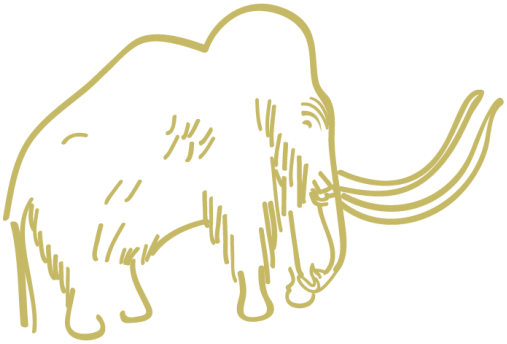

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XIV-1. The first European peopling: chronology, behaviour and environment.

Technological variability in the European Early Palaeolithic: the case of Notarchirico (Italy).

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Notarchirico (Piperno, 1999) is one of the oldest Italian site with bifaces. The large variety of artefacts (cores, flakes, pebble tools and bifaces for some levels) and raw materials make it a key-site for analysing the behavioural variability in the Acheulian record. The excavated deposits of Notarchirico consist of a superposition of sandy and slimy sediments in which the more or less intense levels of frequentation are interspersed with sterile episodes (Raynal et al., 1999; Lefèvre et al., 2010). Here we will present the technological analysis of the lithic industry found on the paleosurface F (670 ka by 40Ar/39Ar, Pereira et al., 2015), which is a natural layer of pebbles.
The lithic industry of level F is composed of some bifaces, various pebble-tools in limestone and quartzite. Flaking products are rarer. This series are compared to the two most recent levels of the site (levels B and E/E1), recently published (Santagata, 2016).

In the level B, the industry is also mainly on limestone and is characterised by shaping chains (choppers, pointed pebble-tools, cleavers, crudely-worked bifaces and handaxes). The core technology is rare and represented by polyhedral cores, biface-like cores and discoid cores. Conversely, in the E/E1 levels, the artefacts are mainly on flint and small. The cores show exhausted and indicate a high variability in the débitage. The shaping is attested by small pebble-tools, mainly on limestone. Flake tools are on flint.

In conclusion, the analysis of the material of level F adds additional technological details to the techno-economic strategies implemented at Notarchirico and during the European Early Palaeolithic, especially the crucial period of time of 700 and 600 ka.

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Keywords: European Early Palaeolithic, bifaces, small tools, Notarchirico

Vallonnet Cave: an early presence of hominins in Southern Europe

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The first "Out of Africa" migrations represent a seminal event in the history of humankind. At the gates of Europe, the first appearance of Hominins is recorded in Georgia, 1.8 million years ago (Ma); however, the picture of migration across the continent remains incomplete. Vallonnet Cave (France) is a Lower Paleolithic prehistoric site with traces of hominin activities including lithic remains and cut-marks on mammal bones. Here, we apply the uranium-lead (U-Pb) methods to two flowstones to date the intervening archaeological levels. The U-Pb data, coupled with paleomagnetic constraints, provide an age range from 1.2 to 1.1 Ma.
The new radiometric U-Pb analyses of the two flowstones (complexes I and IV) combined with paleomagnetism measurements of the deposit infilling provide the first robust chronological framework for the site. The results show the presence of hominin activities in a den for a bivouac at _˜1.2 Ma, associated with a normal paleomagnetism polarity (Cobb Mountain interval) corresponding to MIS 36, a cold glacial period. This result is consistent with the fact that the archaeological levels (complex III) record a cold climate and is supported by palynological data and faunal taxa. Within the 2s uncertainty on the U-Pb dates (sample PLI-H1), the formation of the Lower flowstone (complex I) and the deposit of the beach (complex II) can be correlated to MIS 37, just before 1.2 Ma during a warm climate.

The results conclusively demonstrate that Vallonnet Cave is one of the oldest European prehistoric sites in France with early hominin occupations associated with an Epivillafranchian fauna. Combined with data from other archaeological sites, the new precise chronology suggests a widespread occupation the Northern Mediterranean to Southwestern Europe at _˜1.2 Ma.
It thus greatly improves our knowledge of the first dispersals of the *Homo* genus "Out of Africa" during the Early Pleistocene (Calabrian) in this area of Europe. The new chronological framework is contemporaneous with Spanish sites such as La Sima del Elefante (Level TE9c) and with Bois-de-Riquet in France, suggesting a widespread synchronous Hominin activity around the Northern Mediterranean and Southern Europe at _˜1.2 Ma, followed by a northward colonization at _˜1.0 Ma. While it remains a challenge to precisely date all archaeological sites with adequate precision, the application of robust radiometric dating techniques to current and future sites will offer further insights and understanding into the routes of Hominin dispersal of Africa in to Europe.

Keywords: Europe, Early occupations, behaviours

Late Early Pleistocene age of the hand-axe and Palaeolitrhic assemblage at Cueva Negra del Estrecho del Río Quípar (Caravaca de la Cruz, Murcia, Spain)

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For XIV-1 The first European peopling: chronology, behaviour and environment Abstract submitted here. Full text currently in preparation.
The Cueva Cueva Negra del Estrecho del Río Quípar sediments, 5 m deep, have provided a Palaeolithic assemblage, including a bifacially-flaked limestone hand-axe, together with many small artifacts, some produced by repetitive knapping of small chert nodules, evidence of combustion in deep layers, and an archaic fauna, including 400 micromammalian teeth that testify to presence of several late Early Pleistocene Arvicoline rodent taxa throughout the sedimentary sequence which corresponds to the Matuyama chron and likely belongs to MIS-21. (References: Walker et al., 2016, A view from a cave: Cueva Negra del Estrecho del Río Quípar (Caravaca de la Cruz, Murcia, southeastern Spain). Reflections on fire, technological diversity, environmental exploitation, and palaeoanthropological approaches. *Human Evolution* 31: 1-67; Walker et al., 2016, Combustion at the late Early Pleistocene site of Cueva Negra del Estrecho del Río Quípar (Murcia, Spain). *Antiquity* 90: 571-589: Rhodes et al., 2016, Fire in the Early Palaeolithic: Evidence of small mammal burning at Cueva Negra del Estrecho del Río Quípar, Murcia, Spain, *Journal of Archaeological Science Reports* 9: 427-436; Angelucci et al., 2013, Rethinking stratigraphy and site formation of the Pleistocene deposit at Cueva Negra del Estrecho del Río Quípar (Caravaca de la Cruz, Spain); *Quaternary Science Reviews* 89, 195-199; Walker et al., 2013, Cueva Negra del Estrecho del Río Quípar (Murcia, Spain): A late Early Pleistocene hominin site with an "Acheulo-Levalloiso-Mousteroid" Palaeolithic assemblage, *Quaternary International* 294: 135-159; Scott & Gibert, 2009, The oldest hand-axes in Europe, *Nature* 461: 82-85; A.López, M.Haber Uriarte, M. López Martínez, M.J. Walker, (submitted, 2017) Small-mammal indicators of biochronology at Cueva Negra del Estrecho del Río Quípar (Caravaca de la Cruz, Murcia, SE Spain), *Historical Biology*)

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Keywords: Early Pleistocene, Palaeolithic, hand, axe, biochronology

Pirro Nord (Apricena, Southern Italy): contribution to the first European peopling understanding

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The Pirro Nord site (Apricena, FG) has been systematically excavated for 8 years by the University of Ferrara (Arzarello et al., 2007; 2014; 2016; López-García et al., 2015; Giusti and Arzarello, 2016) and the interdisciplinary approach has helped to define the technical behaviour of the first Europeans.
The site is located inside a karstic fissure within the Apricena Cretaceous limestone and is dated, on biochronological basis, to 1.3-1.6 Ma. The lithic industries have been found associated to the Villafranchian vertebrate fossils of the Pirro Nord Faunal Unit and show several common futures with the other European sites dated before 1 Ma. The environment was probably open and dry, with a seasonal wetland and a low vegetation.

The lithic production is finalized to the production of flakes probably mostly utilized for the exploitation of animal carcasses as attested by the usewear analysis and by the presence of cut-marks on some of the bones.
By a general point of view, the human behaviour is characterized by an expedient technology exploiting local row materials and probably local resources, but some technical behaviours (mainly related to lithic production methods) show a great awareness of production.

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Keywords: First European peopling, Italy, variability, human behaviour

Source and characterization of the silt of Gran Dolina site (Sierra de Atapuerca, Spain).

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The Gran Dolina site is situated in the south of the Sierra de Atapuerca in north-central Spain. It is a cavity infilled by 25 m of Early and Middle Pleistocene sediments which have different fossil-rich layers, including a new hominin species, *Homo antecessor* (Carbonell et al. 1999). The sequence has been divided into 12 lithostratigraphic units, named form bottom to top a TD1 to TD11 (Trinchera Dolina), including the TD8-9 unit (Pérez-González et al. 2001; Campaña et al. 2017).
Terra rossa of the slope of the Sierra de Atapuerca was postulated as the source of the sediments inside of Gran Dolina (Pérez-González et al. 2001). This kind of soil can be formed by differences processes as weathering of limestone or aeolian inputs (Yaalon 1997; Delgado et al. 2003; Berger et al. 2008). The aim of this work is to analyze and identify the sources of silt sediment that are found inside of Gran Dolina cave.

87 samples were taken from TD1 to TD11 lithostratigraphic units of Gran Dolina and terra rossa. The particle size separation was carried out first using a sieve to remove the greater than 63 μm fraction, and then settling times using Stoke's law was used to extract the silt fraction (2 – 63 μm). Granulometry of this fraction was analyzed using Laser diffraction Coulter LS13 320 with an ALM module. Each particle size distribution was fitted with Weibull distribution and normal distribution to identify the contribution of each mode (Sun et al. 2002).

The most of the particle size distribution of silt of Gran Dolina sediment can be explain by two components: one distribution with mode about 42 μm and a second distribution with mode about 10 μm. A third component of 5 μm is observed in few samples of TD10 unit. Normal distribution seems to be more accuracy, especially in TD1 sediments, but Weibull distribution

*Speaker

has best fitting in terra rossa samples. Weibull distribution gives more importance to the biggest distribution (about 42 μm) meanwhile normal distribution gives more significance to the smallest distribution (about 10 μm).
This bimodal distribution means that two sedimentary processes worked to accumulate this sediment in the terra rossa of the Sierra de Atapuerca. These sources can be aeolian transport, as suggested the biggest distribution (Vandenberghe 2013; Sun et al. 2004; Kovács 2008), fluvial transport as indicated by clay fraction presence (Vandenberghe 2013; Kovács 2008) and weathering detritus from limestone (Delgado et al. 2003).

Keywords: Gran Dolina, Distribution function, Grain, size components, Terra rossa

Paleo-climate reconstruction of the Gran Dolina site (Sierra de Atapuerca, Spain) using Hydrogen stable isotope of authigenic clay minerals.

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Gran Dolina is a key site to understand Early and Middle Pleistocene human evolution in Europe. This site is a cave that belongs to the second level of the Sierra de Atapuerca multi-level karst system and shows a 25 m thick Early and Middle Pleistocene sedimentary infilling. It is divided in twelve lithostratigraphic units, named form bottom to top TD1 to TD11 (Trinchera Dolina), including the TD8-9 unit (Campaña et al. 2017).
The stable isotopes are been widely studied in several materials for palaeoenvironmental research (Horbe 2011; Sheldon & Tabor 2009). The isotopic composition of hydrogen in authigenic minerals is a useful tool for reconstructing past paleo-environments. In this work, the δD record from authigenic clay minerals was obtained with the aim of reconstructing the paleo-climate of Gran Dolina site.

45 samples were taken from Gran Dolina site, from TD1 to TD11 litho-stratigraphic units. Each sample was treated to remove carbonates and organic matter. The samples were measured by a ThermoFinnigan thermal conversion elemental analyzer (TC-EA) which is linked to a ThermoFinnigan Delta V + isotope ratio mass spectrometer (IRMS), following the procedures described by Sharp et al. (2001) and Vandelvelde et al. (2013).

The measurement of stable isotopes in clay minerals is not exempt from problems. High variations between measurements taken in different days have been reported, although a similar pattern was observed. The data obtained shows that the δD values are higher in autochthonous sedimentary facies (TD1 and TD2) than in the rest of Gran Dolina. Among the allochthonous sediments, it is to be noticed the very negative δD values from the top of TD4 and in TD6.2,

*Speaker

the sub-unit where hominin remains were found (Bermúdez de Castro et al. 2008). Also, a progressive increase in δD value is observed in TD10 unit. These δD variations can be related to climate changes.
The hydrogen isotope composition in authigenic clay minerals is a powerful proxy to reconstruct paleo-climate changes, although the actual methodology has some problems. Further investigations are necessary to clarify the data obtained in this study.

Keywords: Clay minerals, Hydrogen isotope, Gran Dolina, Early and Middle Pleistocene, Sierra de Atapuerca.

Hominin responses to environmental change during the Mid-Pleistocene transition – a simulation-based approach

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The Mid-Pleistocene Revolution (MPR) represents a shift in global climate leading from an obliquity-dominated periodicity prior to 1.2 Ma to a precession-dominated regime after 780 ka. During the transition period, glacial-interglacial cycles vary rather irregularly with respect to both, duration (frequency) and amplitude of the episodes. As a response to those climate shifts, environments as well as hominin settlement patterns changed accordingly. The effects can be observed in all regions inhabited by hominins, i.e. Sub- Saharan Africa, the Mediterranean and Southwest Asia, Central, North and West Europe, East Asia and Southeast Asia.
Hominin responses, however, differ depending on predominant settlement patterns, archaeological equipment and available technology, subsistence behavior and resource supply. In view of rapid shifts in the environments hominins found regionally specific responses to the same climate shifts on a global scale.
The International Focus Group 'METHOD: Modelling Environmental Dynamics and Hominin Dispersals Around the Mid-Pleistocene Revolution' funded by INQUA studies collaboratively the effects of climate change on hominin environments and corresponding hominin responses. The METHOD-IFG represents a network of scientists from a variety of disciplines including archaeology, palaeontology, palaeobotany, and palaeoanthropology, involved in data collection. With respect to modelling and simulation the network also includes mathematics and informatics. We study and compare the different responses by a simulation-based approach, applying in particular agent-based modelling. Our network and our approach will be introduced.

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Keywords: climate change, hominins, Mid, Pleistocene Revolution, land use strategies

"Oldowan" in Dagestan – archaeology from the seabed or just geology.

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The common recent recognition the Oldowan antiquity of hominin fossils and artifacts at Dmanisi, besides the obvious importance for our understanding of the the first peopling of Eurasia, has also provided a strong logistic basis for some researchers to hypothesize about possible Oldowan expansions northward, through Caucasus into eastern Europe. As the result, attempts to present typologically poorly defined flaked stones, selected from naturally broken rocks found in old geological contexts, as Oldowan artifacts become especially frequent during the last 15 years. Since 2003, artifacts of Oldowan or Early Acheulean affinity and over 1 Ma antiquity have been reported from the western to eastern ends of the Northern Caucasus. Scholars started to discuss significance of lithic assemblages such as Bogatyri, Rodniki, Kermek and others on the Tamanian peninsula (Shchelinsky et al., 2010; Shchelinsky, 2014), in the north-western Caucasus; Muhkai, Ainikab, Gegalashur and others in central Dagestan and Rubas-1 (lower complex) in the south-eastern Dagestan, in the north-eastern Caucasus (Amirkhanov, 2007, 2016; Derevianko et al., 2009, 2012; Amirkhanov et al., 2014), as evidences of hominin dispersals northward from the Southern Caucasus, and along the Black Sea and the Caspian Sea coasts. Among these discoveries, localities of Kermek, dated to 2.1-1.77 Ma (Shchelinsky and Gurova, 2014), and Muhkai II, dated to 2.0-1.8 Ma (Amirkhanov et al., 2014), are claimed to present the first peopling of Eurasia, which reached Northern Caucasus and southeastern Europe at about 2 Ma.
Archaeological comparisons of the "Oldowan artifacts" from the Northern Caucasus with the Dmanisi industry (see Doronichev, 2008; Doronichev and Golovanova, 2010) well shows their differences, suggesting that the materials found in Dagestan and Taman likely represent geofact assemblages composed of naturally broken stones. Recently, radiometric (ESR) estimates between 1.0-1.5 Ma were reported for two equid (Equus stenonis) teeth from Ainikab-I. However, the isochron ESR analysis indicated recent U uptake at _˜330±50 kyr, assuming that the deposits were reworked (Ahmed et al., 2010).

More recently, the Muhkai and Ainikab sites have undergone a detailed geoarchaeological research (Chepalyga et al., 2012), which results combined with other multidisciplinary studies (geomorphology, paleontology, palynology, paleomagnetism) indicates that the sites are dated to the marine Apsheronean stage of the Caspian Sea, from 1.8/1.5–0.8 Ma. Significantly, the geological (sedimentology, mineralogy) studies revealed that sedimentary sequences in these sites are composed of interbedded thin clayey and coarse pebble-boulder strata that were deposited in ingressive marine and terrestrial environments, respectively. The ingressive marine sediments contain authigenic glauconite, nannoplankton, and other marine fossils. The overwhelmng majority of so called "Oldowan artifacts" in these localities, including lithics and bones excavated from the "most significant level" (layer 80) at Muhkai-II (Amirkhanov et al., 2014, 2015), origi-

*Speaker

nates from thin clayey or loamy strata. However, according to the geological evidence (Chepalyga et al., 2012: 85), these sediments "are undoubtedly subaqueous origin, accumulated in shallow waters with a calm hydrodynamic regime." This geological evidence suggests that either the "Oldowan" archaeology in Dagestan comes from the seabed or represents just a geological phenomenon; the result provides support for our earlier conclusion about the natural origin of these materials.

