



Book of abstracts

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**XXXIII-1. Siliceous rocks:
procurement and distribution
systems.**

Prehistoric flint extraction and reduction complexes in the Eocene "strip" of the Eastern Galilee (Israel) – implications for provenance studies

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Recent surveys of the Eocene Timrat flint-bearing formation of north-eastern Israel that appears as a "strip" west to the Rift Valley, revealed three extensive Lower Paleolithic/Middle Paleolithic extraction and reduction (E&R) complexes: The Dishon, Mt Achbara and Sde Ilan, distanced 15 km from one another. In the Dishon E&R complex a large Neolithic/Chalcolithic bifacial workshop was found within the same area of an earlier Paleolithic E&R activity. These finds substantially revise what we have known about the scope of lithic extraction and reduction in northern Israel in both the Paleolithic and Neolithic-Chalcolithic periods. ICP-MS analysis of flint debitage items from the three E&R complexes and of flint tools from relevant prehistoric sites in the Eastern Galilee and the nearby Hula Valley combined with lithic analyses, suggest that flint nodules from the Eocene Timrat formation "strip" were used extensively in Paleolithic and Neolithic-Chalcolithic times.

Keywords: Flint extraction, Paleolithic, Neolithic/Chalcolithic, provenance

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Travelling craftsmen and artefacts in motion. A diachronic view on flint procurement strategies and distribution patterns in Neolithic and Bronze Age Denmark

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An archaeological examination of lithic inventories from a number of Bronze Age settlement sites and adjacent Neolithic flint mines situated in the flint rich province of Thy, Denmark, will provide the basis for a discussion of the role of lithic resources in past metal using societies. Based on a contextual chaîne opératoire analysis the presentation will focus on the technological and socio-economic processes pertaining to raw material exploitation patterns and procurement strategies through time and it will examine the question of control over and access to lithic resources – including the potential (re-)use of (Neolithic) flint mines in the Bronze Age. The concluding discussion will address the role of flint craftsmanship and craft specialization in relation to contemporary socio-economic structures in the region.

Keywords: Bronze Age Denmark, lithic technology, flint mining

*Speaker

Lithic Procurement during the Middle Paleolithic in the Abric Romaní (Capellades, Spain) through a multi-level study

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The Abric Romaní is a Middle Paleolithic site located at the NE of the Iberian Peninsula widely studied from different disciplines exempting, until now, the raw materials procurement dynamics. Through the study of the lithic raw materials exploited by the Neanderthals that occupy the site during levels M, Oa and P (between 50-55 ka BP), we will determine the lithic procurement areas and therefore their mobility patterns. Our analysis are focused on chert, because it is the most abundant and representative raw material in the archaeological record, with percentages around 80% in the studied levels. The study area is a 30 km radius from the Abric Romaní, where we have documented more than 30 primary outcrops with silicifications. For a better understanding of the landscape, we have created a methodology for calculating the chert abundance ratio, a prior and objective approximation of the raw materials availability in the territory. Based on the foraging radius presented by Binford (1980; 1982) for historical hunter-gatherers societies, we establish a theoretical 10 km limit for local procurement, and a regional procurement for those exceeding that limit. The raw materials emerging below the 10 km radius are, in almost all cases, underrepresented in the archaeological record. This fact together the low representation of local materials as limestones, quartz and other rocks, lead us to propose that the procurement occurred in the highest chert ratios areas within the regional range. Our results determine the procurement model for the studied levels (M, Oa and P) of the Abric Romaní, based on a regional range about 15 km, in agree with the possible foraging radius, and where the highest concentration of silicifications are located, represented by the Sant Martí de Tous (SMT) outcrops, arriving sometimes up to 24 km with the procurement of the Panadella chert (PAN) outcrops.

Keywords: Middle Paleolithic, NE Iberian peninsula, Abric Romaní, raw materials, chert, procurement strategies, mobility patterns

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Survey of raw material sources in the Machampane river valley, Massingir Mozambique: preliminary geochemical analysis

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As part of the on-going project "Stone Age Vilankulos: Modern Human Origins Research South of the Rio Save, Mozambique", a geoarchaeological survey of lithic raw material sources in the Machampane river valley was completed in the summer of 2017. A total of 50 raw material samples were removed from the outcrops surrounding the Late Stone Age (LSA) open-air site of Txina Txina (7600m²), and were divided into groups based on megascopic properties; such as color, luster, inclusions, and texture of the raw material. This study presents the preliminary results of the microscopic and geochemical classification of these raw materials, using a compilation of FT-IR, p-XRF, and EBD lv-SEM chemical composition readings, in an attempt to define the geochemical fingerprints of the available lithic raw material sources for the region. These samples will serve as the sole raw material database for the region; allowing researchers to better classify the lithic material, and their sources, found in the Machampane river valley. Preliminary data on the chemical composition and an analysis of raw material "quality" are presented here.

Keywords: Southeast Africa, Geoarchaeology, Lithic Raw material, Geochemistry, Old world Archaeology

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The use of landscape and georesources at microregional scale during Late Glacial and Early Holocene – the case study of Udorka Valley (Polish Jura)

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The aim of regional studies in archaeology is to identify the patterns of landscape use by ancient communities across time, in order to analyze and interpret the history of the relationships between people and their environment. By investigating the remains of material culture within the landscape scale, this kind of research allows to trace the connections between sites (different people groups), circulation of everyday objects, and regional availability of raw materials. This includes also the role of resources thought to be imported according to previous study.

