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## **Topic: Material Productions**

# Thing theory and lithics

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Presumably, all humans through the Stone Ages made at least one lithic artefact, most probably produced thousands. Lithic artefacts are still as very present today, as they were in the hands of past people, albeit handled and understood quite differently. They are found in billions around the world, they are like a fossil language with a multitude of dialects. They carry meanings and memories of past events. What is common through the times is that their full meaning is elusive, impossible to deplete – only fragments of their remembrance may be grasped.

Among the billions, every single lithic artefact is unique; archaeologists depend on simplified classification systems to oversee, analyse and communicate them. However, even the most sensible and successful systems used to classify lithic artefacts, drag along an unintended problem. They enhance and amplify our vision on certain lines of enquiry, while blurring others from sight.

This is evident throughout archaeology’s research history and through all the efforts made to understand the multitude of memories lithics carry. The research history is long: In the early days, artefacts were studied in a naïve and intuitive functional manner. Later, they were grouped in ‘types’ to tighten chronological frameworks, moving away from their individual memories and function, while at the same time losing something of their vast variation. In line with the positivistic and strictly objective research tradition in processual archaeology, the functional aspects were completely and deliberately omitted from morphological classification systems. This improved the scientific communication of the basic technology and shapes of lithics. However, despite the obvious benefits, other problems followed. All of us bump into them as we study lithics, the implement at hand is more than a ‘retouched flake’ or a ‘blade with concave retouch’. The terminology is unable to room the multitude of memory within the lithics. For instance, the cutting tool, the ‘knife’ that was probably the most common instrument in the past, is today absent as a morphological category in Norwegian museum catalogues. But there are ample ‘retouched blades and flakes’. Similarly, researchers have gained new knowledge by studying ‘attributes’ to grasp variations in ‘types’, ‘use wear’ to approach function, ‘experimental knapping’, MANA, ‘refitting’ and ‘chaîne opératoire’ to gain insights into how lithics were produced. We have studied ‘lithic raw material’ and ‘technological profiles’ in lithic production to trace traditions and mobility. At present, there are considerable advances in the study of lithic technology. However, we need to be reminded that lithic artefacts have more to tell us, how lithic instruments were hafted, how they were used and what they did and do in their world

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\*Speaker

still remains somewhat in the shadows.

New and valuable knowledge is produced by all the mentioned methods, and all efforts in methodological expansion deserves generous credit. The point is that they all shed light on a tiny part of the bigger potential of lithics, and (unintentionally) restrict our ability to envision both the past and the contemporary agency of lithics. In this session, we would like to highlight the dilemmas associated with how lithic are studied and encourage new theoretical and methodological approaches aimed at better understanding the human–thing entanglements that flow from the billions of living lithics we have at hand.

**Keywords:** Thing theory, thing memory, lithic classification terminology and analysis', research history, speculative realism

# Material productions (varia)

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General session grouping together papers dedicated to Mesolithic material productions that do not fall within the scope of the other sessions of this topic.

**Keywords:** Material productions

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\*Speaker

## **Session: Thing theory and lithics**

# Changing the perspective, adapting the scale: macro- and micro lithic technologies of SW Iberian Early Mesolithic.

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What determines the choice of a specific lithic solution among the set of skills and know-hows that are part of a group's cultural background? Early Mesolithic from SW Iberia shows a high diversity of lithic solutions considering the various aspects of the manufacturing process: debitage strategies, technical procedures, blanks and tool-types. At each site and at each location the group select the most adequate solution to respond efficiently to the needs. Synchronous sites show different lithic components; there are no recurrent patterns. Macrolithic and microlithic technologies were adopted, depending on the site, but the selection of one over the other seems to be independent of site functionality. What determined the choice? Environmental contingencies, functionality, ability, ethnicity? This peculiar facet that characterizes Early Mesolithic lithic production contrasts to the pattern observed for the Upper Palaeolithic, particularly its latest stages, where the same constellation of tools is systematically represented in the archaeological record. Flint does not abound in SW Iberia and has a very uneven distribution in landscape. But to a greater or lesser extent this lithology is systematically used to produce the small armatures that typifies the hunting equipment of the Magdalenian groups, being present even in sites that are located far distant from flint sources (> 150 km). Conversely, raw material procurement and selection do not constitute a dilemma to Early Mesolithic people: the locally available rocks and minerals are evenly used, independently of their quality for knapping activities.

Macrolithic technologies directed towards the massive production of cutting edges (the flakes) and heavy-duty tools produced from medium coarse-grained quartzite, and similar rocks, co-exist in SW Iberia Early Mesolithic record with microlithic technologies focused to the fabric of very small bladelets to be transformed in tiny armatures made from good-quality flint. Although contemporaneous, each lithic solution has its own geographic identity.

How to analyse, compare and interpret archaeologically assemblages that are so disparate? How to establish a general characterization that can works as a trait, a reference of that time and concurrently respects its plurality? No analytical template or criteria are sufficiently comprehensible to make us *understand the multitude of memories lithics carry* but some approaches can help us to overcome the impasse by letting us get to the histories that are behind the lithic

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\*Speaker



artefacts.

**Keywords:** SW Iberia, Early Mesolithic, lithic, variability, lithic terminology and analysis

# Stone tool technology at the Cabeço da Amoreira shellmidden (Muge, Portugal): a diachronic perspective

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Ongoing archaeological works at the Cabeço da Amoreira shellmidden have allowed the excavation of new areas within the mound, using Total Stations and thorough excavation methodologies. The latter allowed for comprehensive data, which contributed to a fuller understanding of the stratigraphic sequence, the existence of radiocarbon dates and the possibility of spatial analysis.

There are currently two excavated areas within the shell midden (S1 and S2), each showing different layers. Lateral variation of the layers has also been verified for each area. These layers often show different lithic and raw material concentration patterns, which may be understood as different occupation patterns.

This study aims to understand the technological and raw material variability within the two areas of the archaeological site, as a way to understand different patterns and occupations.

To do so, a typological and attribute analysis was applied to all lithic artifacts with individual IDs (superior to 2 cm or inferior, if complete), from sampled units from both areas, including the macroscopic identification of thermal alterations. Raw materials were individualized by type when concentrated in clusters and with macroscopic similarities, in some cases being possible to do a small number of refitting.

Finally, the present study also ran spatial analyses, using the spatial information recovered on the field, correlating it with the technological and raw material data.