Keywords: dubious "Oldowan", Northern Caucasus, geological context, geoarchaeological research, geofacts

The first European peopling along the North Black sea passageway: interdisciplinary studies of Oldowan sites in Crimea and Caucasus

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New Oldowan sites with stone tools was recovered and studied (2014-2017) in Crimea last years. Culture-bearing layers relate to the Black Sea terrace sediments. 18 terrace levels (VI) grouped on 3 terrace tiers (6 terraces in each tier): Lower (I-V terraces, 0 - +65 m asl), Middle (VII-XII terraces, +75 - +200 m asl), Upper (XIII-XVIII terraces, +225 - +450 m asl). Oldowan-type artefacts are associated with terraces sediments of Middle terrace tier: VII Alchak terrace +75 m., VIII Manjil terrace +100 m asl, IX Gorchakov terrace +125 m; X St. George terrace +150 m asl, Trapadja XI terrace- +175 m and possible XII Andrussov terrace +200 m.
These terrace sediments associated with marine basin stages: Gourean (Black Sea) and Apsheronean (Caspian) = Calabrean. Lithological studies recovered two main facies with thickness 10-20 meters for each terrace: coarse pebble littoral facies with Oldowan artefacts and fine-grain clayi silt of lagoon facies without artefacts.

Age of cultural layers based on paleomagnetic studies (Matujama chrone, Jaramillo and Olduway subchrons) ranged between 0,8-1,8 Ma (mln years).

Archaeology represents by several hundred tools, belonging to heavy duty, light duty and micro-tools, including cores, choppers, chopping tools, picks, scrapers, bill-hooks, protoknives, borers, etc. This stone industry belongs to developed Oldowan culture Mode I. Some tools were fire treated. A stone pavement made from prepared limestone plates, accompanied by chart tools (choppers, bill-hooks, scrapers) were recovered in site Bayraki (Dniester valley). Possible it was a location of animal skin preparation. Mammal remains Archidiscodon meridionalis and Equus sussenbornensis are typical for Tamanean complex (=Epivillafranchian).

Now it's possible to reconstruct routes of the first migrants from Africa to the Europe. Initial stage of migrations after leaving of Africa (2,0 Ma) and appearance in South Arabia moved northward, later they reach Israel (1,7-1,8 Ma) and South Caucasus (Dmanisi – 1,7-1,8 Ma). North Caucasus began settled not late 1,8 Ma. That time Oldowan migrations sharply changed to the West direction along the latitude N45○, this is a half way between Equator and North Pole. On this way the first European region, settled by Oldowanean, was Crimea were they can arrive near 1,8 Ma, after crossing recent Kerch strait. That time here was Taman-Kerch terrestrial bridge between Caucasus and Crimea, dividing Gourean basin (Black Sea) on the South and Apsheronean basin (Caspian) on the North.

*Speaker

Later 1,2-0,8 Ma next migration (or dispersion) northward to the Dniester valley (Bayraki site, 1,1-,10 Ma) took place.

Keywords: Oldowan, Bayraki, Crimea, first peopling

Reviewing human subsistence strategies at the Lower Palaeolithic site of Isernia La Pineta (Molise, Italy) through recent archaeozoological investigations on large mammals

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The Lower Palaeolithic, open-air site of Isernia La Pineta is situated in south-central Italy, Molise. Set within a complex stratigraphic series composed of fluvial and lacustrine deposits, travertine and volcanic tuffs impacted by tectonic movements, the site's chronology was recently refreshed to 583-561ka, with the 40Ar/39Ar dating of the first human remain, a deciduous incisor, discovered in 2014. An extremely rich site in terms of archaeological artifacts such as lithics and faunal remains, it bears testimony to palimpsests which reflect adaptive subsistence strategies adopted by human groups in four stratified archaeosurfaces, identified in two sectors of the excavation (3c, 3a, 3s10 in sect I; 3a in sect II). Faunal remains from the site have been subjected to several archaeozoological studies and highlight the dominance of large ungulates hunted for their nutrition rich anatomical parts by hominids. However, in the recent years, the results from these studies were updated with the study of faunal remains recovered from recent excavation seasons at the site with new methodological approaches. This paper, hence, aims to present a summary of refreshed data on archaeofauna which continue to support an anthropic accumulation of animal remains with taphonomic evidence of intentional fracturing on fresh bone, impact areas, morphotypes of fractures, percussion cones and cut-marks produced by lithic tools.

Keywords: subsistence strategie, taphonomy, faunal remains, Lower Paleolithic, Isernia La Pineta

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Premières occupations humaines : de l'Afrique aux rivages méditerranéens de l'Europe. Les premiers peuplements humains. Pré-Oldowayens et Oldowayens

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Premières occupations humaines : de l'Afrique aux rivages méditerranéens de l'Europe. Les premiers peuplements humains. Pré-Oldowayens et Oldowayens

Keywords: premier peuplement, Europe

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XIV-2. MIS 13-11: a major transformation in the European Lower Palaeolithic?

Regional trends in lithic technology and human settlements during the Acheulean: the case study of the Ceprano basin (central Italy, MIS 11-10)

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Several decades of fieldworks at the Ceprano basin yielded the famous human fossil calvarium, but also lithic series of cores-and-flakes type (Mode 1) and Acheulean (Mode 2) on open-air localities. The Acheulean assemblages, in particular, are composed of cores, flakes and, above all, bifaces, made on limestone, secondary flint and quartz. The archaeological corpus also yielded tools on fragments of large herbivores bones.

New dating by 40Ar/39Ar, ESR and U-Th have recently provided a detailed chronological frame of the basin localities. The series with bifaces date to a short period during the Middle Pleistocene, corresponding to MIS 11-10. Comparison between technological strategies and paleo-anthropological results are now feasible and allows us investigating hominin behaviours on a small-scale area for a key-period of time when new features appeared in Western Europe introducing the Neanderthal world. Moreover, the same period indicates trends of regionalisation by a higher number of sites and possibly occupations on a larger scale, following the MIS

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12 glacial event.

We present here the technological study of the Acheulean 2 lithic series of the localities of Campogrande (CG9 and CG10, intermediary and upper levels), Colle Avarone, Casellone, Isoletta level 4, Selvotta and Lademagne upper and lower. We focus mainly on the strategies applied on bifaces, which share common features suggesting a network of connected human occupations. The bifaces are either completely shaped or partial, made by similar strategies. Results are compared with other Italian sites more recent than MIS 12 and help us to consider the meaning of this regionalisation in Europe.

Keywords: Lower Palaeolithic, Acheulean, Italy, Ceprano basin

Introducing Jaljulia: A late Acheulian mega-site in central Israel

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Two excavation seasons at the newly discovered site of Jaljulia have revealed a rich archaeological layer, containing numerus flint artifacts and high number of handaxes in excellent preservation condition. The archaeological layer, found in changing depths of 2-5 m' below modern surface, is estimated to cover an area of at least 1 hectare, representing a dynamic fluvial deposition environment: A vast flood-plain was apparently formed in the contact between an ancient stream coming from the east (possibly the ancient route of the adjacent Nahal Qana) and the sand-dunes covered coastal plain, presenting an attractive location for human activity. Geological observations indicated that this area saw some transitions from a slow-flowing stream to a standing water body (swamp) and vice-versa. Also of note is the probable presence of a sweet water springs within the excavated area.
Six excavation areas were opened, exposing the archaeological layer over approximately 60 m2.Field observations pointed out some differences in techno-typological affinities between assemblages according to excavation areas, suggesting some spatial variability. Only one area (D) demonstrated bones preservation. Area G proved to be the most complex, presenting multiple archaeological horizons and a compound stratigraphy.

Preliminary techno-typological observations have demonstrated the existence of several technological trajectories, the most prominent is revolving around the production and maintenance of bifacial tools, including hundreds of handaxes. Another trajectory was aimed for the production of relatively thin and wide flakes through the use of prepared, central surface cores, conceptually resembling the later, more evolved Middle Paleolithic Levallois method. Other trajectories include the production of large flakes for massive scrapers as well as the extensive use of cores-on-flakes.
The site was ascribed to the Late Acheulian based on techno-typological affinities (e.g., handaxes morphology and the abundance of central surface cores). Magnetostratigraphic analysis demonstrated a normal polarity throughout the sequence. This talk aims to present the first

*Speaker

two excavation seasons in Jaljulia, as well as preliminary results of a multidisciplinary study including a geomorphological analyses and dating attempts using OSL.

Keywords: Late Acheulian, Jaljulia, Lower Paleolithic

Mid-Pleistocene hominins in the landscape of Central Europe

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This study shows how hominins fitted into the Central European landscape of Middle Pleistocene during MIS 13-11 interval. The human activity is interpreted along with discussion of climate and environment of that time, based on floristic and faunal data. Palaeorecords from ten non-archaeological sites (e.g. Dethlingen, Ossówka) are compared with nine artefact-bearing localities (e.g. Miesenheim, Vértesszőlős, Bilzingsleben, Račiněves), indicating favourable conditions for hominin occupations.

The mid-Pleistocene hominins were able to exist in, and adapt to, a wide range of conditions in Central Europe. They occupied mostly shorelines of rivers, springs and lakes in the areas with available raw material. Temperature was not the main driven factor of human action as deposits of interglacial thermal maxima are usually devoid of archaeological finds. The most favourable for early settlers was warm and humid climate of early and late phase of interglacials. They preferred partly forested areas (mainly open forests and/or forest-steppe environments), open landscape with steppe-like vegetation and boreal pine-birch forests, which offered vast areas for gathering and hunting, and enabled mobility through widely available travel corridors. The latter could have been also supported by thinning of plant cover during short-term climate-environment oscillations in MIS 11 (OHO and YHO). However, finding of artefacts directly correlated with those episodes is crucial for further interpretation.

Presumably the mid-Pleistocene settlers could also deal with boreal or even subarctic climates and tundra conditions as evidenced at Ariendorf in Germany, where artefacts were accompanied by steppe and tundra mammal remains, especially *Coelodonta antiquitatis* and *Mammuthus primigenius*.

Keywords: Middle Pleistocene, Lower Palaeolithic, Hominin occupations, Palaeoenvironment, Central Europe

*Speaker

Landscapes of habit: understanding cultural variation in MIS 11 Europe

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Britain has a rich record of human occupation during MIS 11, with a wealth of sites, artefact assemblages and other non-lithic technologies. This record is associated with abundant environmental evidence, which, in combination with improved understanding of the stratigraphic record and application of dating, provides a robust chronological framework in which to place these industries. Three phases of human occupation of Britain during MIS 11 can be identified: initial colonisation during MIS 11c, represented by a non-handaxe lithic industry; a second phase also during MIS11c but with handaxe technology; and a final phase during a later sub-stage of MIS 11, possibly associated with twisted ovates. Each phase of occupation is likely to represent a new incursion of hominins into Britain from mainland Europe. The European record can be characterised by considerable chronological and geographical variation in the archaeological record. It is argued that the complex mosaic of lithic assemblages reflects the creation of landscapes of habit within stable environments, where localised culture developed alongside strategies for living in particular habitats with the specific resources they provided. Persistence of place, however, depended on stability, sometimes provided by protective features of the landscape. The longer-term instability of the open-air sites of northern Europe caused by climatic and environmental change brought about large-scale shifts in population. For Britain we can begin to unpick this record and see how shifts in environment brought changes in population, represented by different material cultures, reflecting population movement from source to sink areas of MIS 11 Europe.

Keywords: MIS 11, Acheulean, hominin dispersals, Northern Europe, Lower Palaeolithic

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Environmental context for human occupation in Britain in MIS 11 from an ostracod-based palaeoenvironmental reconstruction of a Middle Pleistocene lake at Marks Tey, Essex, UK

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The former lake basin at Marks Tey in Essex is considered the most complete archive of MIS 11 in Britain. Knowledge of the changing palaeoclimate throughout this period can provide an environmental context in which to address issues related to human occupation, evidence of which has been found at other British sites of the same age. Whilst the record of the Hoxnian interglacial itself (correlated with MIS 11c) has been investigated in previous research at this site, this is the first comprehensive palaeoenvironmental investigation, since Charles Turner's pioneering work, of the exposed sediments accessible in the Marks Tey clay pit that overlie the interglacial period itself. A sediment thickness of more than 24 m has been logged and sampled, from which assemblage-based and geochemical ostracod analyses are used to investigate changes in the palaeoclimate and palaeoenvironment across the transition to colder conditions. Almost 300 samples have been examined and a fairly diverse freshwater (possibly slightly saline in some intervals) lacustrine ostracod fauna has been recovered. Provisional results reveal two main assemblages. The lower assemblage is interpreted as indicating cold or Arctic conditions. After a sedimentary hiatus, the upper assemblage suggests a more continental climate with warm summers and initial isotope results support a significant change in this upper section. The data hint at a cold-warm climatic variation after the Hoxnian interglacial, although, due to the sedimentary hiatuses, it is not clear whether these represent the same marine isotope stage.

Keywords: MIS 11, palaeoclimate, palaeoenvironment

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MIS 13-11 in northern Europe: a purely maritime zone expansion?

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MIS 13-11 (*c.* 533-374kya) sees a significant change in the scale and extent of the Lower Palaeolithic occupation of Europe, and is a hinge point in the various short chronology models (Roebroeks & van Kolfschoten 1994, 1996). The MIS 13-11 'northern expansion' is often characterised as essentially a north-west European expansion – and it is clearly reflected in the site-specific and river terrace archive records of Britain and northern France (e.g. the British Hoxnian sites and the artefact rich-terraces of the Thames and Somme rivers). But what are the behavioural requirements and implications of this essentially maritime-climate distribution? This paper explores those implications with reference to the palaeoenvironmental demands upon, and survival needs of, Lower Palaeolithic hominins in north-western as opposed to north-central and north-eastern Europe (e.g. reduced seasonality in the maritime zone; enhanced coastal habitats and resources). This palaeoenvironmental context is then considered against those behaviours for which we do (e.g. lithic tool-kits encompassing bifaces and retouched flake tools; occasional pyrotechnology and organic tools) and do not have evidence (e.g. artificial shelters). On the basis of these considerations, the paper explores whether the apparent paucity of MIS 13-11 occupation in north-central and north-eastern Europe is a genuine Lower Palaeolithic pattern, or might be a consequence of other factors (e.g. taphonomic visibility of sites/artefacts; research histories).

Keywords: MIS 13, 11, Lower Palaeolithic, northern Europe, short chronology, behaviour, palaeoenvironment

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Acheulean Occupations in the Upper Tigris Corridor: Iraqi-Kurdistan

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The Acheulean appears in Africa over 1.5 million years ago, but only appears in Eurasia much later, and became widespread and common later still. A major question is, therefore, the timing and context of the first appearance of the Acheulean in Eurasia, especially in areas adjacent to Africa. This research is based on the recent survey in the Upper Tigris Corridor where a number of Acheulean open air sites were discovered. This study is a pioneer research on hominin occupations to fulfil the vast gap, but strategic region between Levant and Caucasus. The Paper will present the distributions of the sites, raw material sources, lithic artefacts characteristics and finally the environmental context of the occupational area.

Keywords: Acheulean, hominin dispersal, Upper Tigris, Iraqi, Kurdistan

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Non-biface assemblages and lithic variability in MIS13-11 Europe

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The Clactonian question - that is the presence of Middle Pleistocene assemblages in England that lack handaxes – has puzzled those concerned with the Palaeolithic of Britain for generations (e.g. Warren 1926; Wymer 1974 McNabb 1992; White 2000; Fluck 2011; Wenban-Smith 2013). However, the phenomenon of absent handaxes is not limited to the UK. By looking at those assemblages reported as lacking handaxes from across Europe an overall pattern of assemblage variation emerges that is often obscured by the focus upon handaxes.
The limitations of available raw material, chronological distinctions, geographical isolation and cultural variation have all been proposed as explanations. This paper will look at sites from England, the Iberian peninsula, France and central Europe and explore whether a single explanation for the absence of handaxes is appropriate, or whether our obsession with the handaxe has clouded a potentially more interesting picture of lithic variation in MIS13-11 Europe.

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Keywords: Palaeolithic, biface, variability

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The long sedimentary sequence of Valle Giumentina in Central Italy: evolution or continuity in human behaviours from MIS 14 to MIS 12?

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In the 1950s an outstanding sequence of nine archaeological layers ascribed to Acheulean, Clactonian and Levalloisian traditions has been discovered within the 70 m deep sedimentary succession of the Valle Giumentina basin in the Central Apennines (Italy). The archaeological sequence was then correlated to the Riss and W'urm glaciations on the basis of the lithic

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industries typology. To better understand the Valle Giumentina archaeological and geological context, a multidisciplinary research project (sedimentology, geochemistry, micromorphology, malacology, palynology, geochronology and tephrochronology) including systematic archaeological excavations, funded by the École Française de Rome, was started in 2012, with the aim of studying in details this exceptional long archive combining both cultural and palaeoenvironmental information.
Sedimentological analysis and biomarkers studies indicate that the stratigraphic succession of Valle Giumentina corresponds to two complete interglacial-glacial cycles, accurately correlated with MIS 15 to MIS 12 thanks to the 40Ar/39Ar dating method. Consequently, the Valle Giumentina succession is at least 200 ka older than previously estimated, and the site must accordingly be shifted into an older phase of the European Lower Palaeolithic. This new chronostratigraphic framework allows us to precise the chronology of each archaeological level and to determine the environmental context of Palaeolithic human settlements. The site was occupied during both glacial and interglacial periods (MIS14, MIS12 and MIS 13 respectively), corresponding to a wide range of environmental contexts, from open steppe and grassland to closed forest landscapes.
Lithic studies with a technological approach are still in progress but according to their typology, every lithic series from each archaeological layers appear to be very homogeneous and don't show any major evolution. The appearance of handaxes tools in a palaeosol correlated to the beginning of MIS 12 is the only technical novelty identified in the archaeological record. Here, handaxes are associated with a core and flake industry very similar to the previous and the further ones. Our geochronological study presents a new sequence to fill the scarcity of sites between the periods of MIS 15 and 11. It allows us to bring forwards lithic studies to look at socioeconomical behaviors in this time range and possibly to their evolution which is not obvious at first glance.