The microregion of the Udorka Valley is located in the central part of the Polish Jura (southern Poland). This region seems to have been exceptionally attractive for hunter-gatherers in terms of living conditions. It offered a number of dwelling sites (caves and rock shelters) within a close distance to siliceous rock outcrops, but also high elevated hill tops enabling the wide field of sight. This region has been intensively investigated by authors for last 10 years. Though the Polish Jura is the most well studied Paleolithic region in Poland, the result of our survey revealed 9 new archaeological sites. The most interesting ones have been a subject archaeological excavation and detailed interdisciplinary study. In addition, the whole region was studied by detailed mapping of lithic raw material deposits.

The lithic assemblages, cartographic data and paleoenvironmental reconstructions provided new and wide insight into Late Paleolithic and Mesolithic spatial activity. Extremely interesting here are the observations of the occurrence of the best quality lithic raw material, so called chocolate flint, in the microregion. The whole cycle of the economical use of this silicite can be detected in the Udorka Valley: from extraction in the mining point, through workshops to usage in form of tools. Due to variability of the site functions and complexity of human economic activity, the microregion of Udorka Valley plays a crucial role in the understanding of the communication and raw material distribution routes for the Late Pleistocene and Early Holocene communities. Research was financed by National Science Centre, Poland, grants no. 2011/01/N/HS3/01299 and 2014/15/D/HS3/01302.

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Keywords: Polish Jura, Late Paleolithic, Mesolithic, lithic raw material distribution, paleoenvironment

Different methods of determination of silicite raw materials and their implication on reconstruction of provisioning networks: case example of the bandkeramic site of Herxheim b. Landau (Germany).

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The bandkeramic site of Herxheim (Rhineland-Palatinate, Germany) is located in the Rhine valley near the german-french frontier. Fragmentation of humans bones and skulls, of pottery and stone tools are evidences of a ritual phase during the youngest part of the bandkeramic culture. The silicite raw materials of the site of Herxheim were determined by macroscopic criteria (naked eye and 10x magnification). The inventory is dominated by Cretaceous flints. Belgium, the Netherlands and France were supposed as regions of origin. Over time the postulated regions of origine were approved by colleagues appraised the inventory. With a longer time lag, the geographic origin of some artifacts from cretaceous flints could be investigated again by petrographic analysis of the microfacies. The regions of origin thus determined deviate in part from the macroscopically determined regions. Unlike in the past, microfacies, which can be found in the baltic glacial till deposits have also been identified. They point out relationships to the North. In the talk we will present the results and their implications on the reconstruction of the supply network of the site.

Keywords: bandkeramic culture, raw material determination, microfacies, Neolithic

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Chert circulation in Neolithic sites from central-northern Apulia: Gargano mines and secondary sources

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The north-eastern part of the Gargano promontory, in the Apulia region, was the main source of raw materials for chert in the central Mediterranean Sea. In this area, at least 20 mining sites were active from the early Neolithic to the early Bronze Age, the remarkable mining network attests the great quantity and quality of chert-bearing rock types, more specifically, three Gargano formations were mined: Peschici limestone, Scaglia and Maiolica formations. Moreover, some secondary sources of knappable materials were directly available near the coasts into beaches, colluvium and eluvium deposits, close to primary sources, and in the marine and fluvial terraces of the Tavoliere Plain, probably employed from Apulian prehistoric communities. In the last decades, primary source characterization of seven Gargano chert mines was conducted by ICP-AES and possible attribution of archaeological artifacts from Apulian settlements was carried out through multivariate discriminant analysis procedures, instead secondary sources have never been examined. The macroscopic and chemical (pED-XRF) analysis of a selection of 105 samples of chert from ten Neolithic mining districts and geological outcrops throughout Gargano Promontory (primary sources) and 50 samples of siliceous pebbles collected in the coastal deposits nearby Mattinata and Siponto (secondary sources) provided a reference dataset to compare with the data obtained on chert tools and débitage from Neolithic excavated contexts at Scaloria Cave, Masseria Candelaro and Monte Aquilone ditched villages (Tavoliere area), and Balsignano and Madonna delle Grazie settlements (Murge area), aimed to locate their provenance. A cluster analysis procedure was chosen in order to classify studied objects after a mixed data matrix and implement provenance study. A total of twelve variables (structure, texture and fracture features, three colour coordinates and six chemical element concentrations) was handled for 219 samples. Partitional clustering algorithm PAM gives back groups of more

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similar object. Primary sources are distributed in three groups, one include Maiolica and Scaglia mines and two groups contain Peschici limestone mines. Secondary sources of Mattinata and Siponto form two separated groups. Scaloria, Masseria Candelaro and Monte Aquilone samples essentially overlap with mines samples and few samples can be associated to secondary sources. Balsignano and Madonna delle Grazie show a much dispersed data, with few samples attributable to the Gargano mines, and Tavoliere secondary sources, while some small groups were not identified. These first results let draw attention to the existing relation between the size and quality of the artifacts and their raw materials. While bladelets and scrapers needed bigger chert nodules from primary sources, smaller tools could have been obtained from a larger variety of raw materials.

Keywords: Chert, Neolithic, Tavoliere, Murge, Portable XRF, CIE L*a*b*, Cluster Analysis

Erratic flint provenance at Krems-Wachtberg, Austria

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Recently, a systematic large scale investigation of Scandinavian flint applying the Multi Layered Chert Sourcing Approach (MLA) achieved clear source assignment of Maastrichtian and Danian primary flint deposits. Provenance studies of secondary beach gravel and – even potentiated – material from glacial deposits transported as far south as the enigmatic ”flint line” are significantly more challenging undertakings. The European ”flint-line” marks the southernmost expansion of erratic, i.e. glacially moved, flint. During different Ice Age events, chiefly Elster and Saale, glaciers distributed resistant flint nodules from Scandinavia as far south as Central Germany, Northern Bohemia and Moravia, and southwestern Poland. Hence, especially terminal moraines in those areas constituted important sources of erratic flint in prehistoric times, since material was accumulated and enriched in those glacial features. Since different glaciation maxima occurred during different chronological stages, the ”flint-line” is no homogeneous horizon. Every ice flow extended in a specific direction, which suggests a recognizable variation of flint types based on the original position from which material was absorbed by the glacier. However, very little work has been done concerning this issue, although erratic flint constitutes a major problem for provenance studies on a large scale.