All statistical and spatial analyses were performed in R environment, using the RMarkdown software.

The results suggest the functional separation of the lithic assemblages and its association with differences detected in the composition of the several identified layers. This separation can be seen mainly in the raw material patterns, but also in the presence and frequencies of technological diversity.

**Keywords:** Lithic analysis, Coastal adaptations.

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# Can Phylogenetics and Factor Analysis be Complementary? The Geometric Microliths as a Case Study

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To achieve a better knowledge of archaeological processes and events, and thus increase our comprehension of past societies, one of the first necessary steps is the systematisation of the archaeological record. In this sense, within the field of lithic industry, there have been many methodological proposals trying to organise how we understand the past material assemblages. From the development of synthetic (or comprehensive) observational typologies to the approach through different hierarchical classifications (from mathematical clustering to taxonomical perspectives), all of these techniques have in common the awareness that archaeological knowledge will not come from the identification of specific types, but from the correct interpretation of the relationship among those types, and how their evolutionary patterns relate within the rest of the archaeological record.

In this present communication we try to go deeper into our knowledge of type significance, and we do so by exploring two different analytical techniques, applied to the geometric microliths of the Eastern Iberian Peninsula. In the first place, we will use factor analysis. This technique is commonly used to assess causal relationships in different research fields and in particular, it has demonstrated its great accuracy in the field of lithic typology. Second, we will use Bayesian phylogenetics to try to understand the stylistic hierarchical relationships between the different geometric microliths. Although not yet very common, phylogenetics have been used in Archaeology to assess a number of research questions, starting in the end of the 20th century, and consolidating in the last years.

Due to different theoretical discussions, it is not frequent to find the combination of these techniques. However, we want to explore their possible complementarity. While phylogenetics try to establish hierarchical relationships through time, based on the inheritance of different traits, factor analysis can be pointed to understanding the causes conditioning those same relationships. If we can successfully combine both techniques, we will significantly increase both our understanding of the past, and the possible veracity of our methods to understand that past.

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<sup>\*</sup>Speaker

**Keywords:** Geometric Microliths. Factor Analysis. Phylogenetics. Typology. Taxonomy.

# The Neolithisation of the Northern French Alps : contextualisation of a transition period according to the lithic study of La Grande-Rivoire rock shelter (Vercors, France)

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The transition period between the Late Mesolithic and Early Neolithic is a singular phase in the Prehistory of Western Europe. Following a complex and arrhythmic movement marked by several moments of progression and adaptation, the first traces of neolithisation in the north of the French Alps appeared in the second half of the 6th millennium BC, between 5500 and 5350 cal BC. Nevertheless, the mechanisms of its implantation are still difficult to apprehend because of the presence of many inaccuracies in the local chronocultural sequence. The subject is all the more complex in that there seems to be a temporal and geographical promiscuity of the last indigenous hunter-gatherers and the first agropastoralists in the northern Alpine region, which could have led to acculturation phenomena in the technical systems of both groups. Several sites will thus deliver archaeological complexes presenting industries qualified as "mixed", where artifacts characteristic of the 2nd Mesolithic and Early Neolithic are revealed jointly on the same archaeological level. These assemblages are generally considered unreliable and consistent with the mixture of asynchronous occupations, preventing a diachronic reading of neolithisation in the northern alpine foothills.

This communication proposes a new study of some of the mechanisms on neolithisation that can be observed in the northern French Alps. In order to define more clearly the chronocultural framework surrounding the transition from the hunter-gatherer lifestyle of the Late Mesolithic to that of the (hunter-)agropastoralists of the Early Neolithic, this study focuses on an analysis of the specific operating chains of the lithic industries of the different cultural groups involved in order to identify the elements that are common to them, or inversely to the distinctive criteria. To address this issue, a comprehensive study of the lithic furnishings from recent excavations of the rock shelter at La Grande-Rivoire (Vercors, France) provides new data to update our knowledge of the modalities of neolithisation in the northern French Alps. The site, excavated annually between 2000 and 2017 revealed one of the few reliable stratigraphic sequences for the period, with virtually uninterrupted occupation of the site. The consequent lithic corpus is likely to highlight possible features of rupture or continuity between technical systems.

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We will focus here more specifically on the initial results of the study of the archaeological complexes of La Grande-Rivoire, relating to the study of changes in behavior observed in the debitage *chaîne opératoire* and shaping of tools from the final phases of the 2nd Mesolithic to the levels attributable to the Early Neolithic pre-sheepfold. Lithic furniture is one of the few elements common and abundant throughout the Neolithic period, thus promoting a better appreciation of the behavioural changes of prehistoric knappers. This communication will also address in particular the question of the origin of the slicing armatures. The hunting pieces, commonly attributed to the Early Neolithic, appear in some recent excavations, within ensembles of the 2nd Mesolithic. A complete study of the processing methods of these diagnostic pieces could reveal possible interactions between the human groups involved in the neolithisation of the region north of the French Alps.

**Keywords:** Neolithisation, lithic industry, typo, technological study, Northern French Alps, slicing arrowheads

# MANA and fragmented lithic records. An example from southeast Norway

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Minimum analytical nodule analysis (MANA) is an analytical tool for investigating mobility patterns and technological organisation among hunter-gatherers using lithic remains, and it has been applied by many lithic analysts since it was formalised in the 1990s. Due to poor preservation conditions, lithics usually constitute the only preserved archaeological material at Mesolithic sites in southeast Norway, and it is therefore not surprising that variants of MANA and *chaîne opératoire* studies have gained popularity among Norwegian Mesolithic scholars. The reconstruction of the lithic production sequences and the technological traditions behind these sequences have been of large interest. Particular attention has been given to Early and Middle Mesolithic sites dated within the timespan, c. 9500 to 7500 BCE. Although there is large variation, the lithic assemblages are often characterised by long and complete lithic reduction sequences indicating on-site production of lithic tool blanks, curation of lithic tools, tool use and discard. But how useful are these analytical tools when the on-site lithic tool blank production becomes less pronounced or when lithics only make up a small part of the prehistoric tool kit?

This paper will use lithic assemblages from eight sites dated to c. 6600 to 5600 BCE, located in the Oslofjord area, southeast Norway, as a point of departure for discussing the problems and potential of applying MANA to multi-phased sites and sites that are characterised by short, incomplete lithic reduction sequences.