Keywords: Lower Palaeolithic, Central Italy, Middle Pleistocene, palaeoenvironnement, MIS 12, MIS 13, MIS 14

Environmental and climatic changes in South Western Europe during the MIS 12. The case of the Caune de l'Arago.

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The Caune de l'Arago is a major site for the comprehension of the Lower Paleolithic in Southwestern Europe. The medium complex is characterized by numerous anthropogenic occupations which have given a great number of remains of humans, of fauna and of artefacts, among them bifaces. The faunal associations allow to observe three climatic stages within this recording: two cold ones and a mild one. The small vertebrates, with their abundance and their diversity, are particularly useful for the observation of these stages, which historically have been correlated to glacial or interglacial stages. If the first cold phase, dated 438+/- 31ka is correlated to the Marine Isotopic Stage 12 (MIS 12), the correlation of the following phases to isotopic stages can be discussed. They may correspond to climatic variations of the MIS 12. Indeed, the latest studies about paleoclimatic reconstitution which allow to define the evolution of the paleo-temperature show that these differences are relatively small. Therefore, instead of a correlation to MIS 12, 13 and 14, the medium complex of the Caune de l'Arago could belong solely to MIS 12. The interpretation of these climatic changes depends on the variations of the faunal assemblages, themselves subjected to various factors: the position of the site, situated halfway between the Mediterranean and the Pyrenees; the geomorphology of the very diversified landscape, which creates numerous different biotopes; the possibility of a recording over the long term which would gather non-contemporary species within a single sedimentary ensemble. We propose here to present both hypotheses and to discuss the various factors which influence the distribution and the representation of the small vertebrate species present on the site.

Keywords: Small, mammals, Palaeoenvironments, Middle Pleistocene, Arago cave

*Speaker

Fire and its required investments in isotope stages 13-11

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By Isotope Stage 11, around 400,000 years ago, there is evidence across Europe of numbers of sites where fire traces are present, and various features point towards its control by hominins. Only slightly later Qesem in Israel adds to this contemporary picture. Beeches Pit in East Anglia, UK, provides evidence in a pattern also seen elsewhere: numbers of penecontemporaneous fire features, occurrence of burnt materials at multiple levels, association with water, and association with human technical activity. The latter is especially well documented at Beeches Pit through the knapping of a biface, which yielded a refit chain of more than twenty pieces, just two of which are strongly burnt. The associated hearth features are as large one metre across at Beeches Pit, reminiscent of much later features at Abric Romani in the Pyrenees, but far smaller hearths are known in the general period, as at Bolomor in eastern Spain, where they appear associated with the cooking of rabbit and tortoise. These varying scales of hearths probably also represent the varying scales of investment by early humans in particular contexts: larger fires are more likely to indicate division of labour within a group and wide-ranging foraging for fuel. This paper reviews the fire record, and considers these varying scales of fire investment with reference both to the character of non-fire material behaviours on primary context and minimally disturbed sites from MIS 11-13, and in comparison to the recent suggestions of non-obligate fire use in the Middle Palaeolithic (Dibble *et al.* 2017).

Keywords: Fire, Homo heidelbergensis, hearthts, Middle Pleistocene

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XIV-3. The bifacial shaping phenomenon over time and space.

Multiplicity in hominin manufactured stone culture across the Middle Pleistocene

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Multiplicity in hominin manufactured stone culture across the Middle Pleistocene

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Abstract

This paper presents the third phase of the structural model for understanding technological change and cultural transmission over time "*Homogeneity to Multiplicity Model*" (HMM). In previous works, we have shown how formal *Variability* in Oldowan stone toolkits stemmed from recurrent unifacial and orthogonal knapping strategies, leading to a long period of technological equilibrium. We described how *Potential* within this cultural entity, defined as techno-morphological flexibility, triggered the transition to the next phase, referred to as *Diversity* and roughly corresponding with the Developed Oldowan or Early Acheulian. During this phase, hominins developed complex volumetric systems to produce Large Flakes and increased their technological concepts to include bifacial forms and to shape different kinds of large cutting tools: all hallmarks of the Acheulian. Here we discuss the ensuing Multiplicity phase, exploring the techno-social consequences of the changes materialized following the onset of the Acheulian and then throughout much of the late Middle Pleistocene. Beyond the systematization of handaxe production, this phase is marked by significant social and behavioral revolutions, including: changes in landscape use, population mobility, toolkit composition and technological

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competence. During this timeframe, hominins also underwent major biological changes with the advent of *H. ergaster and H. erectus* (*s. l.*) in Africa and Eurasia and the appearance of *H. heidelbergensis* in Western Europe. We discuss the cultural techno-genesis of the late Acheulian referring to a two-part systemic to explain its structural nature and evolutionary features: 1) accumulation and 2) overflow.

Keywords: Acheulian, Multiplicity, Middle Pleistocene, stone, tools, Large Flake, Handaxe

Evidence of an early bifacial technology at Notarchirico (Italy) dated to 650 ka in Western Europe.

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For the last decade, debates around the onset of the bifacial technology in Europe address the issue of the origin, local or introduced, and on what we name biface and Acheulean. The site of Notarchirico (Basilicate, Italy) is a case study. It yielded a sequence of several levels, including some bifaces for some of them (Piperno, 1999). 40A/39A and ESR methods recently dated the sequence between 614 and 670 ka (Pereira et al., 2015). The bifaces are thus among the earliest evidence of a bifacial technology in Western Europe. The bifaces made in flint, limestone and quartzite have been technologically revised in order to describe the modes of shaping, the morphological results and adaptation to the raw materials. This analyse contributes to the debate on the degree of complexity and skills of hominins living in Western Europe between 700 and 500 ka, related to *Homo heidelbergensis*. Tools are compared to the bifaces found at sites of the same period of time, for instance la Noira and Carpentier quarry in France or UK sites. They reveal a totally controlled bifacial technology, common features and a wide diversity in the technological and morphological purposes.

Keywords: Acheulean, biface, technology, Europe, Italy

*Speaker

The Acheulean Handaxe Technological Persistence: A Case of Preferred Cultural Conservatism?

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One of the unsolved 'paradoxes' in prehistoric archaeology is that of the gap between the considerable advances in human biological and cultural evolution during the Lower Paleolithic period, and the over one million years of 'stagnation' of the Acheulean handaxe. Most of the research on this topic has focused on explaining failed or delayed innovation - while overlooking the fact that innovation had occurred in many other fields during the same period. We suggest that practical, social, and adaptive mechanisms were in force in certain areas of human behavior and led to enhanced innovation, while conservatism was preferred in handaxe technology and use. Our claim is that the handaxe role in processing large carcasses, which enabled the dependency of Acheulean groups on calories obtained from large mammals and especially megafauna, became fixed in human society, probably through the psychological bias towards majority imitation, which subsequently became a social norm or tradition. We suggest that the technological persistence of the Acheulean handaxe was based on a preferred cultural conservatism, and not a lack of innovation.

Keywords: Acheulean, Handaxe, Stagnation, Innovation, Conservatism, Learning

*Speaker

On handaxes and proboscideans: establishing the possible connection between bifaces and elephants/mammoths during Lower and Middle Paleolithic times

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I will argure here that the major bulk of the available functional, technological, and experimental evidence suggests that the primary use of Paleolithic handaxes and bifaces lay in processing animal carcasses . It is true that in some cases handaxes were used in other tasks than in solely assisting the extraction of calories from different game taxa, and thus some see the handaxe as a multipurpose tool. However, the available data indicates not only the repeated archaeological association of handaxes and processed animal parts, but also the efficiency and suitability of handaxes in skinning, cutting, defleshing, and dismembering carcasses, and in particular carcasses of large-game taxa. It is also true that while handaxes are present at many Lower Paleolithic sites associated with elephant and other large taxa remains, some multi as well as single elephant carcass sites lack handaxes altogether. I will discuss a possible explanation for handaxes not having been found at those sites, and will not claim that the only possible way of processing a large animal carcass was by using a handaxe. I do, however, offer an hypothesis regarding the repeated association of handaxes and very large game at Lower Paleolithic sites in the Old World, coupled with the dependency of Paleolithic humans on animal meat and fat and the intriguing production of handaxes made from elephant limb bones. This hypothesis might be applicable as well for Middle Paleolithic sites with bifaces and mammoth remains. I suggest that handaxes were efficient and effective tools in processing large carcasses, enabling the removal of large quantities of fat and meat and the separation of body parts in order to manipulate and transport them. The handaxe allows the application of considerable force and leverage during cutting and dismembering, and its continuous and mostly curved and sharp working edge is ideal for massive and intensive meat and fat processing tasks . Moreover, handaxes could be re-sharpened in order to prolong the use of the tool for continuous operations, such as the processing of very large game. I thus see the handaxe as the primary tool that assisted butchery during Lower Paleolithic times, and in particular the processing of large game such as the elephant. Moreover, another significant aspect is the chronological and geographical connection between elephants/mammoths and handaxes/bifaces. It is suggested that these two go hand in hand, and that when megafauna no longer comprised part of the diet, handaxes/bifaces ceased to be produced and used. It is my contention that the central role of handaxes and large game in Lower Paleolithic adaptation is of pivotal significance, and that it is the role of handaxes in processing these large 'food packages' that ensured their long service during Lower Paleolithic times.

*Speaker

Keywords: Handaxes, bifaces, elephants, mammoths, fat, meat

Acheulian shortcuts and the use of Handaxes to produce predetermined items: Two case studies from Late Acheulian Revadim and Jaljulia (Israel)

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Handaxes of the Acheulian cultural complex were used at the end of the Lower Paleolithic period in the Levant as "prepared" cores for the production of a predetermined item. Late Acheulian flint knappers recognized the potential in the volumetric structure of Handaxes, and used the convexities that characterizes bifaces as a "shortcut" in the reduction sequence, enabling only few preparations before the production of a predetermined item.

The two phases of use of late Achelian bifaces, as Handaxes and later as cores, were documented at several Late Acheulian sites (DeBono and Goren-Inbar 2001; Shimelmitz 2015) and are a significant component of the Late Acheulian core reduction technologies.

The possible technological and conceptual connection between shaping and maintaining Acheulian Handaxes and the preceding Levallois blank production method had long been suggested (DeBono and Goren-Inbar 2001). Additionally, these extraordinary artifacts might serve as an indication for cognitive and technological complexities due to the recognition of an existing situation, and its manipulation, in order to transfer a biface from its original purpose as a tool to a now function, as a specific core for the production of predetermined flake.

The multi-layered Late Acheulian site of Revadim and the newly discovered site of Jaljulia (both in Israel), were excavated to a large extent and yielded rich lithic assemblages which are typical of the Late Acheulian in the Levant. The assemblages, includes Handaxes, but are mostly dominated by flake-production and flake-tools. Both of the sites present an early appearance of the prepared cores that might signal an early appearance of the Levallois method in the late Acheulian. Here, we will present Handaxes transformed into cores for the production of predetermined flakes from these two sites. An attempt will be made to contribute to the understanding of their role in human cultural evolution and the connection between these two key cultural components, Handaxes and the Levallois method.

DeBono, H and Goren-Inbar, N. 2001. Note on a link between Acheulian Handaxes and the Levallois Method. *Journal of the Israel Prehistoric Society* 31: 9-23.
Shimelmitz, R. 2015. The recycling of flint throughout the Lower and Middle Paleolithic sequence of Tabun Cave, Israel. *Quaternary International* 361: 34-45.

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Keywords: late Acheulian, Handaxes, Levallois

Three in one – a techno-functional analysis of the bifacial tools from the Acheulo-Yabrudian Cultural Complex of Qesem Cave, Israel

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Qesem Cave is an exceptionally well preserved prehistoric site in Israel, firmly dated to the Late Middle Pleistocene. Absolute dates from different dating methods consistently place the stratigraphical sequence in a time range between 420.000 years and shortly prior to 200.000 years ago. Whereas the lower stratigraphic units of the cave yielded the in-situ proof of the earliest repeated use of a central fire place, the upper unit is characterized by a pronounced ash component but no clear fireplaces have been identified yet. All of the abundant and excellently preserved lithic assemblages excavated so far are assigned to the Acheulo-Yabrudian Cultural Complex of the late Lower Palaeolithic period in the Levant, which in general includes three facies: the blade-dominated Amudian, the Yabrudian with Quina-scarpers being the most characteristic tool type, and the Acheulo-Yabrudian, which is defined by the presence of hand axes and scrapers. At Qesem, lithics are dominated by Amudian assemblages, whereas the Yabrudian appears, at the moment, only in three areas and in distinct stratigraphic units. Bifacial tools, e.g. hand axes, presumably of an Acheulo-Yabrudian facies are rare at Qesem. The data set analyzed here accounts for fourteen pieces. These were found in different depths below datum without vertical or horizontal clustering. Due to the fact that bifacial tools from Qesem do not represent a consistent assemblage, the analysis reported here focuses on the elucidation of the following large scale questions:
- Does the production of bifacial tools at Qesem follow one concept or a limited number of concepts, or do the bifacial tools represent individual solutions when confronted with a general need or desire to produce large bifacial cutting tools?

- Is the use of the bifacial tools uniform or individual?

- Given the overall highly economic reduction of lithic raw materials at Qesem, including recycling, do bifacial tools also show signs of reduction and/or recycling, and if so, do these reduction/recycling sequences show similarities?

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In addition to conventional classification, the core of the data analysed here is a working step analysis combined with the investigation of techno-functional units. Working step analysis is dedicated to the chronology of groups of negatives that each have a different technological aim and/or a different address on the upper or lower surface of the biface. The investigation of techno-functional units is based on the notion that tools may have several active working edges, resulting in several prehensile and corresponding transformative parts on one and the same piece. Data collection included an attribute analysis (of working steps) and the generation of 3D-models (using Structure from Motion wih AgiSoft) used for the measurements of angles and the extraction of cross sections especially in the context of the analysis of techno-functional units.

The hand axes from Qesem represent all stages of manufacture, but the majority are medium to large sized pieces with retouched working edges that underwent only minor reduction. Exceptions are two large roughouts and one largely reduced item. The analysis of the techno-functional units revealed that ready-to-use pieces where all following one concept that intended to make available working edges and/or working tips opposite to prehensile areas with steep angles suitable for the reception and transmission of energy suitable for heavy-duty use. However, any actual use must be investigated by future use wear analysis, which already has been successfully conducted on unifacial lithics from Qesem Cave. Typologically, the bifacial tools fall into two major classes: mostly massive hand axes with a thick base and two converging, straight to convex working edges forming a (sometimes worn) tip. Several backed bifacial knives found on-site have either a natural back or a back formed by a breakage. In the latter cases, the breakage occurred during the shaping of the piece, and the fact that it was accepted underlines the importance of (bifacial) working edges opposite to thick prehensile areas for the makers of the bifacial tools at Qesem. The many similarities in the concept of bifacial tool manufacture and use over more 200.000 years point to a remarkable cultural consistency.

Keywords: Lower Paleolithic, AcheuloYabrudianCulturalComplex, Qesem Cave, bifacial tools

On the use of Levantine Acheulean Bifaces: a view from Revadim Quarry and Jaljulia (Israel)

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The Acheulean represents one of the most widespread cultural complexes spanning from Africa to Eurasia between 1.8 and 0.2 Mya. Bifacial flaked stone tools, namely handaxes or Large Cutting Tools (LCT) represent the hallmark of this techno complex. However, functional data regarding bifaces are still relatively scarce and point towards a variety of activities and worked materials. The work here proposed aims to provide preliminary evidence regarding the use of bifaces at two Levantine late Lower Palaeolithic sites: Revadim and Jajuljia. Both sites are located on the coastal plain of Israel. The site of Revadim is dated between 500 and 300 kya, while the site of Jaljulia still awaits firm chronological framework. The flint lithic assemblages unearthed at both sites is characterised by the typical Acheulean toolkit, including retouched and unretouched flakes, bifaces and cleavers, while it seems that bifaces are much more dominant at the site of Jaljulia. The results here presented, derive from the combination of both technological and use wear analysis focused on the biface assemblages of the two contexts, which allowed to provide new hints regarding the use of these specific tools at the sites. Use wear analysis included the application of both high and low power approaches allowing to identify edge damage and micro wear affecting the edges of the tools, allowing a detailed analysis of the function of a sample bifaces at the two sites.The analysis permitted to gather evidence concerning the materials worked and the activities performed at Revadim and Jajulja, identify similarities or differences regarding the use of bifaces at the two sites. Our study allowed to provide significant and new insights about the use of these tools in the Levant, overall contributing to the debate regarding their role within Palaeolithic early human groups.