Using the extensive database from our Scandinavian flint sourcing project, we focused on a case from Palaeolithic Lower Austria to tackle this problem in a pioneering attempt sourcing erratic flint. Like other comparable sites in the Austrian Danube region, the Upper Palaeolithic (Gravettian) site of Krems-Wachtberg, which has gained international fame due to the discovery of three infant burials, contains a rich lithic assemblage containing whitish patinated erratic flint implements. Ten selected erratic flint tools were investigated according to the MLA flint sourcing technique applying visual, microscopic and geochemical analyses using Laser Ablation Inductively Coupled Mass Spectrometry (LA-ICP-MS) coupled with Compositional Data Analysis (CODA) in order to reconstruct their original source environment in the Scandinavian realm. Applying concepts of bedload research, including the recognition of the TGC (=Theoretic Gravel Center) of specific ice flows creating particular moraines, we attempt to locate the

*Speaker

potential depositional catchment area of the Krems-Wachtberg finds, and hence a Palaeolithic source area at the flint-line. Our results can be used for economic considerations concerning far-distance raw material procurement strategies of Gravettian hunter-gatherer societies.

Keywords: Multi, Layered, Chert, Sourcing, Approach, LA, ICP, MS, CODA, erratic flint, Krems, Wachtberg, Gravettian, raw material procurement

The Seasonal Round of Quarry Activities: Modeling the Presence of Exotic Raw Materials Discovered Between Two Contiguous Physiographic Provinces.

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The impact of petrofabric on prehistoric quarrying is evident in the Great Valley Sequence of the Pennsylvania-New Jersey-New York tristate. Investigations of outcrop and fabric characteristics that impact prospection and extraction support the inference that bedrock quarrying involves considerable orchestration (LaPorta et al, 2017). Applying ethnographic analogies of hand-operated bedrock quarry operations (LaPorta, 2004), the authors tentatively flesh out various tasks and procedures required to prospect and develop a quarry around annual subsistence activities. The following is based upon the presence of first-tectonic cycle cherts occurring as artifacts on archaeological sites throughout the Hudson River estuary. Conversely, basalt and diabase axes and adzes are excavated on archaeological sites in the Great Valley, where no basalt naturally occurs.

During late autumn, after the hunting of large mammals, chert discoveries are assayed. Plug-and-feather applications are initiated at future Zone 1 quarry extraction sites (LaPorta, 2005). Maintenance of base camps, processing of hide/meat, and re-tooling of instruments typically begins in the early winter and continues throughout the cold season (LaPorta et al., 2017).

Early spring witnesses preparation of the quarry camp, which requires fire wood gathering, tree felling, scaffolding and stone-wall maintenance, and gathering of glacial erratics for the production quarry tools and instruments (LaPorta et al., 2017). Initiation of Zone 1 extraction is modelled as beginning in early to middle March.

Southward migration of populations, to the fisheries of the Hudson estuary, occurs after Zone 1 extraction and involves transportation of chert, syenite, venison and hides. Quartz vein, mica, graphite, red ochre, serpentine and steatite are gathered during the prolonged stay in the estuary. Construction and maintenance of fish weirs, alewife traps, and estuary base camps occur in the spring through summer (LaPorta et al., 2017). Quarrying, or bartering, for basalt, serpentine and steatite for the production of adzes, celts, axe blades, and stone pipes might occur in early August. By mid-August, northward migration back to base camps transports sweet-grass baskets, shell, turtle carapaces, shark teeth/skin, clay, quartz, mica, serpentine and basalt for

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the production of subsistence items, as well as for tribute and bride-wealth.

The return of the fall shows renewed maintenance of the principal base camp, mammal hunting, nut/seed and fire wood gathering. The annual cycle starts anew with the announcement from the elders that chert is required (LaPorta et al., 2017). Chert assaying, and plug-and-feathering of outcrops, starts the extraction process again in preparation for quarrying next spring.

Keywords: chert, quarries, extraction, distribution systems

The acquisition and conveyance of obsidian in Neolithic in the area of present-day Poland

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Obsidian, a natural volcanic glass, was one of the best siliceous rocks available to prehistoric communities to be applied in manufacturing a wide variety of chipped stone tools. Now, in present-day Poland, we find sites from the Middle Paleolithic, which deliver the initial evidence for its use by prehistoric communities. However, from the period covering the time-span between Upper Paleolithic and Mesolithic, the number of sites, where obsidian items were unearthed, is rather small. Dramatic changes occurred with the onset of the Neolithic (ca. 7,500 B.P.), which is coincident with the development of Linear Pottery Culture, and persisted over the time of Malice and Lengyel culture existence, middle Neolithic.

Due to the distinctive trace of obsidian and rare earth element composition, geochemical "fingerprints" can be determined for geological sources by using various instrumental methods and can then be compared with those derived from archaeological artifacts to determine the most likely source location for the artefactual raw material. Thanks to these stable geochemical properties precise identification of geochemical source is possible, which can allow to reconstruct distribution paths of obsidian artifacts, and to investigate issues of extraction, exchange, and contacts between prehistoric communities

For our presentation we would like to introduce the materials for Racibórz-Ocice site (South Poland) from which two artefacts were analysed by using non-destructive energy dispersive x-ray fluorescence (EDXRF). The new geochemical data regarding artefacts from this site have become the starting point to study long-distance contact between Poland and the Near East during the Neolithic period.