**Keywords:** Minimum analytical nodule analysis, Norway

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\*Speaker

# Polished slate knives and slate raw-material variability in the Late Mesolithic of Northern Scandinavia

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In many parts of Northern Scandinavia there was a shift in raw material use during the Late Mesolithic, with the comparably soft rock-type slate starting to play an increasing role in the lithic industries. This is especially evident in Northern Norway where slate to a large degree replaced hard rock types like chert and quartz in the local industries. Slate is soft and brittle, but has the advantage that it can be shaped into knives and points with even shapes through grinding and polishing. The design of for example knives and arrowheads of slate, are therefore more akin to bone-tools, than to other stone tools, sometimes with intrinsic designs and carved decoration. Despite the fact that slate tools dominate many Stone Age assemblages in Northern Norway, there have been little research done on these type of implements. This paper focus on knives of slate from Finnmark and northern Troms in Northern Norway, and discuss problems of typology, chronology, and practical use, as well as raw-material variability assessed by the use of pXRF.

**Keywords:** slate knives, raw material variability, pXRF, Northern Scandinavia, Northern Norway

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\*Speaker



# Stylistic study of the Late Mesolithic lithic industries in Western France: crossing Principal Coordinate Analysis and use-wears analysis

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As for many other periods of the European prehistory, archaeologists have traditionally employed lithic industries as clues for the periodization of the Mesolithic in Europe. The Tévécien and the Retzien entities are two good examples of that, being characterized by their blade and bladelets production and the typologies of their geometrical microliths. Nevertheless, the concept of "style" described as a "highly specific and characteristic manner of doing something which by its very nature is peculiar to a specific time and place" (Sackett, 1982) is a concept with a much broader heuristic potential, which deserves to be thought beyond a delimitation of "cultural barriers" denied by current anthropological work.

In this work we propose to find different ways to approach stylistic attributes of the last hunter-gatherer's productions of Tévécien and Retzien (Late Mesolithic of Western France, 6th millennium cal BC), using statistical tests in order to find more quantitative clues to study the style of these populations. The interest of this approach is to confront them with functional choices and raw material constraints. To put it differently, we propose to question the form/function dyad with new analytical tools, to shed new light on the notion of choice.

Several sites of the Late Mesolithic in Western France have been chosen as case studies, all of them have been excavated and with reliable C14 dates. Since the truncation retouch seems to be a very specific technique of these industries, symmetrical and asymmetrical bitruncations and truncated bladelets are essentially studied here. The typological parameters are used as statistical variables in the principal coordinate analysis (PCoA). A network analysis was performed in addition to this test, in order to have a better understanding of the organization of the stylistics groups. Finally, functional analyses were carried out using the methodology of the use-wear study, based on the macro and microscopic examination of large samples, including retouched and unretouched blanks.

This study led us to the characterization of the "isochrestic panel" of the Late Mesolithic's symmetrical and asymmetrical bitruncations and truncated bladelets, approaching technological choices made during the manufacture of these objects. Furthermore, use-wear approach

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has allowed us to determine different modes of hafting of symmetrical and asymmetrical bi-truncations and several functionalities, mainly used as projectile weapons. These results led us to discuss about the distribution of the formal and functional characteristics of the Mesolithic toolkit and differs from the traditional cultural analysis of knapped industries.

**Keywords:** Late Mesolithic, lithic industries, style, principal coordinate analysis (PCoA), social network analysis (SNA), use, wear analyses.

# A Little Mystery, Mythology and Romance: How the 'Pigmy Flint' got its Name

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The term 'pigmy flint' was coined in 1900 and frequently used to describe small flint tools, many of them microliths, in British archaeology during the earliest decades of the 20th Century. The term 'microlithe' originates in France somewhat earlier, with markedly different connotations. It was not until after the turn of the century that 'microlithique' was used to describe the industries we recognise as such, and the term was not commonly used in Britain until the mid-1920's, despite cross-Channel academic connections.

The changing nature of the terminology that was used to describe such "very small implements of flint" (Gatty, 1900) is mirrored by the different attitudes of early archaeologists to these tools, and latterly to the application of Mesolithic as a distinct term. They were ignored by some, and marvelled at by others. The presence of morphologically similar 'pigmies' across the world sparked questions of migration, function, and chronology – in its broadest culture-historical sense.

This paper explores the history of the use of the term 'pigmy flint', its role within the development of Mesolithic studies in Britain, and speculates on why the term fell out of use.

**Keywords:** Pygmy flint, pigmy flint, microlith, history of archaeology

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# Handling Pressure: Migrations and Transmission of Knowledge in the 7th-5th Millennia BC

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Large-scale migrations of people are not only a current phenomenon, rather it is something that has taken place more or less constantly throughout history. Past migrations and communication networks were crucial for the spread of cultural traditions and technological knowledge, which has formed the bases of the societies that we live in today. Therefore, it is important to bring forth not only the patterns of prehistoric contacts and migrations but also to highlight the subsequent results of them, specifically relating to transmission of knowledge. The current works deal with large-scale Mesolithic mobility, contacts and transmission of knowledge in northern Europe. The focus lies on a specific technological concept, centred on blade production, from elongated single-fronted cores, known as handle cores. This pressure-based technology is a good study object for transmission of knowledge since it is technologically complex and thus requires some form of teaching, which includes social interaction, to spread. The concept was established in large parts of northern Europe during the 7th-5th millennium BC. The results of detailed technological studies, from different parts of northern Europe, are used as a base for discussing various types of knowledge transfer on several spatial levels.

**Keywords:** transmission of knowledge, technology, lithics, hunter, gatherer, Mesolithic, pressure, migration, mobility, pressure technique

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\*Speaker

**Session: Material productions (varia)**

# Variability of microliths morphology at the Cabeço da Amoreira shellmound: an approach using Geometric Morphometrics

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Geometric microliths are one of the most relevant and ubiquitous lithic technological adaptations of the Late Mesolithic in Westernmost Europe. At Muge shellmiddens, previous studies have revealed large amounts of variability in the morphology of these implements, especially the triangles. Three hypotheses have been suggested to explain morphological variability: 1) idiosyncratic cultural behavior across space and time; 2) successive application of maintenance retouch (Frison effect); 3) or the application of different morphologies for specific functionalities. Drawing upon recent developments on Geometric Morphometrics studies, this poster presents new data on the morphometric variability of geometric microliths from Cabeço da Amoreira, one of the largest shellmounds at Muge. Our goal is to test one of the three mentioned hypotheses, specifically the one that argues that identified subtypes are a consequence of discard at different points along a continuum of reduction. With this study, we expect to contribute to a better understanding of Mesolithic lithic technology and offer new interpretations to the economic and technological strategies of the last hunter-gatherer communities in the Western Atlantic facade of Iberia.