Keywords: Acheulean, Biface, Use Wear, Levant, Palaeolithic

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The peculiar presence of handaxes at Acheulo-Yabrudian Qesem Cave, Israel: A Geoarchaeological Perspective

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The Levantine Lower Palaeolithic Acheulo-Yabrudian cultural Complex (AYCC, ˜420-200 kya) constitutes three major lithic industries: the Yabrudian, dominated by Quina and demi-Quina scrapers; the Amudian, dominated by blades; and the Acheulo-Yabrudian, dominated by bifaces. While the Amudian and Yabrudian industries distinctively appear throughout the sequence of Acheulo-Yabrudian Qesem Cave (QC), Israel, none of the handaxe-dominated Acheulo-Yabrudian assemblages have been detected at the site. Nonetheless, occasional handaxes have been found, in a variety of settings within the site. In this study we present the results of a geoarchaeological analysis of these handaxes. Our analysis includes 12 handaxes, three bifacial roughouts, one trihedral, and one bifacial spall.
The analyzed items were measured and classified into flint types based on visual traits, such as colour, texture, cortex, and any visible fossils. In addition, extensive fieldwork aimed at locating potential sources was carried out. The handaxes were then assigned to potential geologic flint sources and geologic age and formation, using both macroscopic and petrographic data, and compared to a large general sample (˜22,000 artifacts) from various typo-technological categories and from various QC assemblages, studied by the same analytic process.

Results show that the most dominant flint type among the handaxes is type AQ (3 handaxes, 2 roughouts, and one bifacial spall, out of 17 items, 35.3%; 1.4% in the general sample), a siliceous breccia of the Mishash formation (Upper Cretaceous),not available in the current immediate vicinity of the site. Four handaxes and one roughout (29.4%) are made of type T, a flint of an unknown source (1.5% of the general sample). Two other handaxes are made of type W, a flint type of a local Turonian (Upper Cretaceous) origin. The three other bifaces and the trihedral are made of four different flint types, two of which are local, while the other two (including the trihedral) are from undetermined sources. The use of flint types from non-Turonian sources for the manufacture of 13 out of the 17 studied items (76.5%), indicate a specific selection procedure. Previous studies of the Qesem Cave lithic materials demonstrated that at least some of the handaxes at the site were produced from materials originating from primary geologic sources, possibly involving quarrying (Buaretto et al., 2009). Thus, it is possible to suggest that specific traits, such as durability, size, and/or shape, justified specific procurement procedures of the flint types used to produce the handaxes.

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The AYCC displays an innovative and "ahead of its time" lithic array and behavioural patterns (including the production of blades and Quina scrapers, the systematic and cooperative hunt of fallowdeer, and the habitual use of fire). Handaxes are one of the few components of the AYCC that reflect a continuation of Acheulian traditions. We propose that handaxes probably had only a minor functional role, as reflected by their low quantity and by the absence of bifacial knapping waste (other than the one bifacial spall). the presence of stray handaxes at the cave, made of specifically selected and procured flint types, may indicate their possible role in collective memory and appreciation of past traditions, or some sort of a practical connection with biface-rich contemporary or older sites.

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Buaretto, E., Barkai, R., Gopher, A., Berna , F. and Weiner, S. 2009. Specialized Flint Procurement Strategies for Hand Axes, Scrapers and Blades in the Late Lower Paleolithic: A 10Be Study at Qesem Cave, Israel. Human Evolution 24, 1-12.

Keywords: Qesem Cave, Handaxes, flint types, flint sources, Acheulo, Yabrudian

Inter and intra-deposits site variability of bifacial shaped productions in Southeastern France during the Middle Pleistocene

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The Acheulean sites of Southeastern France, allow to observe the evolution of the bifacial shaping in an homogeneous geographic area, during a 400 Ka period. Through this communication we propose to present, the technological and morphological characteristics of these bifacial shaped productions. Thus, with this data, we can discuss and highlight inter and intra- sites variability.
The analyses focus on bifaces from Arago Cave (unit 1, OIS 14 and unit 3, OIS 12), Terra Amata (OIS 10), Orgnac 3 (OIS 9/8) and Lazaret cave (OIS 6). They are studied according to their volume and their production technics. Otherwise, we used an artisanal approach of the tooling. It consists on the search for the cutting edges and the study of their positions on the blank compared to the potential prehensive part. This has allowed us to characterize different types of functionnal structurations of these artefacts.

This methodology revealed importants variations of *chaîne opératoire.* Thus, the variability of raw material used for shaping is not the same depending on the sites; the use of soft hammer is absent for some series but present since unit 1 of Arago Cave. The method of shaping may depend on a lateral or facial conception of the volume. Otherwise, at least two groups may be distinguished within bifaces: one for which the tool has a tip and a latero-distal cutting-edge; the other for which the tool presents a distal cutting-edge.
These results allow to make distinctions - at least technical - between the shaping productions within an archeological level and between archeologicals levels from the same site (unit 1 and 3 from the Arago Cave), or from the same environmental area (Terra Amata and Lazaret Cave in Nice city). Thus, the variability of the bifacial shaping and of its goals of production has to be viewed on a synchronic and diachronic background. The raw material constraints can't explain these variations, which can be linked to cultural differences or site function variations.

Keywords: Biface, Acheulean, Southeast France, Technological analysis

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La variabilité dimensionnelle des bifaces de Montmaurin, dans les Petites Pyénées

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Les occupations humaines à l'origine des productions lithiques acheuléennes et moustériennes ont laissé de nombreux vestiges dans le complexe de grottes de Montmaurin, (Haute-Garonne), entre l'OIS 9 et 5. Il s'agit de plusieurs cavités étagées et communicantes, s'ouvrant aux dépens d'un pointement de massif calcaire danien, que deux canyons viennent profondément creuser (la Save pour l'ensemble de Lespugue et la Seygouade pour le groupe de Montmaurin). L'industrie lithique témoigne de la transition entre le Paléolithique inférieur et moyen, avec le façonnage de bifaces ne s'accompagnant pas de Levallois et dont la production principale relève de schémas discoïdes dans les différents niveaux.

Les outils massifs bifaciaux obtenus à partir de blocs, mais également d'éclats de grandes tailles, ont été classifiés généralement selon leur forme. À Montmaurin, deux catégories dimensionnelles de bifaces sont remarquées : des bifaces de grande taille à la grotte de la Terrasse (n = 10), dont certains, dépassent 20 cm, et de petits bifaces à la grotte de Coupe-gorge (n = 15), qualifiés de " micoquiens " et dépassant rarement 10 cm. La différence entre ces deux groupes de bifaces se perçoit aussi dans la sélection du bloc d'origine : galets massifs, et uniquement sur quartzite à la Terrasse ; galets de petite ou moyenne en lydienne, quartzite et silex pour Coupe-gorge.

Ces distinctions ont conduit certains auteurs comme Serra (1980) à se poser des questions entre influence culturelle et déterminisme environnemental à propos de ces outils. Mais les données paléontologiques et palynologiques mettent en évidence un environnement forestier à " faune chaude " dans ces deux grottes, excluant *de facto* l'hypothèse d'un changement de faune et de couvert végétal, ayant entrainé la variabilité de ces outils bifaciaux. Par ailleurs, les gîtes d'approvisionnement en matière première ne semblent pas avoir varié entre les occupations de la Terrasse et de Coupe-gorge. De ce fait, l'idée d'un déterminisme environnemental nous parait erronée.

Keywords: bifaces, variabilité, Petites Pyrénées

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Shapes and technological procedures of the bifacial tools at the Melka Wakena Acheulian site complex

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Competing hypotheses have been forwarded in the last few decades about behavioural factors governing the technological choices of Acheulian LCTs makers and how they may have affected the morphology of bifacial tools. Hypotheses range from those asserting that Acheulian knappers used expert cognition and fore-planning to impose form on a wide spectrum of raw materials (i.e., mental template hypothesis) to hypotheses suggesting that the final shapes of LCTs are the mechanical outcomes of reduction intensity and the impact of raw material size, form and quality. Consisting of a number of stratified localities in an extensive spatial context, the Melka Wakena site complex presents an opportunity to explore patterns in the technology of Acheulian LCTs production through time. Here we focus on two bifacial tool types – Handaxes and Cleavers – to evaluate the influence of technological procedures, reduction intensity and raw material characteristics in determining the final shape of the bifacial tools. We present a technological study of these two tool types in stratified assemblages, examining the shape, size and raw material trends across time (from 1.6 Ma to ¯ 0.7 Ma) on inter-and intra-site scales. Results show that raw material selection for these tool types was nearly identical across time and space in the MW sites, yet there is no clear co-variation between technology (blank preparation, selection and shaping) and morphology of the bifacial artifacts. We compare these results to other broadly contemporaneous African and Levantine sites and discuss parameters of decision making procedures governing the production of Acheulian LCTs.

Keywords: Early Acheulian, Tool morphology, Lithic technology, Ethiopia

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Acheulean versus Premousterian: two models of hominin survival in European environments

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The most significant recent achievements in the study of Lower Palaeolithic of Eurasia are clear findings that, firstly, the Early Pleistocene hominins in Europe and entire West Eurasia produced the Oldowan-style industry of core-choppers, small flakes and flake-tools; and, secondly, the Acheulean-making hominins invaded to Europe from Africa in the early Middle Pleistocene. Solid evidence that would support the idea of local origin of the European Acheulean has not been discovered in Europe (Sharon and Barsky, 2015). The earliest Acheulean industries in Europe show surprising technological and morphological standardization, which suggests the arrival in the continent of a hominin population with well defined cultural and stone working traditions (Barsky and de Lumley, 2010). Many authors define the Middle Pleistocene makers of Acheulean in Africa and Eurasia as *Homo heidelbergensis sensu lato*, while the first Europeans probably representing the European branch of *Homo erectus sensu lato* and producing the Oldowan industry are commonly defined now as *Homo antecessor*.

The initial hominin population in Europe represented by *Homo antecessor* well adapted to climatic fluctuations and start expansion into northern territories with colder climates and more forested environments, and maintained a continuous settlement in different European ecosystems from ca. 1.4-1.2 Ma until the expansion of new hominin groups with the Acheulean stone-working tradition (Messager et al., 2011). The increasing number of evidences indicate that after the invasion of Acheulean into Europe the tradition of producing small tools and core-choppers was present in parts of West Eurasia beyond the area of the maximum expansion of Acheulean, including central and eastern Europe, during Middle Pleistocene. The authors define these Middle Pleistocene assemblages that show derived Oldowan characteristics, such as core-choppers, small flakes and flake-tools, and lack characteristic features of Acheulean, such as large bifacial tools or true Acheulean handaxes, as well as debitage resulted from handaxe production, and large flake or Levallois technologies, as the "Pre-Mousterian industrial complex" (Doronichev and Golovanova, 2010; Doronichev, 2016) or "Premousterian".

We summarize and discuss data for coexistence in Europe of two hominin populations, whose models of survival in European environments and behavioural strategies contrasted substantially during most of the Middle Pleistocene, between 800/750 and 300/250 Ka. The comparison of the archaeological evidence regarding this period suggests early (before 500 ka) episodic and later (after 500 ka) substantial arrivals into western Europe of hominin groups with new behaviours (Acheulean area) against a background surviving in central and eastern Europe of hominin groups with earlier tool-making traditions (Premousterian area) until the onset of Middle Palaeolithic. Although regional scenarios of interaction between Acheulean and Premouste-

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rian populations may vary depending of regional peculiarities, population histories of these two hominin populations in Europe in general were very different.

Keywords: Acheulean, Premousterian, hominin survival, Europe

Flexibility and faith to conception in the production of Keilmesser with tranchet blow

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This talk would like to highlight the specificity of Keilmesser with tranchet blow production and thus focus chronologically on the Middle Paleolithic. The principle of edge sharpening in the sense of tranchet blow is already known in Acheulian, but it is particularly evident in Keilmesser with tranchet blow that the entire production of the tools is geared towards the goal of making a specific modification to the cutting edge. The stone artifacts to be discussed here are found in both, the early (La Cotte de Saint Brelade, Mesvin IV) and middle Middle Paleolithic (Rheindahlen) but appear to be more widespread in the late Middle Paleolithic (e. g. Abri du Musée, Balve, Buhlen, Ciemna, Grottes de la Verpillière I & II, to name a few). The distribution of these pieces in space and time, which has been investigated so far, will be addressed as well as new objects discovered through own research will be presented. The tools to be discussed here also show that the entire production process can be highly flexible on the one hand, but on the other hand faith to conception must be constantly in mind in order to achieve the goal of tranchet blow modification. By means of examples of different sites, it will be demonstrated how flexible and static the Keilmesser with tranchet blow concept is. In addition, methods are presented on how to determine the production sequence of several objects of several sites in Europe using an analytical protocol based on Working Stage Analysis and Harris matrices. The talk thus expands the chronological view of the bifacial shaping phenomenon over time and space by a Middle Paleolithic component in the European context.

Keywords: Keilmesser with tranchet blow, Pradnik, Late Middle Paleolithic, bifacial shaping

*Speaker

A morpho-technological analysis of Acheulean bifaces (on materials of Satani-Dar locality, Armenia)

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A morpho-metric analysis of bifaces applied in this study consists of two stages: (1) grouping bifaces in separate groups, basing on morphological features of each tool; and (2) analysis of the relationship among the defined biface groups to asses if variation among the groups might be interpreted in terms of the production technology; as a result, there are identified "culturally-significant" models of bifaces.
In the Caucasus, one of the largest collections of Acheulean bifaces is known from the Satani-Dar locality in Armenia. Since the mid-20th century, bifaces from this site have been described using both typological methods (Panichkina, 1950, 1953; Sardaryan, 1954; Liubin, 1984, 1989) and technological characteristics (Matiukhin, 2001). Earlier, the attempt of morpho-technological analysis was undertaken by the author (Golovanova, 1984).
The author has studied the collection of bifaces from Satani-Dar, collected by M.Panichkina in 1947-1949 and stored now in the Hermitage Museum in St.Petersburg. In this collection, the author defined 81 bifaces. The analysis shows that some of biface groups, selected on the basis of their morphological features, may be combined, because they differ only with the sequence of processing methods that produce one morpho-metric form or type of biface. It can be assumed that these groups represent the same tool model, while differences among the groups are due to the blank used.

Keywords: Acheulean, bifaces, morphotechnological analysis, Caucasus

*Speaker

Late Acheulean bifaces of Zaskalnaya IX in Crimea

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Two layered locality of Zaskalnaya IX is localized on the border between steppe and Mountains, next to the concentrated in Krasnaya balka multilayered MP sites that provide numerous remains of Neanderthals. Locality disposed 229 m a.s.l., 45-50 km from the modern sea shore. The upper layer contains few Gravettian points. Several typical Acheulean handaxes, as well as backed bifaces, few preforms, and little series of bifacial waste flakes were revealed in the lower layer of Zaskalnaya IX. This series is accompanied with isolated flake tools, including sidescrapers and points. Lithic artefacts are manufactured by the local raw materials, known in the vicinity of the site. Artefacts were recovered concentrated on the area close to the presumable entrance of buried rock shelter and usually interpreted as evidence of short-term occupation. There are refittings, which allow studying of some technological features of resharpening and reshaping of bifaces. No direct indications of chronological position of the assemblage are known. Geological and paleontological data support the Pleistocene age, but without further details. Morphologically and technologically bifaces of Zaskalnaya IX have a little in common with local Micoquain industries aged to the last interglacial-glacial cycle.

Keywords: Eastern Europe, Acheulean, bifaces

*Speaker

Production system of shaping tools in the late Middle Palaeolithic: the case of the Micoquian workshop from SW Poland

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Shaping tools in Central Europe are well-known from the late Middle Palaeolithic assemblages attributed to Micoquian or Keilmessergruppe/Pradnik cycle. However, the reconstruction of production methods and operational chain concerning shaping tools is hindered due to lack of workshops. The aim of this paper is to present results of the study on remains of the Micoquian workshop Pietraszyn 49a which has been recovered in 2012 in SW Poland. Conducted research comprise morphometric analysis of waste material, refits of tools and their pre-forms, reconstruction of production stages using 3D models, experimental replication as well as microscopic examination of technological traces. This work has been financially supported by Polish National Centre of Science (no project 2017/25/B/HS3/00925).

It was observed that the manufacture was preceded by the selection of flat nodules or chunks of erratic flints. During the tool shaping mineral and organic hammers were used. Approximately 40 bifacial tools were prepared at the site. Although it seems that the manufacture of tools was not governed by rigid rules, several "imperatives" were present. One of the most important steps was the separation of the active part consisting of working edge, sometimes in relation with a tip. Another important working step was the creation or separation of a passive or prehensile part, consisting of a base and a back.

The refitting study of lithics lead us to the conclusion that the production resulted in individualized forms, among which plano-convex specimens predominate. Shaping processes had different dynamics, depending on volume and quality of raw material as well as the specific part of the tool. It seems that the shaping of the flat side of the tools costed less effort and time than the shaping of the convex sides of tools. During the reduction phase, humans produced many flakes and sometimes blades. They have sporadically been used as blanks for expedient tools. It is worth mentioning that the site hasn't provided any traces of core reduction. It seems that the production of bifacial tools could have been a part of logistic systems of hominins related to

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hunting strategies and food extraction.

Keywords: Bifacial tools, Micoquian, Poland, production system

The emergence of Late Acheulean patterns of biface production and resharpening (on materials of Hugub locality, 600-500 ka, in Ethiopia)

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Our report is addressed to the problem of origin of a novel technology of biface production and biface resharpening, both of which are traditionally associated with Late Acheulean. The Hugub locality in Ethiopia reported here has been securely dated to between 600–500 ka ago (Gilbert et al., 2016). The site is sufficiently rich in artifactual and paleoenvironmental data, and vast in the preserved *in situ* artifact-bearing unit to become a benchmark for the study of evolutionary changes in lithic technologies during this period.