Obsidian artefacts are present on more than hundred Neolithic sites in present-day Poland. Long-distance connections also are proved by presence of imported pottery and 'mobile art'. The trade

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contacts are confirmed by appearance of flints imported from Poland, especially 'chocolate' and Jurassic-Cracow flint, in Slovakia and Hungary. In the presentation we would like to focus on acquisition and conveyance of obsidian in Neolithic as an example of long-distance exchange in order to reconstruct the way of transaction, distribution roads and the meaning of 'exotic' siliceous rock in communication of prehistoric communities.

Keywords: obsidian source analysis, Neolithic, prehistoric obsidian use and conveyance, non destructive energy dispersive x, ray fluorescence, Polish archaeology

VIS-spectroscopy as a tool for silex raw material analysis

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The origin of silex material that was used for the production of lithic tools is an important source of information concerning trade or migration routes in prehistory. The silex, or flint, varieties that were used for the production of lithic artefacts are often characterised by subtly different colors, or different grades of lightness. These colors can be determined using spectrophotometrical analysis.

We measured the color spectra, or the reflectance spectra of visible light (VIS-spectroscopy) of neolithic lithic artefacts and of recent raw material samples using a Konica Minolta CM 700d spectrophotometer, which has a measuring diameter of 8 mm. The measured spectral data was converted to CIE L*a*b* color values. The aim was to compare and differentiate between flint material from different sources, mainly from quarries in Belgium, the Netherlands and Northern France.

The measured pieces were selected from 70 silex species groups in the reference collection of the Institute of Prehistoric Archaeology of the University of Cologne. Seven surface categories were defined, of which two categories were chosen for the measurements – artificial prehistoric and recent surfaces. We also tested if recent knapping surfaces and the surfaces of prehistoric material have comparable colors, and if similar surface characteristics can be found in the same raw material group. One difficulty was that the material is usually heterogeneous, and that a flat surface is needed to place the measuring device, therefore an average of at least three measurements per piece was calculated and used for statistical evaluation.

First results showed that specific silex groups can be differentiated by their color and their luminance values, e.g. silex varieties from Hesbaye and the Obourg region in Belgium or the Lousberg material. Therefore the color measurements could be a fast and easy tool for predetermining and silex species, prior to geochemical analyses.

Keywords: silex analysis, color measurement

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Diffusion des rhyolites en Corse néolithique depuis les gisements montagnards : premiers résultats des méthodes d'analyses géochimiques

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Il n'existe pas en Corse de gîte naturel de silex ou d'obsidienne, ces matériaux ont donc dû être importés depuis la Sardaigne voisine au cours du Néolithique. Cependant, la rhyolite, une roche volcanique siliceuse autochtone a également été utilisée par les populations pré et proto-historiques en Corse. Cette roche a pu être exploitée à partir de nombreux filons sur l'ensemble de l'île mais les gisements de meilleurs qualités se concentrent au Nord-Ouest, dans le complexe volcanique du Monte Cintu, ainsi que dans certaines zones de haute-montagne.

Au cours du Néolithique la proportion de rhyolites dans les assemblages lithiques est très variable et semble liée à deux grands facteurs : l'éloignement des gîtes de rhyolites les plus importants, et le dynamisme des échanges avec la Sardaigne. L'étude des artefacts en rhyolite des sites néolithique corses et particulièrement la recherche des sources de matière première peut donc permettre de rendre compte à la fois de l'évolution des réseaux d'échanges et des évolutions d'occupations et d'exploitations des territoires, notamment en altitude.

On observe au Néolithique Final une diminution drastique de l'utilisation des matériaux lithiques d'origine sarde compensée par l'emploi plus important des rhyolites. Or à cette même période les établissements en altitude sont plus nombreux. Certaines de ces occupations de montagne sont en lien direct avec l'exploitation d'un gisement de rhyolite, comme sur le plateau d'Alzu, au Sud-Ouest de Corte. Les fouilles qui y sont menées depuis 2016 ont mis en évidence une exploitation très importante sur 46 ha et une zone d'habitation où l'on peut observer l'ensemble de la chaîne opératoire, de l'extraction à la fabrication d'outils. En août 2017, un nouveau filon de rhyolite, associé à un site archéologique probablement occupé au Néolithique Final a été découvert dans la vallée de l'Ascu en bordure d'un chemin de transhumance.

Afin d'étudier la diffusion des rhyolites exploitées sur ces sites et dans les gisements alentours, nous avons récemment développé à l'IRAMAT-CRP2A des méthodes d'analyses géochimiques strictement non-destructives. Cette approche nous permet d'obtenir, au-delà de " l'empreinte

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digitale ” de la roche, des informations sur la gestion de l’environnement, en particulier montagnard, par les populations néolithiques, via l’étude des modalités de diffusion des rhyolites depuis des sites producteurs comme le plateau d’Alzu.

Keywords: Néolithique, Corse, Rhyolite, Provenance des matériaux lithiques, EDXRF

Procurement and distribution of Castelltallat flint (NE Iberia). Preliminary results from Montvell Quarries

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Since 2014 we have launched a research project aimed at studying quarries and specific sites where the first transformation of siliceous raw materials took place in the Northeastern Iberia. During this time, archaeological work has been mainly devoted to the study of Montvell Quarries (Castelló de Farfanya) and the distribution of raw materials and products knapped on the flint from limestones and marly limestones of Castelltallat Formation (Ebro Basin) that was the aim of the Montvell quarrying activities.

So far the research has been guided by a double objective: On the one hand, we have tried to characterise the nature of flint procurement and the strategies used in flint extraction attempting to determine the chronology of quarrying works; On the other hand, we have tried to establish useful archaeometric criteria for differentiating this flint from other similar. So we have carried out a petrographic, mineralogical and geochemical characterisation in order to determine the scope of distribution of Castelltallat flint within the Northeast of Iberian Peninsula. All those goals are particularly relevant as siliceous rocks are relatively scarce in the area of study.