**Keywords:** Microliths, Muge, Portugal

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\*Speaker

# Raw material economy through Mesolithic in southwest France

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Since long time, raw material procurement territories are perceived as close to Mesolithic sites with a systematic lack of distant acquisition. This territories contraction around archaeological sites seems to be initiated from the Epipaleolithic. Despite everything, differences in the procurements can be perceived within the 1st Mesolithic, but also between the 1st and the 2nd Mesolithic. These differences can partly be explained by typo-technological changes, notably with armatures. However, there also seem to be different techno-economic choices between these two cultural groups. Acquisition strategies during the Mesolithic therefore remain generally poorly defined in their variability and in their diachronic extent.

The study of the Mesolithic sites of Quercy (Occitanie, Southwest France, corresponding to the Lot and a part of Tarn-et-Garonne region), mainly Cuzoul de Gramat (Gramat) and Fontfaurès (Lentillac-du-Causse), allows to initiate a reflection on economic behavior through the Mesolithic. The stratigraphy of these two main sites covers most of the 1st and 2nd Mesolithic. Thus, if the local and regional acquisition are intensively exploited, it is possible to see changes in economic behavior from the first phases of the Sauveterrien to the end of the Mesolithic period. Petrographic analysis of the lithic artefacts makes it possible to better understand territories exploitation by the different Mesolithic groups.

French :

Les territoires d'acquisition en matière première lithique sont de longues dates perçues comme proches des sites pour ce qui est des cultures Mésolithiques, avec une absence assez systématique de matières premières éloignées. Cette contraction des territoires d'acquisition autour des sites archéologiques semble s'initier dès l'épipaléolithique. Malgré tout, des différences d'approvisionnement peuvent être perçues au sein du 1er Mésolithique, mais également entre le 1er et le 2nd Mésolithique. Ces différences peuvent en partie s'expliquer par les modifications typo-technologiques existantes, notamment dans la sphère cynégétique. Cependant, il semble également y avoir des choix techno-économiques différents entre ces deux ensembles culturels. Les stratégies d'acquisition durant le Mésolithique restent donc dans l'ensemble assez mal cernées dans leurs variabilités et dans leur étendue diachronique.

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\*Speaker

L'étude des sites Mésolithiques du Quercy (dans la région Occitanie, située dans le sud-ouest de la France), principalement le Cuzoul de Gramat (Gramat) et Fontfaurès (Lentillac-du-Causse), permet d'initier une réflexion sur les comportements économiques à travers le Mésolithique. La stratigraphie de ces deux sites principaux permet de couvrir l'essentiel du 1er et du 2nd Mésolithique. Ainsi, si les gisements locaux et régionaux sont intensivement exploités, il est possible de noter des modifications de comportements économiques depuis les premières phases du Sauveterrien jusqu'à la fin de la période Mésolithique. L'analyse pétrographique des ensembles lithiques permet alors de mieux appréhender l'exploitation des territoires par les différents groupes Mésolithique.

**Keywords:** Mesolithic, Raw material, economic behaviour, territory



# The Mesolithic in the Marches: Lithic Sourcing in the Random Forest

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It is 50 years since the pioneering research of Sieveking et al. into the geological source of flint artefacts from Neolithic flint mines in southern England. Despite steady but limited interest in the decades since, only modest insights have been gained due to the subtle differences between geological samples across the chalk throughout western Europe and Scandinavia. In recent years however, updated instrumentation and machine learning approaches have enabled a revival of investigation towards this topic, offering more powerful means of differentiating samples and more robust methods of evaluation. This paper presents doctoral and recent research to evaluate three different machine learning techniques, Random Forest, Support Vector Machines, and K-Nearest Neighbour. It presents an example of best practice for pipeline development, provides up to date source determinations for Mesolithic artefacts from the Lower Wye Valley region of the Anglo-Welsh border, and provides insights for future directions for this promising development towards lithic sourcing.

**Keywords:** Lithic Sourcing, Archaeometry, Flint, Mobility, LA, ICP, MS, Machine Learning

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# Macroscopic Analysis of Lithic Grave Finds from Yuzhniy Oleniy Ostrov

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In 2018 –2019, statistical and qualitative data of stone artefacts from graves at Yuzhniy Oleniy Ostrov (in Onega, NW Russia, c. 6200 cal BC) was collected during macroscopic analysis and artefact examination at the Kunstkamera Museum in St Petersburg. The stone tools represent an important part of the finds from the graves. In this analysis, all lithics from the site deposited at the Kunstkamera Museum were examined. The lithic material from Yuzhniy Oleniy Ostrov is unique in many ways. Based on morphology, it can be divided into the following groups: ground knives, flint arrowheads and inserts, grindstones and pendants, scrapers, heavy tools, quartz finds and other tools.

This presentation focuses on a description of lithic artefact types found in the burials, manufacturing technologies and breakage.

The study shows that the morphology and technology of these tools is based on their function as grave offerings and that they were not made to be used traditionally. The quality of the lithic material of the tools varies even within individual graves. Forms of artefact maintenance were also discovered in ground knives. These interesting features among graves and tool types can be spatially linked with discoveries relating to unburnt bone finds and artefacts.

**Keywords:** Stone tools, Mesolithic, Cemetery

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\*Speaker

# Lithic raw material management at Mesolithic shell midden site of El Mazo (Asturias, Northern Spain)

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El Mazo is located in a rockshelter near the coast, in the province of Asturias (Spain). In this area, the Mesolithic is usually characterized by the presence of large shell middens belonging to the so called Asturian culture. Main characteristics of Asturian lithic industry are a small quantity of artefacts, high percentage of quartzite, presence of macro-tools (Asturian picks inclusive), flake production as main target, low percentage of laminar supports and limited repertoire of retouched tool types. Moreover, lithic origin of raw material is local, near the sites. However, not all these features are observed in El Mazo. Archaeological excavations at El Mazo have been carried out since 2009, and nowadays is a key site to provide new data for the discussion of lithic raw material management in this area and chronology.