The studied lithic assemblage from Hugub yields numerous bifaces, most of which are amenable to morphometric analysis. Metrics indicate an apparent bimodality of Hugub bifaces. The Index of Pointedness (the ratio of biface maximum width to the width of the tip measured at 3/4 of the overall length) divides them into two major groups: broad-tipped ovates and pointed bifaces. Ovate bifaces with broad tips are more abundant than pointed bifaces. Most ovates and pointed bifaces are shaped in the plano-convex method. The interdependence between maximum length and thickness of ovate bifaces implies biface size reduction, which could result from modification and edge rejuvenation. The analysis indicates the highest proportion of bifaces made on flakes among large-sized ovates, and a significant decrease of bifaces on flakes among medium-sized and small ovates, as well as substantial decrease of maximum thickness among small-sized ovates. Apparently, these peculiarities are also caused by reduction of ovate bifaces. Most ovate bifaces seem to have been initially made on large flakes, as seen in the larger size ovates, but ventral surfaces of flakes are difficult to identify due to heavy reduction of edges and faces. Almost all small-sized ovates are completely bifacial tools, also likely the result of on-site reduction through rejuvenation. Among pointed bifaces, some smaller size pointed bifaces grade into sub-triangular bifaces or diminutive bifaces similar to MSA-type bifacial points – that are traditionally associated with the Final Acheulean/early MSA.

Regarding the flaking technology in the Hugub site, our analysis indicates that dorsal surfaces and striking platforms on flakes exhibit a predominance of irregular dorsal surfaces (i.e., having an uncomplicated and non-standardized pattern of few removals from different directions) and minimal preparation of striking platforms that are mostly plain or dihedral. The assemblage shows a paucity ($< 10\%$) of flakes with parallel and convergent removals, and virtual absence of faceted platforms (only four items) that are found exclusively on flake tools. A non-Levallois

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recurrent flaking method is clearly present. The absence of Levallois debitage would be consistent with an earlier age for the Hugub assemblage; this coincides with the recent data from the Kapthurin Formation, where no evidence for Levallois reduction is found in earlier Acheulean assemblages dated to 545–510 ka. We conclude that Hugub site documents the earliest emergence of new patterns of biface manufacture and resharpening that are traditionally associated with the Late Acheulean.

Keywords: Late Acheulean, biface production, biface resharpening, Ethiopia, Africa

3D shape analysis and balance in Acheulean bifacial tools

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Acheulean handaxes have received considerable scholarly attention over the last 200 years due to their abundance, longevity, and wide geographic distribution. They are known from sites throughout Africa, as well the Near East, Europe, and parts of Asia. They represent humans' longest lasting tool industry, appearing about 1.9 ma until roughly 200 ka. As the first tools made by form shaping, with some specimens achieving a high degree of symmetry, they are often argued to reflect the cognitive abilities of their makers. Although often associated with *Homo erectus*, they appear to have been the product of at least two or more species of early *Homo.* Most research to date has focussed on the role of symmetry in handaxe design, their potential utilitarian and non-utilitarian functions, and levels variability in the morphology between specimens within an assemblage or between group means of assemblages. Recent years have seen the application of three-dimensional (3D) digitisation of handaxe assemblages and related 3D analyses of their shape. The current proposal is based on doctoral research using 3D digitisation and 3D analyses of assemblages in order to study the internal mechanics of handaxes and its role in their design. Specifically, a protocol has been developed to analyse the role of balance in the design of Acheulean bifacial tools and treats balance as a quantifiable morphological variable. The proposed paper will focus on patterns that the new protocol has identified in the location of balance of Acheulean bifacial tools, how they relate to traditional handaxe typologies, and their importance in overall handaxe morphology and manufacture.

Keywords: 3D Geometric morphometrics, 3D shape analysis, bifacial stone tools, handaxe, balance, acheulean, tool design

*Speaker

From giant cores to bifaces. Technological variability and Cahine Operatoire segmentation in the Acheulean of the Iberian Peninsula.

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Around western Europe, the bifaces are one of the main landmarks of the Acheulian techno-complex (Moncel and Schreve, 2016). The central region of the Iberian Peninsula is characterized by important Miocene formations with a huge abundance of flint outcrops in which important Palaeolithic sites have been discovered. The sites distribution and its density, confirm the large and diachronic human catchment and knapping activities during the interval MIS11 to MIS3. Charco Hondo 1 and Charco Hondo 2 (Bárez et al., 2016) are two of the main Acheulean sites (Los Ahijones- Madrid) in which quarrying of flint blanks and the knapping of bifaces were the main developed activities. Although in both cases the lithological context and the shaping propose were similar, there are fundamental differences between them. We recorded changes in knapping techniques and shaping methods between levels and sites. But the major differences were register in the blank production strategies and the general organization of the reduction process(Sharon, 2010). In this contribution, we analyse these differences in order to carry out a comprehensive understanding of the variability of those assemblages and the possible reasons that were behind it. (Moncel and Schreve, 2016).
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Keywords: bifaces, acheulian, Iberian Peninsula, Chaine Operatoire, segmentation, lithic technology

*Speaker

The Western European Acheulean: a new methodological approach for the study of the Middle Pleistocene occupation of Europe

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The Acheulean technology marked a revolution and its presence can be clearly tracked along the European seaboard from the Iberian Peninsula to Great Britain, mainly between 700 to 300ka. Nevertheless, to go beyond the local perspective and gain a regional point of view requires a deep understanding of the underlying technology to identify the differences or similarities in processes and traditions of manufacture. The different criteria to analyze and to categorize the results make it difficult to compare data from different research traditions. Although many technological approaches have been developed, there are still differences in method between the different countries. The British research has been based on the typological system of Wymer or the morphometric system of Roe for the analysis and classification of handaxes, as well ason the simple description of shaping sequences developed by Newcomer and Wenban-Smith. In turn, the French traditions are mainly based on the typological view proposed by Bordes, on the complex approach of the *chaine operatoire,*and on the techno-functional approach proposed by Bo´eda. Meanwhile, the Spanish tradition has been highly influenced by the French school, with significant methodological developments coming from the Logical Analytic System. This work proposes a common method of analysis for the study of Large Cutting Tools from several sites in UK and France (La Noira, Brandon Fields, Cagny Le Garenne, Elveden, Swanscombe, La Celle, Saint Pierre les Elbeuf, Menez Dregan), based on a selection of technological attributes from the main traditions of lithic analysis (typological, technological, morphometrical and sequential) that are considered to be specially significant. The attributes will be those which give more information about the Large Cutting Tools and how they have been produced. Each tool will be analyzed as a unit and also divided in its three main morpho-potential sections: distal, medium and proximal parts. In addition, taking advantage of new technologies and combining the basic technological analysis with 3D models, will allow us to standardize the process of measurement

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and documentation of the pieces more objectively. The measurements obtained will be managed through an open-access data base in order to promote the accumulative information of Western European sites.

Keywords: Handaxes, Acheulean, Middle Pleistoce, Western Europe

Rare, but there: the bifacial components in the Armorican Peninsula between MIS 11 and 8

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This paper focuses on the bifacial elements of the Lower Palaeolithic record in the Armorican Peninsula, either found on sites or isolated, in different contexts, with an emphasis on the site of Menez-Dregan and its 250 ky-long sequence. Recent studies evidence that bifacial tools are sporadically but persistantly present in the Armorican Peninsula between MIS 11 and 8, in almost all the Lower Palaeolithic assemblages. Rare, but there, the low quantity of handaxes does not differ from most contemporaneous european sites. How can we explain this low rate of handaxes in most of sites? Can we see a linear technical trajectory between the numerous pebble-tools and the crudely made handaxes found in Menez-Dregan? Do the raw materials used (e.g. pebbles) have an influence on the technical behaviours? It is also typical that handaxes or cleavers are frequently found isolated and without any stratigraphical context (e.g. on the foreshore or along the main river valleys), suggesting a higher mobility for these kinds of tools than more common heavy-duty tools, such as choppers. Does that imply that handaxes are multifunctional tools that can be easily transported? Excavation at the Lower Palaeolithic site of Menez-Dregan I has yielded evidence of the presence of bifacial components in almost all of its 16 layers of human occupations, except in 5 levels : layers 9 and 9a (end of MIS 12), and in layers 5b, 5c and 5d (MIS 9a), which do not contain any handaxes or biface thinning flakes. Despite broadly similar environmental conditions, same raw materials and possibly site functions, can this fact highlight different raw material managements, or technical or cultural traditions?

Keywords: Bifacial shaping, Acheulean, Menez Dregan, Lithic technology, Armorican Peninsula

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Large Cutting Tools in East Asia - A convergent development or indicator of migrations?

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Representing a step up in complexity and often associated with an increase in cognitive capability (McNabb et al. 2018), the Acheulian is the first lithic technocomplex in which tool shapes follow stronger cultural moulds. With the earliest evidence dated to 1.8 million years ago (Ma) in Kenya (Moncel et al. 2016; Lepre et al. 2012; Díez-Martín et al. 2015), the Acheulian toolkit spread out of Africa into the Levant *circa* 1.5 Ma (Sharon & Barsky 2016), in south west Asia as early as 1.1 Ma (Pappu et al. 2011; Paddayya 2007) and finally to Europe around 0.9 Ma (Moncel & Schreve 2016; Scott & Gibert 2009). Its main defining characteristic is the presence of large cutting tools (LCT) such as cleavers, picks and, the most iconic of these tools, the handaxe (Lycett & Gowlett 2008; Goren-Inbar & Sharon 2006; Soressi & Dibble 2003). Its geographical distribution encompasses almost all of the areas were early hominids spread in the Old World.

While it's true that the presence or combination of these tool types define the Acheulian, this classification is becoming increasingly more controversial (Lycett & Gowlett 2008). Despite their supraregional presence, LCTs were rarely known in East Asia (though recently were well typified e.g. in China and Korea: Li et al. 2017; Yang, Hou & Pelegrin 2016; Yang, Hou, Yue, et al. 2016) which led to theories that it did not exist in these regions (Movius 1948). While recent findings argue in favour of the presence of an Acheulian in East Asia (Dennell 2016; Yang et al. 2014), lingering questions over the nature of these tools still remains. More prominently, it's theorized they may result from convergent developments (Wang et al. 2012) or a development rooted on an earlier convergent culture in the region (as indicated by other researchers e.g. Boeda and Hou, 2011). This handaxe absence could also be a distinctive characteristic of the Acheulian in East Asia, similar to Middle Paleolithic industries, more specifically the Mousterian, in China (Li et al. 2018). The vast geographic distances involved may be the main reason of the aforementioned distinctiveness.

The possibility of migration, however, or a mix of cultural spread, technological convergence and migrations can't be ruled out as the possible origin for East Asian LCTs. The migratory hypothesis as well as theories proposing a "genetic" origin for the Acheulian have been the

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subject of recent investigations (Romanowska et al. 2017; Tennie et al. 2017; Corbey et al. 2016) but they don't directly address the questions surrounding the rarity of a full Acheulian assemblage in the archaeological record of East Asia or their similarity to their counterparts in the rest of the world.

Keywords: Acheulian, Bifaces, Asia, Lithics

Façonner le biface à l'Acheuléen : quel rôle pour les techniques de percussion ?

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Durant l'Acheuléen, les tailleurs de la Préhistoire ont façonné des milliers de pièces bifaciales, dans un éventail de matières premières, allant du silex au basalte en passant par l'os et le calcaire. La variabilité technique et morphologique incontestable de ces outils emblématiques ont conduit à diverses analyses et interprétations, en particulier sur leur réalisation. Ainsi, on présume souvent que les techniques de percussion utilisées pour façonner un biface ont une incidence sur la qualité d'exécution ou le degré de finition de celui-ci. Et il n'est pas rare de voir le percuteur tendre organique, dont l'utilisation a été établie dès -700 000 ans au Kenya, élevé au rang d'outil qui aurait permis l'obtention de pièces bifaciales plus abouties d'un point de vue symétrique et volumétrique, pour ne pas dire esthétique. Mais y a-t'il réellement un lien de cause à effet ? Pour aborder la question de la reconnaissance des stigmates de percussion sur le matériel archéologique de manière critique, dans le cadre spécifique des matières premières microgrenues et tenaces propres aux premières séries identifiées pour la percussion tendre organique, une expérimentation a été réalisée exclusivement avec des matériaux africains, tant pour les produits façonnés que pour les percuteurs. Plusieurs techniques de percussion ont été testées, permettant ainsi de mesurer le degré de résolution de ces stigmates. La mise en relation de l'analyse structurelle des pièces bifaciales avec les techniques utilisées donne des éléments de réponse sur la question du lien entre la technique de percussion et la morphologie du biface permettant ainsi de comprendre la hiérarchie technique qui peut en découler. Grâce à d'autres résultats, concernant à la fois des collections issues de sites du Sud-ouest de la France et une expérimentation sur des quartzites, l'importance du concept de départ et de la structure du biface est ainsi mise en exergue, face aux possibilités qu'offrent les techniques de percussion. Les perspectives obtenues autorisent alors une réflexion nouvelle sur la place de ces techniques à l'Acheuléen.

Keywords: Technique de percussion, Acheuléen, Afrique de l'est, Analyse structurelle

*Speaker

A Tale of biface technologies from S. Peninsular India ; (British Museum collections) - 3D geo-morphometric and classical techniques of analysis

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Biface tools have played an important role in the Palaeolithic studies trying to decode ancient lifeways through them. Often the traditional metrical analysis has been unsatisfactory and subjective, especially in instances of asymmetrical tools with various possibilities of orientation, for capturing data reflecting their shape. Recent years have seen the application of 3D scanning as an accurate, efficient and objective method of data collection as an alternative. It has the additional advantage of being both interactive and reversible analytical process.

Traditionally the collections of Palaeolithic artefacts kept since long in the museums are seldom subject to study (due to lack of related documentation, and often doubtful or mixed context thereby increasing the possibility of misinterpretation). Moreover, if at all they are studied, it is often the classical typo-technological analysis which is applied, along with very simple measurements to record the bifaces morphology.

This paper will present the preliminary results of both geo-morphometric as well as classical analytical methods applied to bifaces from South Peninsular Indian Palaeolithic assemblages kept in the British Museum collections. It will highlight the complimentary nature of both methods in deciphering the tool technology and morphology and show the advantages of the geo-morphometric analysis.

This combined methodology will be further applied to other collections and participate to the current increasing availability of 3D data. This enhances the possibilities of statistical comparisons at a large scale, geographical and temporal as well. The present study will also contribute

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to the development of digital data repositories, easily accessible for the community of archaeologists and sparing collection specimens repeated manual handling.

Keywords: Lithic Technology, Digital Data, Biface analysis, 3D geo, morphometrics, Museum collections

HOW USE-WEAR ANALYSIS CAN BE HELPFUL TO UNDERSTAND LITHIC TECHNOLOGICAL CHANGES. USE-WEAR ANALYSIS OF THE LITHIC INDUSTRY OF GUADO SAN NICOLA MIDDLE PLEISTOCENE SITE (ISERNIA, ITALY)

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The Middle Pleistocene site of Guado San Nicola (GSN) is located near the village of Monteroduni (Isernia, Molise, south-central Italy). Anthropic units date to the transition between marine isotope stages (MIS) 11 (i.e. 400 ± 9 ka) and MIS 10 (i.e. 345 ± 9ka), according to radiometric dates (40Ar/39Ar and ESR/U-series).
The lithic industry is characterized by the presence of bifacial shaping and Levallois débitage, of which GSN represents the most ancient evidence in Italy and one of the earliest evidence in Western Europe. The considerable archaeological record found during the excavation campaigns, the clear chrono-stratigraphic context, and the early presence of the Levallois method, make Guado San Nicola one of the sites that can strongly contribute to a better understanding of the Lower/Middle Palaeolithic transition in the Italian peninsula and in the Mediterranean basin.
The main objective of this work is the use-wear analysis of the lithic industry to understand the types of activities carried out in the site. This work focuses on flakes and for these reason bifaces were excluded from this study but of course not the bifaces' manufacturing (and maintenance) flakes. The use-wear traces found on the lithic industry of GSN are indubitably referable to animal carcasses processing and the presence of few traces linked to woodworking activities can be related to the maintenance or manufacturing of wood objects, like spears. The presence of use-wear traces on bifaces and Levallois flakes demonstrates that there was not a practical difference between flakes produced through débitage and those from shaping. These empirical evidences also suggest the hypothesis that Levallois technology could be an inherent property of the Acheulian, that evolves out of the existing, reflecting an ancestor-descendant relationship.

*Speaker

Keywords: usewear analysis, Acheulian, Levallois débitage, bifaces shaping flakes

Bifacial shaping: experimental and archaeological approaches for the identification of manufacture's stages

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The study of handaxes' waste products can contribute to better understand the bifacial mode of shaping and the mobility pattern of the hominins. By studying experimental and archaeological samples, we tried to identify attributes that enable to differentiate handaxes' flakes according to stage of manufacture. Flakes resulting from experimental bifacial shaping and archaeological handaxes from two sites, Guado San Nicola (Italy) and la Noira (France), are examined and analysed by technological and statistical methods. Although most of the considered attributes are not significant, some characteristics allow differentiating the first stage of shaping from the final stages. We also notice that further information about flakes' phases attribution can be obtained if the knapping technique and the blank used to shape the handaxes are known. In addition, to separate the experimental samples based on knapping techniques allow making some remarks on the validity of the attributes usually associated with hard and soft hammer percussion.