The archaeological excavation and recording of the surface of the quarried bedrock suggest that the dismantling of limestone strata was carried out by means of steps or small platforms dug in the rock surface. It was probably related to horizontal surfaces of weakness in the layers that would have favoured the removal of limestone rock in blocks in order to obtain the flint nodules. So far, no evidences of flint knapping have been found here, probably because flint nodules do not require any preparation work prior to their distribution and knapping. Despite the preliminary character of this work, there are reasons supporting a Neolithic chronology for these quarries.

In the region of the Pyrenees its geographic distribution in prehistory is attested within a surface area of about 6000-8000 km², whereas the reach and regularity of its distribution to the south of

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the outcrops is therefore still unknown, being necessary to carry out specific studies on the flint types in archaeological assemblages in this geographic area. This way, Flint from Castellatallat Formation turns out to be a valuable lithological marker to evaluate the range of mobility of the human groups who lived in the north-eastern Iberia and their contacts with neighbouring areas.

Keywords: flint quarrying, distribution of raw materials, Neolithic, NE Iberia

Lithic resource management dynamics from the Middle Palaeolithic to the Middle Neolithic in northern Hungary: a research project

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Natural resource management was a basic questions of adaptation along human history. Our project studies this topic with the focus on lithic raw materials resources within a time frame, from the Middle Palaeolithic to the Middle Neolithic, with important climatic-environmental changes and important economic-cultural changes. The Northern Hungarian Range, belonging to the inner Western Carpathians, is dominantly built up from Mesozoic and Tertiary rocks of sedimentary and volcanic origins. Due to its complicated formation history, there are various geological formations which contain different types of siliceous rocks. The southern foothill regions of the Northern Hungarian Range, especially the Mátralja and the B'ukkalja areas, are rich in human occupation sites from the Stone Age. Taking into account palaeogeography, settlement strategy, access to raw material source, aptness of raw materials to knapping, and lithic economy, it will be possible to see a diachronic tendency with cultural and natural factors. Our research project use a complexe methodology. All occurences of siliceous rocks will be mapped in the regions by studying geological properties, using Fine-grained Pebble Examination (FPE) method and field surveys. They will be evaluated as raw material sources regarding exploitation possibilities and rock quality. Applying palaeogeographic reconstructions their palaeo-accessibility will be reconstructed for the study periods. Human settlements from the study periodes will be mapped in the study areas using archaeological data and field surveys. The exploited raw material spectrum in an archaeological assemblage will be identified. Based on technological analyses the modes of acquisition and processing of each raw material will be recognized. Due

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to the application of GIS based data processing on geological, geomorphological and archaeological data sets, the modelling of the dynamics of the lithic economy will be undertaken for the study time frame. The role played by the changes in the environmental and the cultural factors will be evaluated. The project is financed from the NRD Fund (K 124334).

Keywords: lithic resources, raw material economy, palaeoaccessibility, Palaeolithic, Neolithic, GIS

Lithic Raw Material Sourcing and Economy in Late Pleistocene microlithic industries. The case of Courbet Marine (Northern Algeria)

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This communication brings valuable information on the lithic raw material economy of the Iberomaurusian culture, a Late Upper Palaeolithic based-bladelet industries of the Maghreb in North Africa. The case study is Courbet Marine, an open air site located in the north-eastern littoral of Algiers and excavated by C. Brahim in the seventieth. This last studied the lithic assemblages according to a typological approach. Our reexamination of the entire lithic assemblages according to a techno-economic approach shed light on the existence of different strategies in raw material supply and several core-reduction modalities closely linked to the raw material qualities. Moreover, the lithic raw material analysis based on both petrographic (thin section) and geochemical studies carried out on the knapped stones, and the geological samples, essentially siliceous rocks, allowed to identify several microfacies and to recognize the outcrops of these different varieties. Up to now, petrographic and geochemical analyses carried out on prehistoric lithic assemblages are not yet known or published elsewhere in the Central Maghreb. Hence, this contribution can be useful to develop a regional reference "lithothèque".

Keywords: Lithic raw material, sourcing, northern Algeria, petrographic analysis, geochemical analysis.

*Speaker

Cantacorbs: Recovering a forgotten Neolithic site at the Prades Mountains (Montblanc, Catalonia)

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In the mid of the past century a series of high-altitude chert workshops were found in the Prades Mountains (Montblanc, Catalonia). These workshops were ascribed to the Neolithic, but to date just one of them -Cantacorbs- become part of a wider archaeological project. This open-air site is located in the top of a calcareous high plateau (1022 masl), dominating one of the main routes through the Prades Mountains. The main characteristic of the site is the large amount of knapped lithic material on the surface, among which all the stages of the reduction sequence (cortical flakes, cores on different stages of reduction, crested pieces, core tablets and other core-shaping flakes, blades and blade fragments, etc.) are represented. Raw material provenance shows a regional range, coming from at least four different procurement areas.

The aim of this work is to propose an organization of the occupational sequence based on the study of the lithic assemblage from the "Capdevila" private collection together with the data obtained during the two fieldwork campaigns carried out to date. Technological and typological traits allow to ascribe the occupations of the site to different moments of the Neolithic. Although the majority of the lithic assemblage is composed by flint knapping by-products, blades and fragmented blades, there are also found some geometric elements, truncated pieces, notches and a noteworthy presence of borers.

The identification of percussive elements, standing out the presence bush hammers for the production of ground tools, reinforces the interpretations of the functionality of the site as a chert workshop area (although to date just one ground axe was recovered). In the same way, the abundance of cores, core-shaping elements and the presence of a large amount of small by-products allow to infer the *in situ* character of the site.