The aim of this work is to define the origin of lithic raw materials and their relationship with technology and typology. The resulting data will be crucial to evaluate the management of lithic resources by human populations during the occupation of the coastal Asturian Mesolithic site of El Mazo.

Lithic from the different stratigraphic units identified at the site were used for analysis. Data collection was carried out in several phases. First results of technological analysis showed that the "*chaînes opératoires*" have different degrees of integrity, depending on the raw material. Retouched industries, organized by Fortea's typology, are composed of notches, denticulates, end-scrapers, sidescrapers/pieces with continuous retouch, truncations and geometrics. The study of raw materials focused on non-detrital crypto-microcrystalline siliceous varieties (chert, flint and radiolarite). For obtaining the data, the methodology used in this case was similar to the one used in other Mesolithic sites in the area, thus allowing the comparison of the results. All items were studied in a stereomicroscope, and later grouped into larger groups including all pieces with similar characteristics. Finally, these groups were compared with the "*LegioLit*" lithotheque of the University of León and assigned to a geological formation of origin according to their characteristics: texture, inclusions and bioclasts. In general terms, most raw materials are from local origin (< 30 km from the site to outcrops), but some of them are from regional (30-120 km), and even extra-regional (> 120 km) origin.

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**Keywords:** lithic raw material, chaînes opératoires, Mesolithic, Asturian, shell midden

# Mesolithic Kukrek technocomplex revisited in the light of the collection from the Kamyana Mohyla 1 site (south-eastern Ukraine)

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Kukrek is a taxonomic unit defined on the territory of modern day Ukraine and Moldova and unknown elsewhere in Europe. The definition of Kukrek aspect differs in fundamental way from any other definition of Mesolithic taxon in Ukraine. While the latter are grounded on microlithic projectile point's typology, Kukrek specificity is sought in other functional tools: Kukrek inserts and Kukrek burins.

Abundant Kukrek complexes of Kamyana Mohyla 1 site (excavations 2011-2019 by N.S. Kotova) provide the empirical basis for re-assessment of Kukrek technocomplex.

Kukrek inserts are medial fragments of blades with marginal retouch and hard ventral trimming. They were identified exclusively by Soviet and post-Soviet researchers. G.A. Bonch-Osmolovsky was the first to define them. V.N. Danilenko interpreted some inserts as "cutters" (prorezyvateli) for cutting grooves in bone, antler and wooden hafts. Current concept of "Kukrek insert" was developed by D.Ja. Telegin. Function of these tools was identified by use-wear analysis. They were used as planing knives on hard wood and bone. The perspective of the Kamyana Mohyla 1 site collection proves that Kukrek inserts are working elements of composite tools. These tools were used for planing hard organic materials (wood, antler, bone). Their reconstruction can be carried out as follows. Kukrek inserts cannot be placed in their hafts by long sides because some inserts were curved in profile. We suppose that they were hafted by their ends which were inserted in grooves or some other type of binding. That's why length of inserts was relatively standardized. When hafted like this, both sides of an insert were free and probably were used with a mechanic of movement similar to modern hard planes with force applied perpendicularly to a long axis of insert.

"*Kukrek burins*" were defined in several contradicting ways. They could be understood as "simple burins on chunks of flint" (Telegin 1982), burins on flakes with flat burin scar (Stanko et al. 1981: 11), multiple burins on flakes. We accept the latter approach.

If defined this way, "Kukrek burins" resemble secondary cores (cores on flakes). This point is supported by some refitting in the KM1 collection that gave us a possibility to ask whether "Kukrek burins are tools or cores? (McPherron 2007).

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Thus, Kukrek cultural entity was defined by classics of Ukrainian Mesolithic studies (Stanko 1982; Telegin 1982). However, we cannot continue to rely on this definition. Kukrek is rather a technocomplex than "tradition" and it is structurally similar to large technocomplexes of Upper Paleolithic like Aurignacian or Epigravettian (Anikovich 2003-2004). Its specifics are based on functional tools rather than on projectiles. Later, a concrete realisation of Kukrek technocomplex should be understood region by region and period by period, taking a particular attention to the morphology of projectile points.

**Keywords:** Lithic technology, theory of systems, technological syntax, hidden structures

# Evolutionary dynamics of armatures in southern France in the 2nd Mesolithic and Early Neolithic

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The use of weapons, and therefore of arrowheads, is structuring in the technical, economic, social and cultural fields. In the technical sphere, projectile armatures, emblematic tools, are often considered to be highly charged with cultural values and the expression of the identity of human groups. In addition to the culturalist approach, the study of their variability, in time and space, can shed light on the mechanisms of mutation and innovation that may result of adaptative strategies and cultural choices.

During the 7th and 6th millennia, the renewal of weapons and arrowheads corresponds to important changeover in lithic equipment, both in terms of function and production. Between the Second Mesolithic and the Early Neolithic, there is a diversification of the arrowhead shapes and an evolution of represented types. These observations enrich interpretative scenarios, especially around the question of know-how transfer, techno-economic renewal and neolithisation.

Our paper proposes to study these evolutions from the sequence of the Baume de Montclus site, a key Mesolithic and Early Neolithic site in Southern France. The selected sequence covers 1.5 millennia of occupation, roughly from 6500 to 5000 BCE cal., with a corpus of geometric bitruncations of about 650 pieces, distributed in about fifteen archaeological layers, making it one of the richest sites in Southern France. The cross-study of traceological (residues, micro and macroscopic analyses), technological and typological data allows a detailed interpretation of the manufacturing processes, hafting method and function. Beyond typological considerations, these analyses make it possible to approach the diversity of quivers, to identify specific technical traditions and to characterize techno-functional ruptures throughout this sequence. These results will be integrated into a wider, regional and extra-regional context, especially in the question of the emergence of the blades and trapeze industries complex and the neolithisation of the western Mediterranean basin.

**Keywords:** arrowheads, bitruncations, use, wear analyses, typo, technological study, technical traditions, neolithisation, Baume de Montclus

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# Provenance Archaeometric Study of Chert Artefacts from Cocina Cave (Dos Aguas, Valencian Community, Spain)

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The present study aims to understand the dynamics related to chert raw materials supply of the human groups who occupied the Cocina Cave.