Keywords: bifacial shaping, experimental approach, statistics, acheulean

*Speaker

The Acheulean site of Porto Maior (Galicia, Spain): an example of successful combined ESR and Luminescence dating applications

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The Acheulean site of Porto Maior (Galicia, Spain) has delivered an exceptional extensive accumulation of large cutting tools (LCTs) showing affinities with Lower Palaeolithic assemblages from Africa. The chronology of the site has been established by the combination of two dating methods independently applied to the different sedimentary units of the sequence. Electron Spin Resonance (ESR) dating of optically bleached quartz grains was carried out at CENIEH (Spain) following the Multiple Centre approach. Both Aluminium and Titanium centres were measured. Luminescence dating was conducted at the University of Adelaide's Prescott Environmental Luminescence Laboratory (Australia). Post infrared (IR) IR stimulated luminescence (pIR-IR) dating of coarse K-rich feldspar grains was applied to all samples, while single-grain optically stimulated luminescence (OSL) of quartz grains was applied to one sample located at the top of the sequence. A total of 6 ESR and 4 luminescence dating sediment samples were independently collected from deposits bracketing the main LCT accumulation and processed. Age results constrain the chronology of the deposits to between ca. 300 ka and ca. 20 ka. A detailed comparison of the different age results and associated data obtained will be presented and the main sources of uncertainty affecting each method will be discussed.

Keywords: Porto Maior, Galicia, Acheulean, Luminescence, Electron Spin Resonance dating, quartz, feldspars

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A large acheulean LCT accumulation in the Iberian Middle Pleistocene (MIS 8-7): The Porto Maior Site (Galicia, Spain)

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Porto Maior (Galicia, Spain) is a Middle Pleistocene acheulean site located in the lower Miño basin (NW of Iberian Peninsula), which documents the existence of an extensive accumulation of large cutting tools (LCTs). The stratigraphic sequence of the site is made by a succession of several fluvial layers belonging to the terrace level + 34 m above the current level of the Miño River. The chronology of the site has been established by the combination of two numerical dating methods, Electron Spin Resonance -ESR- applied to optically bleached quartz and Post infrared (IR) IR stimulated luminescence -pIR-IR- applied to coarse K-rich feldspar grains. They provide consistent age results and constrain the chronology of the main acheulean levels between ca. 300-200 ka. The lithic industry consists primarily of quartzite handaxes of large size when compared to previous finds on the European continent. Taphonomic observations indicate that most of the LCTs are found in an autochthonous position. The chronology of Porto Maior coincides with a period of marked expansion of Acheulean technology in SW Europe, as well as the occurrence of Early Middle Paleolithic technologies at other sites in the region. Traditionally, the Acheulean technocomplex of southwest Europe has been linked with its African counterpart. In particular, the use of LCTs made from large flake and the presence of flake cleavers at Iberian Acheulean sites provide clear evidence for technological affinities with the African Acheulean technocomplex. Another characteristic feature of the African Acheulean is the existence of occupation sites characterised by large numbers of LCTs. However, until very recently the only known deposits with this type of occupation found outside of Africa have been identified in the Near East. The techno-cultural and occupation pattern evidence from Porto Maior provides support for a cultural connection between Africa and SW Europe.

Keywords: Acheulean, LCT, Middle Pleistocene, Iberian Peninsula, Porto Maior

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Les bifaces au sein des industries acheuléennes dans le sud-est de la France. Signification et comparaisons avec les cultures à bifaces du pléistocène moyen dans le monde

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Les bifaces au sein des industries acheuléennes dans le sud-est de la France. Signification et comparaisons avec les cultures à bifaces du pléistocène moyen dans le monde

Keywords: acheuléen, biface, France

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XIV-4. À l'ombre du biface. Complexité des systèmes techniques au Pléistocène moyen en Europe.

Barbas I (Creysse, Dordogne) : Une séquence archéologique à bifaces du Pléistocène moyen

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Tout au long du Pléistocène moyen, la présence du biface dans les industries nous permet, de fait, de parler d'un phénomène bifacial. Néanmoins, cette réalité archéologique masque une grande diversité de réalités anthropologiques. L'Europe méridionale semble être dans une situation particulière quoique difficilement définissable. Bien que l'on observe la singularité du phénomène bifacial dans cette région, son interprétation nous échappe.
Dans le sud-ouest de la France, le site de Barbas (Dordogne) offre une séquence archéologique d'industries bifaciales du Pléistocène moyen. Les fouilles de Jean Guichard (1965 à 1968) puis celles des secteurs de Barbas I, II et III sous la direction d'Eric Bo'eda, de 1988 à 1997, nous permettent de présenter ici cette séquence archéologique originale. Se succèdent quatre ensembles archéologiques, s'insérant tous dans le Pléistocène moyen d'après les datations disponibles pour deux des ensembles dont le plus récent.

De bas en haut nous décrivons un premier ensemble à bifaces associé à un débitage Levallois récurrent unipolaire, suivi d'un ensemble d'Acheuléen méridional, avec une très forte représentation de trifaces et quelques rares bifaces. Il s'ensuit la dernière couche archéologique composée d'un très grand nombre de biface associés à une production de petits éclats Kombewa. Cette dernière couche est contemporaine des premières industries du Moustérien ancien telle que celle de Vaufrey (Dordogne). Seule séquence acheuléenne du sud-ouest de la France présentant une telle diversité, ses industries se distinguent nettement de celles du nord de la France et du Sud-Est.
Ces données montrent qu'à côté du biface sur lequel l'attention se focalise nous avons laissé dans l'ombre toute une gamme de produits de la boîte à outils de ces populations qui, loin d'être homogène, témoigne d'une forte altérité.

Keywords: France, Sud, Ouest, biface, débitage, interaction

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Central German Lower and Middle Palaeolithic inventories with and without bifaces – an overview

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The landscape between the southern border of the last – Weichselian – Glaciation and the northern foothills of the Central German mountains Harz, Thuringian Forest, and Erzgebirge is characterized by multiple alternations of continent-wide ice shields and human settlements. As it is still unclear if there are worked stone artefacts before the Elsterian Glaciation, we are sure that the Post-Elsterian sediments like river gravels of the "Older Middle Pleistocene Terrace" really contain human traces: flint artefacts including cores, flakes, and differently retouched implements, "tools". And even Middle Pleistocene limnic layers like the travertine complex found in Bilzingsleben with a large amount of plant remains, fauna (sometimes with human cut marks), and human skull fragments includes flint and non-flint (quartzite, crystalline, limestone) pieces a part of which has been worked by early humans.
The question of presence and frequencies of bifacial tools – from small bifacially retouched points through classic handaxes up to bifacial backed knives and leaf points – seems to be not the most important one if we try to understand the technical development from the Middle up to the Early Upper Pleistocene during the local Lower and Middle Palaeolithic. The oldest "Clactonoid" inventories contain already roughly elaborated bifacial tools (Wallendorf and Bilzingsleben). Later, during a long part of the Early Saalian there are bifacial-poor (like Markkleeberg) and bifacial-rich assemblages (like, e. g. Eythra, unfortunately not well-dated). In Zwochau near Leipzig, a limnic layer dated in the time span between the Elsterian and Early Saalian (Drenthe) Glaciations, we find several flakes (including quite small pieces) in "Levallois Technology" without larger pieces including bifaces comparable with the newly excavated Hundisburg Acheulian material from the Early Saalian. Among the older pieces from this gravel pit Hundisburg we have, however, two handaxes.

The Weichselian sites sometimes also contain bifaces – from an "MTA" and a "Micoquid" handaxe found in the carstic fissures in Westeregeln up to the series of well-performed bifacial backed knives in K´onigsaue A and C (there is also an intermediate layer practically without bifacially retouched pieces – K´onigsaue B) and the gravel collection from Barleben-Adamsee near Magdeburg with handaxes and a leaf point fragment.
The Late Middle Palaeolithic (Micoquien) inventories in the Bitterfeld and Northern Saxonian region, Pouch, Goitzsche, and L´obnitz, also include different bifacial tools, mostly bifacial backed knives. It should be noted, however, that the presence or absence of bifacially worked tools is not crucial for the technological classification of the inventories.

*Speaker

Keywords: Central Germany, Lower Palaeolithic, Middle Palaeolithic

Chaînes opératoires in Sch'oningen: an example for the Middle Pleistocene?

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The *chaînes opératoires* of the findings from Sch'oningen (Lower Saxony, Germany) offer a unique opportunity to study how hominins manufactured and used wooden, bone and stone tools. This detailed analysis is not based on isolated or scarce artifacts, as it occurs unfortunately in many Paleolithic sites, but rather on the basis of a large and varied dataset of tools. Moreover, in Sch'oningen, also the remains of the production process have been identified. All this not only reveals the procedure to create tools, but also the knowledge, the experience, the intention, the choices and the expertise of the manufacturers. The clear patterns in tool production and raw material selection indicate standardized *chaînes opératoires* revealing the traditions and culture within the group living nearby the Sch'oningen lake, which could have determined the production of these artifacts. They show on the one hand the ability of a significant planning depth and on the other hand the intelligent opportunistic use of local materials. In Sch'oningen, the presence of a kit of weapons (spears, lances and throwing sticks) as well as the numerous animal bones with cut and impact marks indicate that the hominins in Sch'oningen were able to hunt, to defend themselves as a group and to develop complex activities. Several tools show that the activities were not only hunting or butchering, but also included a wide range of actions, as e.g. digging on the lake shore probably to collect roots. The aim of this presentation is to discuss the results from Sch'oningen and to compare if similar patterns are present in other sites too.

Keywords: Sch'oningen, chaîne opératoire, bone tools, spears, lithics artifacts, culture

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Complexité et opportunisme dans les systèmes techniques du MIS 12 au MIS 8 dans les sites de la Somme et de l'Escaut, France

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Résumé :
Au Paléolithique inférieur et au Paléolithique moyen ancien (stades isotopiques 12 à 8), les gisements à bifaces du bassin de la Somme et de l'Escaut se caractérisent par une fréquentation régulière des lieux, jusqu'à une dizaine d'occupations par site, même si ces dernières ont été discontinues au cours du Pléistocène moyen. Cette récurrence permet d'analyser de façon diachronique, les productions lithiques, les chaines opératoires autour du biface mais aussi celles, qui à l'ombre du biface génèrent des éclats-supports aux outils retouchés. Cette récurrence d'occupation nous permet de les comparer intra-site et inter-site dans un rayon de 20 km et de saisir leur originalité. Dans une région où la matière première minérale s'exprime uniquement sur le silex, les données sur les diverses séries lithiques mettent aussi en exergue des chaines de production en fonction de la qualité, de la quantité et de l'éloignement aux sources d'approvisionnement. La diversité des contextes topographiques et géomorphologiques (versants, terrasses alluviales, bords de chenaux, fonds de dolines), conditionnant la fonction et la durée d'occupation des sites, sera aussi intégrée dans ce bilan régional.

Keywords: Mots, clé : bassin de la Somme, Acheuléen, chaînes opératoires, biface, éclat, matrice, gélifract, Cagny, la, Garenne, Ferme de l'Epinette, Cagny, l'Epinette, Revelles, Gentelles, Gouzeaucourt.

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Human settlement during MIS 12 at Valle Giumentina (Abruzzo, Italy): does the lithic serie shows us a northern influence or a technical response to local raw material and paleoenvironmental context ?

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European Lower Palaeolithic stone tools diversity is currently under analysis with a technical and functional approach. As soon as we look at no-bifacial industry, each tool seems to be original within the lithic series, making it hard to classify. These past few years, more and more studies try to go beyond this difficulty seeking for their realities as technical and functional objects. They describe the raw material chosen to make tools, the knapping concepts and technics, the morphological features of the tools, their use, the activities that take place on the site...
The multidisciplinary research lead on the open air site of Valle Giumentina since 2012 allow us to locate the 12 archaeological layers it contains from MIS 15 to MIS 12 in a fine paleoenvironmental context. The more recent layer called ALB-42 has been excavated on a 55 sqm area and yielded 440 artefacts. They are made in different kinds of flint and are well preserved thanks to a silty sediment. Half of them are very small flakes, we count 35 tools (retouched or not) and 12 refitting units within at least 15 different blocks brought on the site. Remains are analysed in a techno-economical point of view, by putting together taphonomical, petrographical, technological, functional and spatial analysis.

The possibility to make refittings and the well preserved artefacts offer a good case of study.

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This industry without any bifacial shaping products tells us that here the flake is the main blank for tools but that it is also a raw material stock for further and later activities.
Our work wants to illustrate how original is this lithic series in the Middle Pleistocene Italian context. Must we find in this example the sign of a Northern European influence or a technical response to local raw material and paleo-environmental context?

Keywords: Middle Pleistocene, Valle Giumentina, technology

Les industries lithiques sur éclats au Paléolithique inférieur en Europe de l'Ouest : l'exemple du niveau archéostratigraphique "L" de la Caune de l'Arago (Tautavel, France).

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En Europe de l'Ouest, entre 650 ka et 300 ka, un manque d'informations et de reconnaissance de l'importance de la production d'éclats comme supports d'outils au regard du phénomène bifacial est évident. En effet, que révèle la pluralité des industries à éclats d'Europe de l'Ouest au Paléolithique inférieur et quels liens entretiennent-elles sur le plan technique, économique, et fonctionnel avec les industries bifaciales ? La diversité techno-morphologique et fonctionnelle attestée sur l'outil bifacial est-elle aussi présente sur les outils sur éclats de débitage ? Quels sont les facteurs qui amènent à cette dissociation observée des ensembles lithiques pour cette période ?
Une approche techno-économique et morpho-fonctionnelle est ainsi menée sur des industries du site en grotte de la Caune de l'Arago (Tautavel, France). Ce site majeur, célèbre pour les restes humains de prénéandertaliens qu'il a livré, présente une imposante séquence archéostratigraphique synthétique épaisse d'environ 17m et comprenant à ce jour 55 niveaux d'occupations dans la partie fouillée, rapportés au MIS 14 à 5. Des séries lithiques sont articulées uniquement autour du débitage d'éclats et d'autres sont mixtes, c'est-à-dire à la fois centrées sur le débitage et le façonnage.

Nous présentons ici les premiers résultats de l'étude du niveau archéostratigraphique L, bien individualisé dans la séquence et bien préservé. Il est daté d'environ 540 ka (MIS 14). Il ne contient pas de pièces bifaciales et présente une chaine opératoire structurée autour du débitage d'éclats. Au total, 5581 artefacts lithiques sont présents, associés à des restes nombreux et largement majoritaires de Renne (Rangifer tarandus). Quelles réalités techniques peuvent être observées au sein de cette occupation ? Quels systèmes de débitages sont en présence, pour quels objectifs et quels supports d'outils souhaités ? Existe-t-il une flexibilité entre le mode de débitage et la matière première utilisée qui est de nature variée (quartz, quartzite, jaspe, silex) ? Quelles intentions sont perceptibles concernant la fonction des outils sur éclats ?

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Cette étude participe à la mise en lumière des industries du Paléolithique inférieur dont une partie est restée longtemps masquée par l'ombre du biface, afin de décrire dans leur ensemble les comportements techno-économiques des sociétés humaines du Pléistocène moyen en Europe.

Keywords: Pléistocène moyen, Paléolithique inférieur, Caune de l'Arago, Technologie lithique, Outils sur éclats

Lower Palaeolithic stone tools: a techno-functional study on flakes from bifacial shaping at Soucy 3P (MIS 9, Yonne, France)

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Historically, European Lower Paleolithic cultures have been divided according the presence or the absence of bifacial tools. In order to go beyond this typotechnological classification of *Homo heidelbergensis* groups, we now question socio-economic behaviors. These are identified by territorial, functional and technical analysis. It involves the study of the whole lithic production from raw material gathering to the making and the use of stone tools and their abandonment or their export out of the site. Functional studies on Lower Palaeolithic tools are rare mostly because of the alteration on such an old material.
We choose to focus on this products made of small flakes, unretouched big flakes and flake-tools using a techno-morphological and functional analysis on the lithic serie from the main archeological level of Soucy 3 (MIS 9, Yonne, France). It is contained in a fine fluvial sequence. Here, the whole lithic production results from bifacial production. It has yielded the higher quantity of bifacial tools observed in Europe (n = 276) but also a very large amount of retouched (n = 887) and unretouched flakes. This archeological layer is well-preserved and shows a great diversity of tools.

First, we identify flake-tools uses and then compare it to bifaces uses. We also assess the role of flakes in understanding bifacial tools making and reduction process. It helps us to esti-

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mate which kind of tools are made in situ and take away from the site. Our techno-functional combined analysis gives us similar results and shows the informative potential of flakes in the study of techno-economics behaviors.

Keywords: Middle Pleistocene, Bifacial shaping flakes, Use wear analysis, Techno morpho functional study, Soucy

Nouveaux regards sur des sites à Large Flakes. La grotte de l'Observatoire (Monaco) vs le site de plein air de Chanos-Curson (Drôme).