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Keywords: Neolithic, chert workshop, lithic technology, geometrics, bush hammers

From mines to settlements (and vice-versa): the raw materials from the Mons Basin (western Belgium) as a proxy to study mining products circulation and experience the definition of a mining complex

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A synthesis of Neolithic flint extraction sites from the Mons Basin (Western Belgium) has established the presence of 5 to 7 extraction sites concentrated on a small area (65 km²), including the very famous World Heritage site of Spiennes. These extraction sites are distinguished both by extraction methods and by the nature of their products. These differences refer to various aims within the socio-economic organization of agro-pastoral communities.

In parallel with this topic, a pioneering work to characterize silicifications from the Upper Cretaceous to Paleocene deposits allows to take a fresh look at the regional and extra-regional circulation of mining products from the Mons Basin (mainly within the Haine valley and the Upper Scheldt area).

The circulation of raw materials, as a proxy, establishes relationship, even indirect, between village communities and it sketch a diachronic overview of the most important extraction sites of the Mons Basin (Spiennes, Douvrain and Flénu) from the 5th to the end of the 3rd millennium. This component also suggests a form of organization between some extraction sites and leads us to question the relevance of the notion of mining complex, currently used to define any regional cluster of flint extraction sites.

Keywords: Mons Basin, flint extraction, mining complex, circulation nextwork

*Speaker

LIDAR and geophysics, how to try to document a flint mine without digging, the example of Malaucène (Vaucluse, France).

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The neolithic flint mine and quarry of Malaucène is one of the largest known in Europe. Flint extraction witnesses are identified on an area which exceeds 250 hectares. The extraction zones are distributed along several coombs that are nearly 2km long. The height of the slopes can approach 50m high. These valleys are narrow at their base and 200 m to 300 m wide at summit. Today vegetation is often made up of scrubland, hardly penetrable. Because of these topographic specificities and poor soil quality, these lands have never really been cultivated. They have almost remained in the state in which the neolithic people have abandoned them. The intense activity of the miners has left enormous amounts of material related to mining. These wastes, consisting of limestone blocks and flint (nodules, fragments, chips or flakes), almost completely cover the ground. Nevertheless, they did not completely erase the underlying relief. In many areas the stigmata of flint recovery can still be discerned. They are in the form of large depressions that probably correspond to vestiges of large pits or wells. On the other hand, the walls of the coombs are sometimes totally hidden by the debris. In some cases these heaps are more than 30m high and 200m long at their base. We then have no idea of the general topography of the coombs walls.

Confronted with such large and extensive vestiges we wondered how to document them as a whole but also with accuracy. First and foremost, it was a question of being able to precisely point out the remains and give an account of their diversity and their complexity. A classic topographic survey would have been possible but almost unimaginable given the size of the area to be covered and its rugged relief. We opted for a Lidar survey. Despite the existence of areas

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with a fairly dense scrubland type vegetation, results are very convincing.

Once the current surface mapped by Lidar, we wondered how it would be possible to determine the thickness of the waste covering the substrate and whether it would be possible to find the traces of the walls of wells, pits or flanks of the coombs in order to find back the original reliefs and trying to precise the methods and techniques of extraction. To do this, we initiated a dialogue that led to a collaboration with the geophysics team at the University of La Rochelle and the Agphy Valor structure. In the course of the year 2017 we carried out a campaign of measures to see if these methods could be successful. Despite complications related to the configuration of places and difficulties of bringing equipment we were able to perform half a dozen test areas.

We will present here the results of both Lidar and geophysics. The combination of these two methods makes it possible to propose a new vision of the flint extraction methods on the Malaucene flint mine and quarry.

Keywords: flint mine and quarry, lidar, geophysics

**XXXIII-2. Flint mines and chipping
floors from prehistory to the
beginning of the nineteenth century.**

Ateliers de taille du silex, habitats et sites d'extraction du silex de la fin du Ve au IIIe millénaire avant notre ère dans le bassin minier Marne et Morin (Seine-et-Marne)

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Le but de cette communication est d'identifier les liaisons entre -atelier de taille-habitat-minièrè- dans le bassin minier Marne et Morin et d'observer diachroniquement leur variation même si toutes les périodes ne sont pas uniformément documentées. Pour explorer ces liens, l'effort a été porté sur la *circulation de la matière première, la complémentarité des productions lithiques et des chaînes opératoires* (Georges et Kerdivel, 2012).

Jusqu'à présent la question de la diffusion d'une partie de la production des lames de haches des grands centres miniers du Néolithique tels que celui de Jablines (Seine-et-Marne) dans les habitats voisins restait encore à ce jour peu documenté (Bostyn et Lanchon dir., 1992 ; Collet et Bostyn, 2011). Récemment, la fouille et l'étude de plusieurs aires de taille du silex associées à des habitats distants d'une dizaine de kilomètres de Jablines ont montré contre toute attente qu'il s'agit de sites producteurs secondaires de lames de haches.

La question n'est donc plus question de savoir si la production de lames de haches issue des minières est diffusée dans les habitats voisins, mais comment circule la matière première : plaquettes brutes, préformes? L'analyse de 21 séries lithiques réparties en basse vallée de Marne avec des contextes variés (5 habitats, 2 enceintes, 4 sites en couche, 8 sites à structures isolées et 34 aires de taille du silex) a permis de faire le premier bilan diachronique de l'industrie siliceuse dans le bassin minier Marne-Morin.

On se propose dans un premier temps de présenter rapidement les sites étudiés et dans un second temps, de montrer les variations des liens entre minières-ateliers-habitats. L'accent étant porté sur la complémentarité éventuelle des productions lithiques et des chaînes opératoires. Ce qui nous amènera à évaluer si les haches façonnées dans les habitats relèvent d'un savoir-faire spécialisé comme dans les minières ? Et finalement à poser la question de la diffusion des haches qui sont façonnées dans les habitats? Du point de vue de l'organisation, on verra qu'il existe une distinction entre ateliers de contexte minier et domestique notamment au niveau de la gestion des déchets.