Chert nodules were collected from the individuated local outcrops and a set of artefacts found during the recent fieldworks was selected in order to compare natural and archaeological samples. An archaeometric method was chosen to compare the cherts and confirm the compatibility among natural and archaeological samples. In particular, each sample was analysed by X-ray fluorescence spectroscopy (XRF) and inductively coupled plasma mass spectrometry (ICP-MS) to obtain major minor and trace elements concentrations, including rare earth elements ones, and multivariate statistics was employed for the classification.

While most of the artefacts showed elemental profiles comparable to the local chert types, few ones revealed different chemical features which suggested a possible origin from the area of the Serpis Valley (Alcoy, Spain), located more than 50 km south of Cocina Cave.

The present work revealed interesting insights about chert raw materials procurement and territoriality of the hunter-gatherers groups who occupied Cocina cave during Mesolithic, and of the occupants groups of the following Neolithic and Bronze Age phases.

**Keywords:** raw materials, chert, provenance study, archaeometry, multielement analysis, lithic artefacts

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# Mesolithization, Mesolithic and Neolithization in the South-West of France: contribution of the Cuzoul de Gramat (Gramat, Lot, France) to the establishment of a new chronocultural framework between the Pyrenees and the Massif Central (XI-VI millennia cal BC).

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First explored in the 1920s and 1930s by Raymond Lacam, the Cuzoul de Gramat deposit has been since one of the major stratified sites of the French Postglacial Period, one of the very rare sequences covering all the early Holocene. If the discovery of a burial in 1927 ensured its reputation, it was the monograph published in 1944, that has made it a key deposit, documenting in particular the evolution of lithic industries (Lacam et al., 1944). This one was perceived

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by Lacam as linear and continuous from the Azilian to the end of the Mesolithic (supposed to last until the beginning of the Bronze Age) and has long served as a frame of reference. With the resumption of work on the site since 2005 (Valdeyron et al., 2015; Constans et al., 2019) the stratigraphical and chronological data have been considerably renewed. Now reconstructed from reliable observations, the sequence covers the extreme end of the Tardiglacial and the ancient Holocene, with levels reported successively to Azilian, Laborian, Sauveterrian, Montclousian, Recent Mesolithic and Late Mesolithic occupations. The early Neolithic is present but only in disturbed position. Supported by a rereading of the stratigraphy and reliable C14 dating, the sequence slicing is now based on a techno-typological analysis of the lithic industries. This analysis underlines the lack of continuity between Azilian and Sauveterian and shows a major and brutal break in the technical traditions between the 1st (Sauveterian and Montclousian) and the 2nd Mesolithic (Late Mesolithic and Final Mesolithic), which takes place around 6200 cal BC. This rupture raises questions about the nature of the replacement process and the elements that may have favoured it. Moreover, the spread of the final stage of the Mesolithic in Cuzoul during almost the entire 6th millennium cal BC raises the question of possible relations with the Early Neolithic of Cardial tradition developed at the same time on the Languedoc coast.

Therefore, the aim of this communication is to establish the first data synthesis acquired in recent years, from the Azilian to The Early Neolithic, with particular emphasis on the new chrono-cultural phasing of the Mesolithic sequence of Le Cuzoul de Gramat. The framework for the application of this new phasing largely exceeds the causses of the Quercy. It concerns in fact a large quarter of southwestern of France, between the Pyrenees and the Massif Central, at least.

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**Keywords:** Cuzoul de Gramat, Mesolithization, Mesolithic, Neolithization, Southwestern France, lithic industries, New chronocultural Framework.

**Topic: Cultural traditions, regional  
identities and transitions**

# The Great Transition – Early to Mid-Holocene cultural and biological transformations in western Eurasia

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For decades the various chronological entities, the Late Palaeolithic, the Mesolithic and the Neolithic have been understood and treated as separate entities, with the academic communities having operated separately, often with differing methodological and theoretical toolboxes. This has, however, changed gradually in more recent years and nowadays many studies focus particularly on overlaps and continuities. The entire field has been enriched by archaeogenetics, and the previous largely typological studies may now be complemented and broadened by studies of demographic events and genetic admixture.

What evolves is a scenario of complex interactions between various Eurasian hunter-gatherer populations and incoming farmer populations from Anatolia. Regional patterns vary greatly from almost no contact to rapid and sometimes important admixture, but also long-term cultural contacts with few biological exchanges. With data increasing the general picture is becoming more and more nuanced.

We invite communications from both archaeology and archaeogenetics on the entire range of the topic and from any region across western Eurasia. We will specifically focus on definition criteria of what is to be understood as "Mesolithic" or "Neolithic", on mosaics of land use and resource exploitation, patterns of coexistence between hunters-gatherers and hunter-gatherers and farmers, exchange within and across landscapes, qualitative and quantitative criteria in material culture, biomolecular approaches to humans and their subsistence, food storage and transformation practices.

**Keywords:** Mesolithic, Neolithic, western Eurasia, archaeology, archaeogenetics, admixture

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# Cultural and regional identities (varia)

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General session grouping together papers dedicated to Mesolithic cultural and regional identities that do not fall within the scope of the other sessions of this topic.

**Keywords:** cultural identities, regional identities, variability

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\*Speaker

**Session: The Great Transition -  
Early-Mid Holocene biological and  
cultural transformations**

# On the brink of cultural change : animal resource procurement and use in the final Mesolithic at "Tivoli" Place Saint Lambert, Liège (Belgium)

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Excavations in the Tivoli sector of Place-Saint-Lambert (Liège, Belgium) by P. Van der Sloot and J.-M. Léoard (SPW) yielded an exceptionally well-preserved collection of faunal remains (NISP=2037) dated to the late Final Mesolithic of Belgium (ca. 5 300 cal. BC). Due to the poor bone preservation usually recorded on similar sites, such assemblages are rare, and the subsistence strategies of this period are still under-documented. This time-frame is nonetheless one of particular interest for the study of cultural change : current research times the arrival of Neolithic farmers in the Belgian plains around 5 300 cal. BC, and it appears likely that the Mesolithic hunter-gatherers of Tivoli were (sub-)contemporary to such groups.