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Les grands éclats de l'Observatoire (Monaco) ont récemment fait l'objet, au côté des autres éléments lithiques associés, d'une étude technotypologique exhaustive et inédite (Rossoni-Notter *et al.*, 2016 ; Notter *et al.*, 2017). Mis au jour dans l'ensemble inférieur dit *la Fosse*, et plus particulièrement entre les niveaux paléolithiques i et l, ils sont attribuables à des technocomplexes acheuléens datés de 230 Ka (plancher III) à 418–386 Ka (niveau l) (Viriot *et al.*, 1991 ; Haussmann *in* Simone, 1993). De grandes dimensions, en calcaires semi-locaux du Paillon et/ou du Var, ces artefacts illustrent une stratégie et des objectifs technofonctionnels spécifiques. Il s'agit de produits importés, essentiellement débités et (re)façonnés à l'extérieur du site. En regard d'une standardisation morphométrique, différents schèmes de production (*Débitage de l'Observatoire* d'après Porraz *et al.* 2014 complété par des sous-phases, concept Levallois, méthode Kombewa) et des techniques de percussion (directe sur nucléus immobilisé au sol et/ou tenu à la main et sur enclume dormante) ont toutefois pu être discriminées. La lecture morphofonctionnelle révèle également une variété de ces outils employés bruts : des " bord tranchant convexe à section biconvexe ou plan-convexe " (cf. hachereaux), " pointe ", " bord-pointe ", " bord-pointe-bord ", " biseau " de type burin, en parallèle de ceux plus rares retouchés intentionnellement tels des macro-racloirs. L'observation préliminaire de stigmates systématiques sur le fil des tranchants et des pointes semble relater des gestes liés à des percussions violentes et perpendiculaires ainsi qu'à des activités de découpes. Dans la littérature, quelques mentions rapprochaient ces grands éclats de ceux de Curson, site de plein air à Chanos-Curson (Drôme) découvert à la fin du XIXème siècle. Une mission a ainsi intéressé ces pièces lithiques plus ou moins corticales, associées à d'autres et plus rares artefacts lithiques (produits de débitage, débris, nucléus) et fauniques. Les grands éclats de Curson ont en commun avec ceux de l'Observatoire d'avoir été essentiellement laissés bruts mais ils retranscrivent des séquences opératoires plus courtes et des aménagements plus simples à partir de galets calcaires,

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quartzitiques et siliceux. Le morphotype recherché est par ailleurs quasi-systématiquement l'outil à biseau de forme convexe et à angle très fermé, qui s'oppose à des dièdres obliques ou abrupts (Unité passive). Les grands esquillements d'utilisation observables sur les industries monégasques y sont en outre absents, attestant de fonctionnements différentiels. Aussi, malgré une conception technique et une morphométrie assez proche, les grands éclats de Curson se distinguent finalement, sur la base de plusieurs facteurs technofonctionnels, de ceux de la grotte de l'Observatoire.

Keywords: Paléolithique ancien, Acheuléen, bifaces, grands éclats, hachereaux, clactonien

Reuse and scavenging of handaxes during the Middle Pleistocene. The case of Boxgrove (Sussex, UK)

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The re-use and recycling of artefacts can be studied through a number of avenues, including refitting, diacritical and use wear analyses. Reuse could refer to different stages in the life of a tool whilst in the possession of a single hominin individual but sometimes the presence of a discard phase between the different technical/functional episodes, identified by differences in patination, can also be identified. While changes in the surface patination of artifacts is still a poorly understood subject, and might be affected by various processes, identifying phases of reduction distinguished by different surface conditions is a clear indicator of multiple, separate phases of artefact use. Where artifacts previously discarded in the landscape can be shown to be reworked after a period of time, by a different hominin individual we might be seeing an important reuse mechanism which we could characterize as scavenging or recycling. This pattern of reuse of pre-existing artifacts could have important implications and may reduce the energy invested in lithic production, taking advantage of previously manufactured artefacts for which the use-life can be extended. Boxgrove Q1/B provides a good context for analyzing the reuse of Large Cutting Tools (LCT). Together with the abundance of raw material in the same occupational site, there is a high level of discard of handaxes due to the intense mobility pattern of hominins through the landscape. Artifacts are either unpatinated or lightly patinated allowing variations in surface weathering to be easily identified. This pattern could be related to the short-life of the tools and the result of an expeditient way of life. Through examination of surface condition and patterns of LCT tip preparation and re-sharpening through specialized tranchet removal techniques, we explore how extensive the reuse of these tools might have been and how this affects the morphology of tools. The research considers factors such as landscape patterns of movement, intensity of site use and the effective constraints of LCTs for multiple periods of recycling. The work also considers how multiple episodes of re-use might be identified where differential patination is less likely to develop within an assemblage.

Keywords: Reuse, Scavenging, Handaxes, Boxgrove, Acheulean, Middle Pleistocene

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Sch'oningen: low density sites and human occupations

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The site of Sch'oningen (Lower Saxony, Germany) with its more than 20 sites is a unique archaeological complex for understanding how hominins lived and interact with the environment 300,000 year ago (MIS9). Due to the great level of preservation the number of findings is large, these include: macro and micro faunal remains, botanical finds and lithic industry. However, some of these lithics finds are often isolated artifacts. Some of these lithic assemblages have been partly analyzed and published revealing non-standarized reduction sequences, opportunistic modification of natural spalls, some retouched artifacts, isolated flakes or small-flake debitage from retouching. However, it has not been found levallois technology or the presence of handaxes.The faunal finds with cut marks and impact fractures, as the result from skinning and disarticulation, reveal the specific use of the artifacts and exploitation patterns. In addition, some faunal remains has also been interpreted as bone tools, enlarging the tool kit repertoire.Furthermore, the interaction with the environment extends to the use of wood as raw material being the world famous spears the best examples. The findings of these oldest wooden spears, which were associated with several dozen butchered large Mosbach horses on a lakeside, suggest that hominins living in Sch'oningen were skilled hunters, exhibiting a high level of planning depth, mastering of technical expertise and a manual talent. Here we present the results of the ongoing analysis of the lithic finds recovered from the first Pleistocene excavations in 1992 until 2017. Many sites can be classified as low or very-low density find horizons due to the scarce record found. The aim of the analysis conducted was to determine the type of finds and the technology used; the behavior when exploiting other raw materials, the uses of each site or the type of landscape exploitation. Therefore, the site of Sch'oningen is a great example for studying the behavior of these hominins moving along a lakeshore. These types of sites are good examples for addressing issues of land use, economic strategies and settlement dynamics during the late Lower Paleolithic.

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Keywords: Sch'oningen, late Lower Palaeolithic, lithic assemblages, low density sites, land use, economic strategies

The acheulean technocomplex in the lower Miño basin (NW Iberian Peninsula) as an example of technological continuity through the Middle Pleistocene

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The river Miño is one of the main Atlantic river basins of Iberia. Despite the good preservation of the Middle Pleistocene sedimentary record in the region, there is very little information available about human occupations during this time range. Nevertheless, a research project focused on this area has recently led to the identification of several Acheulean sites of large flake blank (LFB) type with some LCT of African affinities (e.g., Gándaras of Budiño, Porto Maior or Arbo, among others). These sites are found in fluvial deposits associated with the system terraces between +40 m and +20 m above the current Miño river level. Their chronology range between MIS 9 and 6, and the study of the large lithic materials collections suggests a strong technological continuity over this time range. During this period, two different technical systems (i.e., Acheulean and the Early Middle Paleolithic) are apparently coexisting in South-western Europe. The most frequent raw materials found at this sites are quartzites and quartzes and have a clear differential economic concept in this management. The lithic assemblages are characterised by elementary reduction patterns (monopolar fundamentally), peripheral, bipolar on anvil or discoidal, but without an organised reduction system, in contrast to levallois or quina. The LCTs' *chaine operatoires*, mainly handaxes and cleaver on flakes, are very important and only in some sites (e.g., Porto Maior). These LCTs are shaped on large flakes, extracted from giant cores or sometimes from pebbles with an appropriate morphology. The information obtained from the Middle Pleistocene archaeological sites of the Miño basin is close to that of other sites in the SW of Europe with similar chronologies, and suggests the coexistence of two different technological behaviours around ca. 300-150 ka: the Acheulean and the Early Middle Paleolithic.

Keywords: Acheulean, LCT, Middle Pleistocene, Lower Miño Basin, Iberian Peninsula

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The appearance of Quina/Yabrudian technical behavior in the Balkans: implication for understanding the Lower to Middle Palaeolithic Transition in Europe

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On the onset of Middle Palaeolithic, 400-200 kya, major changes in technical, economic and social behavior of middle Pleistocene hominins occurred. In the Middle East, these changes occurred in the range of Achelo-Yabrudian cultural complex, which was regarded as a regional phenomenon for a long time. Recent exploration of Velika and Mala Balanica in Sićevo showed that Yabrudian facies of Achelo-Yabrudian complex was present in Balkans as well. In these cave sites, in layers dated to MIS 9-7, traces of Quina/Yabrudian system was documented, identical to those verified in Anatolia (Karain) and at number of sites in Middle East. This result demonstrates that, at the end of Middle Pleistocene, Quina/Yabrudian facies was spread across wide range of east Mediterranean and that population movement and/or cultural transmission from Middle East considerably affected formation of Middle Palaeolithic behavioral package in Southeast Europe.

Keywords: Quina, Yabrudian, Palaeolithic, Balkans

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À l'ombre du biface en Europe

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Si l'Acheuléen est, encore de nos jours, principalement défini par la présence de bifaces, d'autres chaînes opératoires lui sont toujours associées. Ces autres modalités " de faire outils ", qu'elles soient associées ou non à des bifaces, jouent un rôle dans les industries du Paléolithique inférieur européen et leur prise en compte est nécessaire dans la compréhension des systèmes techniques.
L'introduction à cette session aura donc comme objectif de mettre en lumière les chaînes opératoires à l'ombre de la composante bifaciale afin de comprendre les interactions entre tous les éléments du système technique. Quel est le rôle du débitage dans l'obtention des supports fonctionnels ? D'autres outils jouent-ils un rôle dans le système technique (éclats, macro-outils, galets, petits outils, etc.) ? Quelle place occupe les façonnages bifaciaux dans la gamme d'outils ? Peut-on mettre en évidence à travers l'identification des différents supports d'outils et de leur interaction, mettre en évidence des aires techniques ? Cette pluralité des Acheuléens peut-elle être approcher justement grâce à la prise en compte des autres composantes du système techniques ? Comment peut-on dans le temps comprendre l'évolution de l'Acheuléen ?
Nous tenterons d'établir une synthèse des données en Europe mais aussi de proposer des axes de réflexions qui pourraient permettre d'appréhender les comportements techniques à l'Acheuléen dans leur globalité et leur diversité.

Keywords: Europe, Paléolithique ancien, Acheuléen, Industrie lithique

*Speaker

XIV-5. From natural to cultural object: raw material-related human behaviors in the early technologies.

Investigating extant non-human primates to infer fossil primate manual abilities: An interdisciplinary approach utilizing behaviour, morphology and modelling evidence

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Humans are considered to have unique manual abilities in the animal kingdom. However, we still do not know what the extent of manual abilities in primates is, nor how they evolved. What makes humans unique? The present study investigates the manipulative abilities of Hominids, using an interdisciplinary framework combining behavioural, morphological, functional, and biomechanical approaches. Behavioural strategies were quantified across captive great apes and humans during the same complex tool use task. A three-dimensional geometric morphometric (3DGM) approach was also used to investigate surface shape variation and co-variation at the base of the thumb. This was combined with a musculo-skeletal model to better interpret the behavioural results and to test the putative biomechanical constraints imposed by Hominid hand proportions during tool use. The behavioural and functional results demonstrate that each species uses different techniques. More complex manual abilities, such as in-hand movements, were observed in African great apes and humans to the exclusion of Pongo. However, humans show distinct manual dexterity and perform faster the task than great apes. The different behavioural demands of each species habitat may explain this variability, as well as their concurrent variability in manual morphology. Results of 3DGM show that shape variability at the base of the thumb seems to be linked with the in-hand movements used by each species. Results of the musculo-skeletal model show that certain grips are more challenging for some species, particularly orangutans, such that they require stronger muscle forces to perform these grips in a given range of motion. This integrative approach clearly shows that the different manipulative abilities of Hominids cannot simply be a consequence of the different thumb morphologies but also of the different mechanical constraints related to the overall hand proportions. These results highlight and discuss the difficulties of inferring manual abilities in fossil taxa from morphology, without

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taking into account the overall morphology of the hand and its possible link with biomechanical constraints.

Keywords: Hominids, tool use, grips techniques, hand, manipulation

Lithospaces vs territories : a journey through space and time.

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In Palaeolithic studies, territories are most often seen as congruent with lithospaces, even though a few studies avoid the trap. Mostly lithospaces are simplistically drawn following maps illustrating raw material procurement. Not only are such procurements tied to the availability and quality of georesources, but they also depend upon technical and cultural limitations, as the use of the *chaîne opératoire* concept and the ethnographic records tell us.
Technical limitations require attention be paid to the aspect and quality of the raw materials available: strecht and thikness modulus, roundness *vs* angulation of natural faces, weight, cortex modifications, conchoidal fracturing... since tool-making began, all human groups have needed to consider these constraints.

Cultural limitations refer to the position in space of the resource (its association or otherwise with other specific items; concept of establishing an itinerary); resource morphology (global shape, fragmentation), its colour(s)... These considerations are often denied to ancient humanities - including Neandertals – and using ethnographic knowledge as a proper reference point is not widely undertaken by archaeologists who generally use it with reluctance.
On the basis of new Palaeolithic studies performed in East and North Africa and in Europe, we have made a diachronic examination of the relationships between different humanities and the lithic environment (the lithospace), to demonstrate how an optimised petro-archaeological approach to lithic resources allows a revision of procurement maps and how by taking some ethnographical visions of territories into account, it is possible to broaden attitudes and look at Palaeolithic territories from a new and different perspective.

*Speaker

Keywords: Palaeolithic, lithospaces, territories, diachrony, tool, making, culture

Middle Pleistocene raw-material procurement and use in the Aegean: a view from the Acheulean of Lesbos

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Rodafnidia in its volcanic setting near a large palaeo-lake, is a Middle Pleistocene open-air site on the island of Lesbos, yielding compelling evidence for Acheulean groups in the Aegean. Their toolkit comprised a variety of tools, amongst which number Large Cutting Tools (LCTs) with strong affinities with the Large Flake Acheulean. The industry was knapped on three types of chert, which is the main rock used, an andesitic tuff (ignimbrite), and volcanic rocks, such as basalt. The Acheulean finds derive from fluvio-lacustrine deposits at a locale with abundant fresh-water and lithic resources, near the shore of the present-day Kalloni Gulf. By virtue of its content and position at the junction between Anatolia, the Aegean Archipelago and the Balkan Peninsula, Rodafnidia links the Lower Palaeolithic archaeology of south-east Europe with that of west Asia and Africa. This paper presents the strategies of lithic raw material procurement and use at Rodafnidia. It brings together a coherent methodology for the study of Acheulean lithic raw material economy and consumption, founded on interdisciplinary research. The evidence from Lesbos is discussed in a comparative manner.

Keywords: raw material, Acheulean, Lower Palaeolithic, Large Cutting Tools, Aegean, Bifaces

*Speaker

Raw material constraints and techno-functional diversity in East African Oldowan: Case study on Fejej FJ-1, Koobi Fora FxJj-10 and Olduvai DK assemblages

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Raw material constraints are often highlighted to explain technical variability during the Oldowan. If environmental constraints do matter in lithic technology, especially access to raw material sources, they cannot be the only factor that explain the variability.
From a technical point of view, raw material selection is the basic first step of tool production, and the quality of the stones available at a site vicinity is essential for tool production. On the other hand, if raw material availability involves an adaptation of knapping methods, does it change the hominin capacity to produce the tools they want?

By studying three Oldowan assemblages with distinct contexts, this paper focuses on the relationships between production methods and tool functionality. Fejej FJ-1, with a predominance of quartz pebbles, Koobi Fora FxJj-10, with basalt blocks and pebbles and Olduvai DK with basalt, phonolite and quartz were finely studied using technological and techno-functional analyses.

The raw material selection processes, very different in each site, show precise choices involving the research of regular technical criteria on the pebbles and blocks. The production modes are adapted to the type of raw material, and specific knapping methods can be observed, depending on the material selected.

Tool analysis reveals two important features for understanding the Oldowan technical complex. First, although retouch rate on flakes is very weak, a huge techno-functional diversity is observed, taking account of whole flakes as well as retouched flakes. Second, despite very different raw material qualities, and the application of specific knapping methods, the stone tool-kits show strong similarities and a high range of diversity, whatever raw material is predominant.

This research highlights an important variability concerning the production processes and a huge tool diversity, despite the relatively simple technologies involved in Oldowan assemblages.

*Speaker

Then, if raw materials involve an adaptation in terms of production methods, they do not necessarily represent such a limiting factor. Raw material constraints would be better thought as hominin choices corresponding to technical traditions into the Oldowan complex in East Africa.

Keywords: Oldowan, lithic technology, technofunctional analysis, raw material constraints

Raw materials, mobility and mental templates in the Lower and Middle Pleistocene of the southern coastal plain of Israel.

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The southern coastal plain of Israel is one of a few areas in the Levant where the natural availability of stones suitable for knapping is limited. Due to extensive deposition of quaternary sands the only available raw material on the southern coastal plain are pebbles from sparse secondary sources. As a consequence, the area provides an excellent case for studying how hominins responded under a pressure of low stone availability.
Here, I present a study of raw material use at Bizat Ruhama, Lower Pleistocene Oldowan-like core-and-flake site, and Nahal Hesi, Middle Pleistocene Acheulian site. Both sites are located on the southern coastal plain of Israel about 4 km apart.
Comparison of the patterns of raw material use indicates that the Middle Pleistocene hominins had very different habits of raw material acquisition and exploitation comparing to their Lower Pleistocene counterparts. The differences are reflected in longer transportation distances, influx of large flakes made elsewhere and significantly more complex pattern of selectivity in the exploitation of the raw materials at Nahal Hesi. The differences between the two sites point to higher mobility and more complex mental templates at Nahal Hesi and they may lie in culturally imprinted habits of Nahal Hesi hominins. Being under constraints of raw material availability, the Acheulians at Nahal Hesi responded by transportation of prepared artifacts and by exploiting usually overlooked lithic resources, but still produced the same culturally designed forms. Unlike at Nahal Hesi, the decisions that governed the choices of the Bizat Ruhama hominins do not have a clear, culturally restricted expression, visible to archaeologists. The technology at the site was most probably governed by functional needs and raw material constraints. Instead of looking for material to realize their mental template as Acheulians did, Bizat Ruhama hominins adapted their technology to local raw material availability.