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L'ensemble de ces sites témoigne d'une structuration spatiale des productions très poussées, permettant de mettre en évidence des différences entre les périodes étudiées concernant l'organisation et l'évolution des réseaux de distribution.

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Keywords: Territoires, ressources lithiques, atelier, habitat, minière, enceinte, Seine, et, Marne

Neolithic quarries and crafts in northern Corsica. The rhyolite deposit of Plateau d'Alzu

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The Plateau d'Alzu is an archaeological site located in the north of Corsica, at a height of around 1600 meters. A survey programme started in 2007 led to the discovery of a rhyolite deposit, and a lot of neolithic chipped stone in this material. This survey, also led to the identification of many rock shelters, with neolithic material, located a few hundred meters from the deposit.

Since 2016, these numerous discoveries (from raw material to tools) and the site's geographical arrangement led to an excavation. The proximity between rock shelters and the deposit, is an opportunity to study the complementarity between archaeological sites, in a restricted area. The preliminary results of the excavation, confirm the Neolithic assignment and allowed the identification of a rhyolite exploitation area and a settlement area under a rock shelter, with lots of debitage product, arrowheads in particular.

Keywords: Neolithic, mining, workshop, Corsica

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Borownia upon the River Kamienna (Poland) - a prehistoric mine of striped flint in the light of the first excavations

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Borownia upon the River Kamienna (Poland) – a prehistoric mine of striped flint in the light of the first excavations

The Borownia prehistoric mine of striped flint is situated in central Poland on the right side of the Kamienna River, a left tributary of the Vistula, 7 km south-east of the Krzemionki Opatawskie flint mine site, several metres above the River Kamienna floodplain. In this area 3.7 ha are covered with deep hollows, remnants of prehistoric flint mine shafts. The Borownia mining field is one of the best preserved prehistoric mining fields in Europe.

The site was discovered in 1921 by S. Krukowski and J. Samsonowicz during field surveys of flint sites in the valley of the Kamienna River; at the time it was described as "campignien". The discovery a year later of the striped flint mine in Krzemionki led to the recognition that Borownia was also a prehistoric mine. Before 2017 the site was studied by many archaeologists using non-destructive methods (both traditional, such as surface collection of artifacts and new, e.g. geophysical prospecting, Airborne Laser Scanning), and was dated to the Early Bronze Age.

In 2017, the first excavations were conducted in order to collect charcoal samples for dating. The main cross-shaped trench was cut in the NW part of the mining field, near the Kamienna valley. The second, smaller trench was dug in the SE part of the site, at a distance of *c.* 500 m.

The upper parts of several shafts were explored and numerous charcoal samples were collected for analyses, both radiocarbon (concluded) and palaeobotanic (still underway). Single snail shells and bone fragments were sent for specialized analysis.

More than six thousand flint artifacts indicate that bifacial axe head roughouts were produced, of a type known from a nearby Mierzanowice settlement and cemetery, lying ten kilometres from the mine. There is strong evidence that the settlement was connected with the mine.

*Speaker

The results of the ^{14}C dating point to the exploitation of the mining field at Borownia in the period between 2300 and 1500 BC, which is roughly the end of the Neolithic and the first periods of the Bronze Age. Most of the dates correspond to the times of the Mierzanowice culture, whose communities are associated with the late phase of striped flint exploitation.

Keywords: flint mining, settlement system, shafts, chipping floors, flint artifacts, Late Neolithic, Bronze Age

Flint mines and axes' chipping workshops in Lisle "les Sablons" (Loir-et-Cher district, France). Firsts results of 2 archaeological excavation campaigns in 2016 and 2017.

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Mine et ateliers de façonnage de haches en silex à Lisle " les Sablons " (Loir-et-Cher, France). Premiers résultats des campagnes de fouille 2016 et 2017.

Une fouille archéologique programmée a débuté en 2016 et s'est poursuivie par une seconde campagne en 2017 sur le site de Lisle " les Sablons ". Le site est implanté en rive droite du Loir, en rebord de plateau, sur les premières pentes du coteau d'un talweg débouchant à la perpendiculaire sur la vallée du Loir. Ce talweg comme la vallée du Loir cisaille plusieurs formations géologiques dont des argiles à silex issues de l'altération des craies du Crétacé supérieur. Le site est localisé à l'aplomb des formations des argiles à silex qui affleurent tout le long de la vallée et du talweg.

Le site est connu anciennement par prospection de surface et le ramassage de très nombreux éclats de silex et d'ébauches de haches abandonnées en cours de fabrication. Le mobilier lithique très caractéristique, récolté en surface, a été interprété comme lié à une chaîne opératoire de façonnage bifacial de haches et ont permis d'identifier la présence d'ateliers spécialisés sur le site. Après seulement deux campagnes de courtes durées, deux semaines chacune, les résultats obtenus confirme bien la présence d'un atelier de façonnage de haches en silex matérialisé par plusieurs amas associés à des fosses, en cours de fouille, creusées dans l'argile.

L'étude lithique des données issues de ces premières campagnes de fouille montre la présence d'une seule chaîne opératoire de production. Les déchets de taille sont composés de larges éclats arqués dont les caractéristiques morpho-techniques correspondent à une unique chaîne opératoire de façonnage bifacial. Plusieurs ébauches de haches abandonnées en cours de fabrication ont également été récoltées lors de la fouille. L'activité du site semble donc exclusivement tournée vers le façonnage de haches en silex.

