12- Sa (15:40)  
Sinitsyn, Andrey: S4- Fr (14:20), (14:40)  
Skinner, Matthew M.: S7- Sa (8:20);  
Post- Fr (33), (34), (35), Sa (109)  
Sladek, Vladimir: Post- Fr (42)  
Smaers, Jeroen: Post- Fr (1), (21)  
Smith, Geoff M.: S5- Fr (16:00); Post- Sa (124)  
Smith, Tanya: Post- Sa (107)  
Soligo, Christophe: Post- Fr (1), (30)  
Sommer, Robert: S5- Fr (17:20)  
Sorensen, Andrew: Post- Fr (48)  
Soressi, Marie: S7- Sa (8:20)  
Soudack, Michalle: Post- Fr (22)  
Spor, Fred: S2- Fr (11:50);  
Post- Fr (6), Sa (77), (85), (90)  
Spry-Marques, Pia: Post- Fr (60)

Steele, James: Post- Fr (21), Sa (82)  
Steele, Madeleine: S5- Fr (17:00)  
Steele, Teresa E.: S7- Sa (8:20)  
Stelzer, Stefanie: Post- Fr (6)  
Stephens, Nicholas: Post- Fr (35)  
Stewart, John: Post- Fr (56)  
Stock, Jay T.: S8- Sa (10:00), S12- Sa (15:20);  
Post- Fr (20), (25), (32)  
Stoessel, Alexander: S2- Fr (11:50);  
Post- Sa (90)  
Stout, Dietrich: S2- Fr (10:50)  
Strauss, André: Post- Sa (77)  
Street, Martin: S5- Fr (17:40); Post- Sa (126)  
Stringer, Chris B.: S8- Sa (10:20);  
Post- Sa (96), (130), (150)  
Svoboda, Jiří: S5- Fr (17:00), S8- Sa (11:20)

T

Tabarev, Andrei V.: Post- Fr (56)  
Tafelmaier, Yvonne: Post- Fr (64)  
Tafforeau, Paul: S2- Fr (11:10); Post- Sa (107)  
Tagliacozzo, Antonio: Post- Sa (117)  
Talamo, Sahra: S7- Sa (8:20); Post- Fr (56)  
Tardieu, Christine: S3- Fr (14:00);  
Post- Fr (23)  
Teasdale, Matthew D.: Post- Fr (12)  
Teira, Luis C.: Post- Sa (148)  
Teschler-Nicola, Maria: Post- Fr (12)  
Texier, Jean-Pierre: S7- Sa (8:20)  
Thackeray, J. Francis: Post- Fr (16)  
Thun Hohenstein, Ursula:  
Post- Sa (118), (119)  
Tillier, Anne-Marie: Post- Sa (89)  
Tilotta, Françoise: Post- Sa (82)  
Tobolsky, Victoria: Post- Fr (25)  
Toro Ibacache, Viviana: Post- Fr (5)  
Tozzi, Carlo: Post- Sa (95)  
Trinkaus, Erik: S12- Sa (15:20)  
Tsegai, Zewdi J.: Post- Fr (34)  
Tuma, Petr: Post- Sa (83)  
Tuniz, Claudio: S11- Sa (15:40);  
Post- Fr (43), Sa (95), (111)  
Turner, Elaine: S5- Fr (17:40); Post- Sa (125)  
Turq, Alain: S7- Sa (8:00); Post- Fr (51)  
Tushabramishvili, Nikoloz: Post- Fr (58)

U

Urban, Brigitte: S12- Sa (16:00)  
Uribelarrea, David: S1- Fr (9:40)  
Usik, Vitaly: Post- Fr (60)

V

van der Made, Jan: S2- Fr (10:30)  
van der Plicht, Johannes: S4- Fr (14:20),  
S8- Sa (11:00)  
van Heteren, Anneke H.: Post- Fr (38)  
Van Sint Jan, Serge: Post- Fr (39)  
Vandermeersch, Bernard: Post- Sa (99)  
Vanhaeren, Marian: S7- Sa (9:00);  
Post- Fr (75)  
Vaquero, Manuel: Post- Sa (153)  
Vashro, Layne: Post- Sa (128)  
Velemínska, Jana: Post- Sa (83)  
Venema, Koen: Post- Sa (129)  
Venturo, Donata: Post- Fr (29)

Veres, Daniel: S8- Sa (10:40)  
Vialat, Amélie: S9- Sa (13:40)  
Villaluenga, Aritza: Post- Sa (125)  
Villaverde, Valentín: Post- Sa (116)  
Viola, Bence: S2- Fr (11:10); Post- Fr (36)  
Voinchet, Pierre: S12- Sa (16:20)  
Volpato, Virginie: S11- Sa (15:40);  
Post- Fr (43)  
von Cramon-Taubadel, Noreen: Post- Fr (24)

W

Walker, Christopher S.: Post- Fr (17)  
Walker, Michael J.: Post- Sa (116)  
Wallinga, Jakob: Post- Fr (49)  
Weaver, Timothy: S11- Sa (16:20)  
Weber, Gerhard W.: S3- Fr (15:20),  
S11- Sa (15:20)  
Weber, Kristin: Post- Sa (136)  
Wells, Jonathan C.K.: S8- Sa (10:00)  
Wesselingh, Frank: S8- Sa (11:00)  
Wijbrans, Jan: Post- Fr (49)  
Wilkinson, David: Post- Fr (76)  
Will, Manuel: Post- Fr (20), (65)  
Wilshaw, Alex: S10- Sa (13:00)  
Windhager, Sonja: Post- Fr (13), SA (80)  
Wood, Rachel: Post- Fr (63)  
Wragg Sykes, Rebecca: Post- Sa (142)  
Wright, Duncan: Post- Fr (63)  
Wynn, Thomas: S6- Fr (16:00)

X

Xing, Song: S11- Sa (16:00)

Y

Yoneda, Minoru: Post- Sa (149)  
Yravedra, José: S1- Fr (9:40)

Z

Zanolli, Clément: S11- Sa (15:40);  
Post- Sa (95), (108), (111), (112)  
Zeidi, Mohsen: S10- Sa (13:20)  
Zhang, Lizhao: S2- Fr (12:10)  
Zhao, Lingxia: S2- Fr (12:10)  
Ziggiotti, Sara: S4- Fr (15:00)  
Zwyns, Nicolas: Post- Fr (56)

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