Keywords: Lower Paleolithic, Lower Pleistocene, Middle Pleistocene, Oldowan, Acheulian, raw materials, lithic technology, metal templates, culture

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Raw-material variety and Palaeolithic variability ca. 0.8 Ma at Cueva Negra del Estrecho del Río Quípar (Caravaca de la Cruz, Murcia, Spain).

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For: XIV-5 From natural to cultural object: raw material-related human behaviors in the early technologies Abstract: Cueva Negra del Estrecho del Río Quípar is a rock-shelter containing a late Early Pleistocene depth of ¸˜5m of fluviolacustrine sediment deposited between < 0.99 - > 0.78 Ma according to magnetostratigraphy and biochronology (Angelucci et al., 2013; López et al., submitted; Scott & Gibert, 2009; Walker et al., 2013, 2016). Palaeolithic artifacts appear throughout. Petrology is mainly chert (poor-quality flint), with some hard limestone (often containing quartz), marble, quartzite, and quartz. Many cobbles were split open in the cave, brought from a nearby Miocene (Tortonian) conglomerate outcrop (where also artifacts were collected) of cemented detritus from high Jurassic escarpments below which also Pliocene and Pleistocene gravels and conglomerates afford chert blocks and cobbles throughout the upper Quípar (a.k.a. "Tarragoya") valley. Lanthanide trace-element analysis implies some chert came from up to 30 km upstream (Zack et al., 2013). Tabular black chert came from Cretaceous outcrops, both 2 km downstream and 20 km upstream. An excavated radiolarite artifact suggests a radiolarite outcrop source 40 km downstream; marble also likely came from hills 10-20 km downstream (quarried nowadays). Possibly some chert also came from Miocene and Pliocene outcrops sampled immediately south of the "Tarragoya" valley. A hand-axe was fashioned by bifacial flaking of a flat cobble of quartz-rich Jurassic limestone (examined by X-ray diffraction and optical microscopical petrography: Walker et al., 2006). Knapping abounded on small subparallelepiped chert nodules that, when struck, more often shatter than producing conchoidal

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fractures. Secondary knapping is common on stubby blocks and laminar fragments. Nevertheless, chert flakes with facetted striking platforms and dorsal flake-scars attest to repetitive flaking on a core, and even to core-preparation for hierarchical flake-removal, in support of which are discoidal chert and limestone cores bearing central scars of final flake-removal. Artifacts rarely exceed 5-6 cm in size. Abrupt secondary knapping along thin laminar fragments converted perpendicular edges into cutting/scraping artifacts. Invasive secondary knapping exists also, sometimes on "microlithic" pieces. Pointed and "beaked" artifacts occur. Small tronco-conical pieces show steep flaking/notching around delicate protruding spurs whose tips sometimes show minuscule retouch. Flaked plano-convex "garden-slug" pieces, lacking use-wear traces, were perhaps cores for removal by bipolar knapping of diminutive (1-2 cm) unretouched flakes (cf. Crovetto et al., 1994). Secondarily-knapped "microlithic" flakes (2-3 cm) exist. Knapping smalls abound, with complete recovery attained by washing all excavated sediment over 2-mm mesh sieves. Microscopical use-wear analysis of notched and denticulate artifacts implies use on hard materials (e.g. wood, bone, antler). Microstriae and micropolishes on other artifacts suggest use on soft materials (e.g. skin, meat). (References: Angelucci et al., 2013, *Quaternary Science Reviews* 89, 195-199; Crovetto et al., 1994, *Human Evolution* 9, 175-207; López et al., submitted, 2017, *Historical Biology*; Scott & Gibert, 2009, *Nature* 461, 82-85; Walker et al., 2006, *Eurasian Prehistory* 4, 3-43; Walker et al., 2013, *Quaternary International* 294, 135-159; Walker et al., 2016, *Human Evolution* 31, 1-67; Zack et al., 2013, *Quart'ar* 60, 7-28.)

Keywords: Palaeolithic variability, petrology, late Early Pleistocene

Techno-economic variation and variability in an invariant lithospace: Early Pleistocene techno-complexes at Melka Kunture (Ethiopian Highlands)

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Melka Kunture is located 50 km south of Addis Ababa on the western edge of the Main Ethiopian Rift, in a half-graben depression of the Ethiopian Plateau. This cluster of sites preserves one of the longest and most complete prehistoric sequences in East Africa, from the late Oldowan to the Late Stone Age.
The raw materials available in the Melka Kunture region are of volcanic origin. Systematic sampling and mapping of primary sources, old alluvial deposits, worked and unworked materials in archaeological sites document an invariant lithospace in the Early Pleistocene (1.9-0.85 Ma). If lithic resource availability and accessibility remained unchanged in the paleolandscape, changes occurred in chaînes opératoires are clearly linked to cultural choices, objectives, and knowledge. This allowed us to evaluate 1) the human technical responses to raw materials in a synchronic/diachronic perspective; 2) when and how raw materials constraints were superseded. Results demonstrate that adaptation/ anticipation, preparation, and predetermination are three technical and cognitive processes occurring in the late Oldowan, early Acheulean and middle Acheulean, respectively, in order to override raw material constraints, here intended as a natural restriction on the degree of freedom knappers have in providing a technical solution. This progressive "emancipation" from the raw materials (=nature) through technique (=culture) occurs as a sort of puzzle being gradually established and corresponds to a non-linear and multifactorial depletion of variation and variability.

Keywords: Early technologies, Oldowan, Acheulean, raw materials, lithic technology, variability and variation

*Speaker

The cultural pattern and question of morphological variability of handaxes: Boxgrove Q1/B (Sussex, UK)

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Boxgrove –c.500ka– represents one of the richest and more interesting sites at which to analyse shaping strategies and morphological variability inthe European Middle Pleistocene handaxes, due to the high quantity of finished handaxes and also to the presence of complete operative chains. The morphological variability of Large Cutting Tools during the Middle Pleistocene has been traditionally associated with two main variables: raw material constraints and reduction intensity. The Quarry 1/B sample is ideal for assessing the role of some key raw material characteristics (size, form, and homogeneity of the flint nodules) in the shaping process, and to ascertain if they represent real constraints in the production of a handaxe. In addition, because of the large number of handaxes and the intensity of the thinning process at Boxgrove, we aimed to assess the extent to which reduction intensity affected the final shape as proposed by some authors.

In Q1/B we found both rough-outs (N=62) and finished tools (N=358). Each piece was systematically measured, and the data subjected to statistical analyses. The morphological variability was analysed using a geometric morphometrics methodology and PCA. In addition, we developed an experimental programme aimed to replicate the Boxgrove shaping strategies, which was especially focused on assessing the raw material role within these processes.

Our results show that the knapping strategies were flexible and adapted to the blank's physical characteristics and attributes. These affect the reduction strategy but there is no clear relationship between the initial morphology of the blank and the specific final handaxe shape. Throughout the experimental programme, we also explored the knapper's capacity to solve problems arising from reduction accidents and mistakes, which led to re-configuring the knapping strategy to achieve a "mental template". The idea set in the knapper's mind was consistent and persistent along the whole process; no substantial morphological differences related to reduction intensity were noticed within the Boxgrove Q1/B handaxes. Only the most invasive distal shaping, usually through *tranchet* removals, generated minor variations in shape. Thus, systematic

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re-sharpening as the cause of shape variation seems highly unlikely, and it could be more related to the short use-life of the Boxgrove handaxes.

Keywords: Handaxes, Morphometry, Raw material, Reduction intensity, Boxgrove, Acheulean, Middle Pleistocene

The function of Manuports in late Lower Pleistocene sites: a case study from Unit US2 of the Bois-de-Riquet site (Lézignan-la-Cèbe, France).

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In archeological record for the late Lower Pleistocene, *manuports* often represent a high proportion of the stone tool assemblages. Examples from well-known sites in Eurasia, such as; Olduvai Gorge Beds I and II, Dmanisi or Hummal, underline the significance of these items. Yet these materials are usually only summarily mentioned and their analysis is generally occulted by the, more thoroughly studies knapped materials.
Archeostratigraphic Unit 2 (US2) of the Bois-de-Riquet site provides a good opportunity to evaluate the importance of imported materials for understanding hominin activities and interactions with carnivores. A few basalt cores and flakes were uncovered from the excavation, along with some rounded basalt nodules imported to the site.

The relative abundance of *manuports* in the BDR-US2 assemblage raises issues pertaining to their significance: where do they originate from? Which characteristics were involved in their selection? What were they used for? Were the nodules used in relation with carcass consumption, with stone knapping, or with both of these activities? Finally, how might we integrate the Bois-de-Riquet US2 site into the European late Lower Pleistocene record?

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In order to address these issues, different kinds of analyses were carried out. Dimensional and morphological analyses were performed in order to identify the selective process and compare it with natural, historical and other Oldowan contexts.

Also, techno-functional analyses were carried out to identify percussion marks and breakage in order to better understand how these nodules could have been used. Accordingly, the spherical nodules and blocks used for flake production were compared and show a clear distinction from the selection process.

The imported nodules in Bois-de-Riquet are then part of the technical toolkit, along with the basalt flakes used for obtaining meat from bones in which some cutmarks were identified. They could have been used as percussive tools for bone breaking as well as throwing objects used to put the carnivores out.

The assemblage from Bois-de-Riquet US2 provides valuable information for understanding stone knapping stigma on basalt nodules, as well as a methodological reflection on the analysis of *manuports.* It is also an exceptional early example of hominin-carnivore interaction in a Mediterranean late Lower Pleistocene environment.

Keywords: Techno, functional analysis, Manuport, Basalt industry, Lower Pleistocene, Oldowan, Mode 1

The significance of subtlety: contrasting raw material use at the Oldowan sites of Barranco León and Fuente Nueva 3 (Orce, Andalusia, Spain)

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The significance of subtlety: contrasting raw material use at the Oldowan sites of Barranco León and Fuente Nueva 3 (Orce, Andalusia, Spain)
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Barranco León and Fuente Nueva 3 (Orce, Andalusia, Spain) are major archeological sites

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corresponding to the Western European Oldowan. Situated in southern Spain's Guadix-Baza depression, these sites are among the most numerically rich lithic and faunal records providing information about the earliest hominins outside of Africa (1,4-1,3 Ma, respectively). Ongoing excavations and inter-disciplinary research efforts allow to discern contrasting raw material procurement and exploitation patterns used by the hominins present at both of these occurrences; in spite of their spatial and temporal proximity. This new data allows us to discern subtle, landscape-related behavioral differences in the treatment of limestone and flint materials between the two sites. The context of the sites: on the shores of a paleo saline lake with in-feeding thermal fresh water sources, and an abundance of other large mammals including coompetitive carnivores, underline questions of expedience as an influence on techno-morphology in these early stone toolkits. We analyze these themes, accenting updated information from these and other key European late Early Pleistocene sites.

Keywords: Orce, raw materials, technology, stone, tools, hominin behavior, Oldowan

The story of colorful "old" flaked items: collecting and using fully patinated flaked flint items at Qesem Cave, Israel

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The presence of fully patinated flaked flint items in archaeological sites is a well-known phenomenon. In recent years, fully patinated flaked flint items bearing post patina modification (post patinated flaked items, hereafter PPF items) from Qesem Cave, Israel (420-200 kyr) have been associated with flint recycling represented by other recycling trajectories at the cave (Assaf et al., 2015; Lemorini et al., 2015; Parush et al., 2015). Recycled patinated items are defined as flaked flint items that were discarded/abandoned/lost, covered by patina as a result of being exposed to the elements and after an unknown period of time collected and modified again. These items thus show "fresh" modification scars exposing the original color and texture of the flint, or a "new" patina over the new scars, as well as an "old" patina over the original, discarded item.
Recycled patinated items were found in the site of Qesem Cave assigned to the Acheulo-Yabrudian cultural complex of the Late Lower Paleolithic. The many hundreds PPF items found at the site exhibit a variety of colors and textures, and are found alongside thousands of "fresh" flint items. A preliminary study of the recycled patinated items from Qesem Cave indicates that PFF items appear in varying numbers and frequencies throughout the cave and in both the blade dominated Amudian and the Quina scrapers dominated Yabrudian industries. PPF items are also found in all techno-typological categories of the lithic assemblages. This suggests that the inhabitants of Qesem Cave selected and collected modified patinated blanks and cores that suited in morphology and size for further modification and use.

The purpose of this study is to elaborate on recycling behavior regarding fully patinated flaked items as a resource for a new production trajectory. We also study diachronic dynamics in the PPFs along time and follow their synchronic, spatial patterning in the cave.

The Diachronic dynamics were tested on 11 assemblages from all parts of the stratigraphic column of Qesem Cave including both the oldest (800-1130 cm below datum) and youngest (elevation 115-200 cm below datum) assemblages. The studied assemblages comprise a total of 32,815 items, 11% of which (N=3,763 items) are PPF items show post patina modification. While there is not clear diachronic patterning in (frequencies of) PPF items at the cave, the

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results indicate that the four Yabrudian assemblages show higher percentages of PPF shaped items when compared to the Amudian assemblages.

The spatial distribution (diachronic) aspect relates to five assemblages that are roughly contemporaneous, dated to around 300 kyr, and surrounding a central hearth. Two of the assemblages are Yabrudian, and three are Amudian. These assemblages contain a total of 13,446 items (including débitage, shaped items and cores), out of which 12% (n=1612) were PPF items. A detailed analysis of these items shows that the hearth assemblage has the highest percentage of PPF items compared to the rest of the assemblages surrounding it. In contrast, the category of shaped items (tools) in the hearth assemblage shows the lower percentage of PPF items compared to the other assemblages/areas.

The analysis indicates that collecting, importing into the cave and using PPF items was continuous throughout the ca. 200 thousand years of human use of Qesem Cave and comprised a noticeable percentage of the assemblages. As in the case of other recycling trajectories at Qesem Cave, we suggest that the use of PPF items by the cave's inhabitants was not related to raw material scarcity, as the cave is located in an environment rich in flint to this very day. The different use of PPF shaped items in Yabrudian versus Amudian assemblages, may suggest a preference in the selection of PPF items for the production of side scrapers but this would need further study. It may however provide yet another indication to various behavioral differences between the Amudian and the Yabrudian industries.

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Keywords: Lower Palaeolithic, Acheulo Yabrudian, Recycle, Patina, Diachronic dynamics, Spatial analysis

Tool use in primates or who made the first tool ?

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For a long time, humans were thought to be the only mammalian species capable of dexterous manual grasping and manipulation. However, manipulation is widespread among tetrapods, and among primates, it is associated with a wide range of behavioural (including too use), morphological, dietary and locomotor variation. From an evolutionary perspective, this prompts several questions: is the origin and evolution of grasping in primates derived from requirements associated primarily with feeding or primarily with locomotor behaviour? Are there grasping and manipulative abilities that are unique to humans? Who made the first tool? The main purpose of this talk is to present a short overview of grasping and tool use in primates in order to open a discussion. We show that grasping strategies vary across species, depending on food properties and the substrates used. We also demonstrate that non-human primates can control individual digits, allowing them to use their hands dextrously. Finally, using some examples of what some great apes are able to produce, we discuss the challenges that arise in distinguishing anatomical features related to grasping and the debate around the first hominin tool-makers.

Keywords: Hominids, tool use, great apes, grips techniques, hand, manipulation

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Variabilité comportementale à Garba I (MK).

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Alors que les approches quantitatives et morphométriques dominent encore dans les études des assemblages acheuléens, il est de plus en plus clair que les classifications traditionnelles des matériaux archéologiques, si révolutionnaires durant les années 60 et 70, ne permettent plus de rendre compte de la véritable complexité des situations archéologiques et la variabilité des complexes technologiques.
Les grands complexes classiques africains sont aujourd'hui revisités avec un œil neuf, dans l'objectif d'apporter de nouvelles données au grand débat sur l'évolution de l'homme.

De nouvelles questions sont posées concernant l'évolution des capacités cognitives des hominiens, nécessitant l'application de nouvelles approches capables de mettre en lumière toutes les informations que le matériel archéologique peut nous donner en termes de cognition.

La révision de l'assemblage lithique de Garba I (Melka Kunture, Ethiopie), considéré comme l'un des grands sites acheuléens d'accumulation de bifaces, constitue une importante source de nouvelles données pour contribuer à l'avancée de ce débat.

Cette présentation portera davantage sur la production des pièces bifaciales et aura pour but de montrer, à travers l'analyse technologique des pièces, que les tailleurs acheuléens étaient beaucoup plus flexibles dans la conceptualisation de leurs productions que les archéologues ne le sont dans leur étude aujourd'hui. Et que, en termes de cognition, ces mêmes tailleurs avaient la capacité cognitive non seulement de visualiser les formes finales des artefacts, mais aussi de sélectionner et d'appliquer une gamme de modalité d'actions différentes pour atteindre leurs objectifs.
Pour amorcer la discussion, une description des matières premières utilisées pour la réalisation de ces outils sera présentée. Je montrerai que cette variabilité de stratégies techniques n'est pas due à l'adaptation du même schéma mental aux différentes contraintes propres aux matières premières utilisées mais, au contraire, à des connaissances invariantes, expression d'un savoir indépendant, dont la mise en pratique fut possible grâce à un haut niveau de savoir-faire.

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