Une précédente fouille archéologique à Pezou " la Chenevière-Dieu ", effectuée à la fin des années 1960 sur la rive opposée du Loir, avait révélée la présence d'un site d'extraction de silex néolithique associé à la production de haches. La réalisation d'une seconde fouille archéologique sur le site similaire de Lisle permettra de confronter les données entre les deux sites pour mieux appréhender la structuration du complexe minier néolithique de la vallée du Loir.

*Speaker

Keywords: Flint mines, axes, neolithic

Copper age lithic workshop on Mount Doc (Segusino-Treviso, North-eastern Italy)

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This paper aims to present a late prehistoric site related to flint exploitation and first stages of working. The site was excavated in 2002-2003 on the ridge of Mount Doc (1394m above sea level), one of the westernmost peaks of the Prealps range of Treviso (North-eastern Italy). The site itself and some of the documentation obtained from surveys and from the extensively excavated sectors have already been the subject of preliminary reports. These have concluded that between an advanced stage of the Neolithic Age and the Copper Age, this site was used to supply and work flint. Mount Doc is potentially an area of raw material extraction, given the availability of flint formations (Biancone and Scaglia variegata) which abound in the most exposed segments of the ridge. The technological analysis confirmed an interpretation of the site as a chipping area linked to the rough-hewing and the production of "pre-processed" products from blocks, small plates or flint fragments found, in all likelihood, a short distance away. Two production goals were identified, one of which involved making preforms whose size made it possible to build bifacial foliate retouch tools, while the other involved the extraction of blades and bladelets. What is almost entirely missing are the final products, as well as prepared cores. This, and other technological data, suggested that the raw materials were chipped quickly and roughly in order to produce rough-hewn preforms and blade/bladelet cores to be taken elsewhere for subsequent stages of production. The activities documented in the sector of excavation under study could be placed within a much wider economic and environmental context, as these activities were probably carried out seasonally by specialised itinerant groups linked to pastoral farming.

Keywords: Lithic workshop, flint quarry, Copper Age, bifacial preform

*Speaker

‘Chocolate’ flint mining from Final Paleolithic up to the Early Iron Age – a Review

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‘Chocolate’ flint occurs within a wide belt of outcrops of Jurassic rocks and, at present, we know of 26 exploitation points of this type of flint, forming the richest complex of monuments of prehistoric flint mining in the Vistula river basin. The first scientific investigations of the sources of this flint in Poland were undertaken by archaeologist Stefan Krukowski and geologist Jan Samsonowicz in the early 20th century. They described their differentiation and showed the potential location of the deposits.

First ‘chocolate’ flint mine excavations were undertaken by Krukowski in Orońsko (Szydłowiec distr.) in 1935. In the 1968 Romuald Schild collected samples of this flint, based on the location of exploitation points lying along the north-east edge of the Holy Cross Mountains – HCM (in Polish Góry Świetokrzyskie). As a result of Schild analyses, 11 groups of ‘chocolate’ flint were distinguished.

In the seventies excavations were carry at Tomaszów (1973-1975; Szydłowiec distr.), Polany Kolonie II (1971-1972), Polany II (1971-1972) and at Wierzbica ”Zełe” (1979-1988; Radom distr.). In the XXI century excavations were continued in Orońsko (2016-2017) and at Wierzbica ”Zełe” (2012-2014).

As a result of those excavations we have series of radiocarbon dates, mining features and flint materials showing unquestionably the prehistoric ‘chocolate’ flint mining from the Final Paleolithic up to the Bronze Age, even the Early Iron Age.

In the presentation we would closely consider mining strategies from the Final Paleolithic to the Bronze Age, even the Early Iron Age – to present the variations between mining features, along with geological structure. We will also focus to describe details concerning characteristic of obtained flint nodules, mining and knapping techniques used at the particular mine by prehistoric communities from the Paleolithic to the Bronze Age.

Keywords: flint mining, ‘chocolate’ flint, Final Paleolithic, Mesolithic, Neolithic, the Bronze Age, Poland

*Speaker

Ostroga” in Ruda Kościelna (Central Poland) – the tiniest point of banded flint exploitation

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The outcrops of banded flint in the Kamienna River basin were located for the first time in 1921 by J. Samsonowicz and S.W. Krukowski. One year later, the first remnants of prehistoric flint mining were identified. The research that has been carried out since then has brought a good recognition of the entire flint mining area. The large and very well-preserved site of the "Krzemionki" is the most famous place. Its surface contains about 2/3 of the entire area of the banded flint outcrops. It is accompanied by nine smaller sites of various sizes and states of preservation. They all lie in areas that are now overgrown with forest, which is very difficult to investigate.

One of the smallest sites associated with the exploitation of banded flint is the "Ostroga" mining field in Ruda Kościelna, district Ostrowiec Świętokrzyski. It was discovered in 1982 during field walk survey conducted by Janusz Budziszewski. It is situated on a tip, cut out by two, nowadays, dry valleys in limestones of the higher Upper Oxfordian (Upper Jurassic). Extremely dense vegetation at this area makes it very difficult to observe the surface of the site. However, during the first research it seemed that the original, anthropogenic but poorly visible relief was preserved on its part.

The emerging, in recent years, methods of forest prospection by airborne laser scanning have enabled new site analysis. Preserved mining area of "Ostroga" is only several thousand square meters. The S-W part of the site has a varied but not very deep relief, in which individual objects cannot be distinguished. In the N-E part, on the slope of the tip, the mines have forms of small quarries facing the slope, where the heaps were naturally dropped down. In both cases the exploitation was carried out with shallow pits. Although the artefacts that could be collected from the forested area are extremely little, there are some waste from the production of axes, both from Neolithic and Early Bronze age.

Keywords: flint mining, banded flint, airborne laser scanning, Neolithic, Early Bronze Age

*Speaker