Our paper investigates therefore strategies of animal resource procurement and use in the latest stages of the Mesolithic in this area, documenting practices in a society on the brink of major cultural change. Our results highlight that the animal economy at Tivoli is in most ways consistent with the uses of the Belgian Mesolithic in general, though regional comparisons show a number of local peculiarities, most notably in the exploitation of the red deer. Finds of worked red deer skulls and of bones with unusual weathering patterns reveal the use of animal bones for symbolic or technical purposes. Some have equivalents in other Late Mesolithic cultural contexts, other are unknown.

The unusual presence of domestic cattle (NISP=6) in the collection, a domesticate documented for the first time in Mesolithic Belgium, raises nonetheless the question of contacts between the site's inhabitants and contemporary LBK Neolithic groups.

**Keywords:** Final Mesolithic, Belgium, zooarchaeology, animal resources, hunting, cultural coexistence

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# The Meso-Neolithic Transition in the Alpine and Peri-Alpine Region: Still Open to Debate

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Despite intensified field research and re-evaluations of existing contexts, the period of transition between the Mesolithic occupation of the inner and peri-alpine area and the establishment of a sedentary agricultural Neolithic still remains widely unknown. This is in many regions due to a lack of sites with an appropriate archaeological material basis, but also to problems of terminological, chronological and technological resolution. The late 7th to 5th millennium BCE is incompletely documented, in particular in the central Alpine region.

Of the many scenarios conceivable, a persistence of a late Mesolithic way of life – e.g. a subsistence economy largely based on hunting and gathering – into the 6th and possibly 5th millennium deserves some attention, since it would bridge the gap between the attested late Mesolithic presence and the advent of the first Neolithic communities shortly before 5000 BCE in the Valais and Leventina, and around 4300 BCE on the Swiss Plateau.

This raises the question of processes of transmission, acculturation and tradition, topics that are not new in the discussion of the Meso-/Neolithic transition, but that need an adapted framework of analysis in the alpine and peri-alpine regions due to their specific topographic, climatic and resource situation. This paper will investigate some of these contexts.

**Keywords:** alpine region, transmission, continuance, tradition

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\*Speaker



# Approaching spatio-temporal analysis to explore mechanisms about the Late Mesolithic and Neolithic spread in the central and western Mediterranean

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The present proposal is based on spatio-temporal analysis considering radiocarbon dates and distances (distance-age modelling) from the Central and Western Mediterranean. The experiments conducted allow us to consider a comparative view taking into account both Late Mesolithic and Early Neolithic contexts in order to, a) compare the rhythm of spread, b) and to explore several hypotheses regarding its mechanisms. To do this we have compiled two data frames from both Late Mesolithic and Early Neolithic radiocarbon dates with spatial points to create a distance matrix. After that we have applied a spatial analysis of aggregate radiocarbon dates that explore spatial heterogeneity in the SPDs and a permutation-based statistical significance framework. The results allow us to comment the spatial density estimates of radiocarbon dates for discussing spatio-temporal behaviour relating the mechanisms (demic and/or cultural) of the Late Mesolithic and the Neolithic spread in the wide region considered.

**Keywords:** Mesolithic, Neolithic, Spatio, temporal analysis, 14C, central and western mediterranean

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# The Hidden Factor – The socio-political and economic contributions of indigenous hunter-gatherer populations to the Mid-Holocene societies in Temperate Europe

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Fostered by the early archaeogenetic studies, narratives about the Neolithic were dominated for about two decades by the idea, that these populations were rather homogenous and had successfully "conquered" at least larger parts of the European continent. If a contribution of surviving hunter-gatherer populations to the Neolithic was considered, it was thought to have been marginal.

However fine-grained archaeological studies from the 20th century and continuous approaches after AD 2000 had revealed an interesting and differentiated pattern of assimilation, acculturation but also cohabitation and parallel existence of mutually exclusive groups of immigrant farmers and indigenous hunter-gatherers. In some cases, the two biological groups seem to have formed new "multicultural" societies. But in others there are indications that hunter-gatherer populations, while co-existing with farmers, nevertheless did indeed play marginal roles in these societies, possibly for millennia.

Some of the dominant farmer societies may have even collapsed because they were unable to successfully manage integration of the two populations.

The presentation will go over the archaeological data of the last decades, review the discussion and suggest possible approaches for further investigations.

**Keywords:** Mesolithic, Neolithic, assimilation, marginalization, multicultural societies

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# An elusive transition: Revisiting the Mesolithic/Neolithic continuity in the Southern Adriatic and its margins

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Both Mesolithic and Early Neolithic occupations have been recorded in several caves in the south of the Adriatic Sea with hinterland (Crvena Stijena, Vruća Cave and Odmuť in Montenegro), and in the area between the Adriatic and Ionian seas (Sidari in Greece and Konispol in Albania). This apparent stratigraphic continuity was often interpreted as an evidence of population continuity and therefore as an evidence of acculturation of indigenous Mesolithic groups, i.e. their adoption of Neolithic innovations. These claims were supported by an apparent technological stability in the lithic production over time evidencing a cultural continuity between the Mesolithic and Neolithic. In this paper, we question these claims of continuity by re-examining the data from two cave sites in Montenegro, Crvena Stijena and Odmuť.

We do this by considering two lines of evidence: lithic technology from both Mesolithic and Early Neolithic layers, and the quality of contextual information that will inform about possible post-depositional disturbances and/or inadequate excavations and artefact curation.

Lithic assemblages were studied according to the concepts of *chaîne* and *schéma opératoire*, débitage economy, and raw material economy. The contextual information was evaluated based on the available excavation documentation and collected data.

The reinterpretation of the data shows that the lithic industries from both horizons can be described as Castelnovian, which leaves the acculturation hypothesis possible. Such claims, however, cannot be reliably demonstrated because of evident post-depositional disturbances coupled with inappropriate methodologies of old excavation field techniques and post-excavation treatment of the data (mixing of materials, "inversions" in radiocarbon sequences, excavation performed by unskilled workmen following arbitrary layers, inadequate recording of the context, dissatisfactory storage, non-critical interpretations, etc.).

**Keywords:** Neolithisation, Castelnovian, Montenegro, Adriatic, Lithic production, excavation and curation

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\*Speaker

# Mobility and territoriality during the Mesolithic in southern Scandinavia

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Is it possible to trace the extent of eventual territoriality during the Mesolithic in southern Scandinavia, and if it changed over time? Previous studies indicate that territoriality may have increased during the Late Mesolithic, as the frequency of possible territorial markings such as burial grounds increases. In this recently initiated study, strontium isotope ratios in human and animal material will be analyzed. The basis is the material from an older Mesolithic settlement (Norje Sunnansund, ca 7000 cal. BC). The material will be compared to material from a later Mesolithic settlement, to further interpret the mobility signals and to better decipher how the suggested territories were constructed. Most of the previous research using Sr isotope ratios have been based on bulk sampling methods. This provides great information regarding average values, and thus where the individual has spent most of his/her time during the forming of the teeth, but not high-resolution data of specific whereabouts during the formation of each specific incremental growth line. By analysing strontium isotope ratios on specific incremental growth-lines on human teeth from one Early and one Late Mesolithic archaeological site, where the humans have previously shown affiliations to the area they were found in, the aim is to study territorial mobility. By relating high-resolution data, from human teeth to that of different animals, the intention is to study group territory and areas of resource procurement to investigate human territoriality, mobility and networks in ancient landscapes.

**Keywords:** Mobility, territoriality, southern Scandinavia, Strontium isotope analyses

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\*Speaker

# Britain in or out of Europe during the late Mesolithic?

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Lacking well-dated 5th millennium Mesolithic evidence and based on a consensus that late Mesolithic Britain was isolated from the continent, discussion of the Mesolithic-Neolithic transition has focused on the centuries around 4000BC. This discourse has over-simplified complex neolithisation processes. New, high-quality evidence from 460,000 lithics found at the Bexhill to Hastings Link Road helps redress this. Here, well-dated microliths (5500-4300BC) may have continental affiliations. This, alongside other sites, including the Isles of Scilly and Horsham, offers exciting opportunities to contribute to debates on an isolated late Mesolithic. As a result, this work may also provide alternative explanations of the new evidence proposing European influences on British Neolithic DNA. Instead of an isolated island, we propose that, through this evidence, late Mesolithic Britain was culturally connected to the continent and, therefore, the Mesolithic-Neolithic Transition of Britain was a longer, more complex and nuanced process than previously thought.

**Keywords:** Mesolithic, Neolithic Transition, Microliths, Lithics

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# Comparison between Mitochondrial DNA haplogroup frequencies of Prehistoric and Modern Siberian Populations

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This Cis-Baikal prehistoric hunter-gatherer populations inhabited Siberia, Russia several hundred years ago. The Lake Baikal of Siberia was home to two temporally distinct populations from Early Neolithic (EN: ~7560–6690 cal BP) to the Late Neolithic-Early Bronze Age (LN-EBA, ~6060–3470 cal BP). No cemeteries were identified during the Middle Neolithic, and the EN group was separated from the LN-EBA group by a 700-year hiatus. Several cemeteries have been excavated as a part of the international Baikal Archaeology Project (BAP) including EN cemeteries (Lokomotiv and Shamanka II), LN-EBA Ust'-Ida and EBA Kurma XI. Maternally inherited mitochondrial DNA (mtDNA) has been examined previously for individuals from all the excavated cemeteries using PCR amplifications for the HV1 region (bp 16191 to 16367) and assigning a mtDNA haplogroup to each of the examined prehistoric individuals. Biological distances were predicted from mtDNA haplogroup frequencies between modern and prehistoric (EN, LN and EBA) Siberian populations using Nei's pairwise GST estimate. The modern populations' mtDNA haplogroup distributions were recruited from literature. Pairwise GST estimate was calculated using the SAS/STAT® software, and results from pairwise GST estimate were plotted on a two-dimensional PC plot using SAS PROC PRINCOMP software. From the PC plot we can deduce several useful points. First, the PC plot shows that Tuvinians are an outlier, while the remaining groups cluster together. Second, the EBA Kurma XI-EBA Ust'-Ida group is in close affinity with the Itel'men population. Third, the novel appearance of haplogroup Z, more frequent in northeastern Siberian populations, gives the EBA Kurma XI-EBA Ust'-Ida group a closer affinity with some northeast Siberian populations such as the Koryaks and

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\*Speaker

Itel'men. Finally, EN Shamanka II associate closely to the Egyin Gol ancient Mongolian population due to the fact that both of EN Shamanka II and the Egyin Gol have a high frequency of haplogroup D. Despite the small sample size from the Cis-Baikal prehistoric populations the mtDNA signature is of importance in understanding the maternal background of the area when comparing the frequencies of mtDNA haplogroups with the modern populations. This research shows closer genetic affinities with modern populations and heterogeneous background of the prehistoric population with respect to maternal origin.

**Keywords:** Hunter, Gatherers, Early Neolithic, Late Neolithic, Bronze Age, mitochondrial DNA haplogroups, Modern Siberian populations.

# Para-Neolithic in Eastern and East-Central Europe. Reflection of our classificatory imagination or reflection of the real past?

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In Eastern but also in East-Central Europe hunter-gatherer communities existed deeply into the Holocene, even until the 2nd millennium BC. However, this fact is somewhat overlooked or even forgotten in common knowledge. In case of Eastern Europe, this is due to the widely used term 'Neolithic' to designate such communities with pottery. In East-Central Europe communities of this kind, including also those using pottery, coexisted with the "proper Neolithic" communities (i.e. characterized by the presence of a full "Neolithic Package"), probably until the beginning of the Bronze Age. In scientific practice, the latter ones attract most attention and somewhat eliminate the awareness of the former. A situation of this kind, resulting largely from ingrained research traditions, makes it difficult to reconstruct prehistoric reality in all these territories. It also causes problems of a classificational and terminological nature when analysing the relations between hunter-gatherer groupings (but also agricultural ones) of Eastern and East-Central Europe, especially in the belt between the Baltic and the Black Sea. Of course, such problems also arise in case of wider scale comparisons, when we analyse the references to hunter-gatherers or farmers in other territories. Archaeological data relating to these topics can be better interpreted and understood through the results of genetic investigations. However, their number has so far been rather modest. The correct approach to typology of different components of material culture and to the issue of homogeneity of sites (including contexts of the increasing numbers of radiocarbon dates) is therefore fundamental. Taking these factors into account demonstrates that, despite the evident, longstanding interactions between farmers and hunter-gatherers, the latter groups are by no means disintegrating and disappearing, even in East-Central Europe. Neolithic or rather Neolithic-like elements, which spread through cultural transmission, are taken over by them very selectively. One can speak of cultural self-awareness and mentality, separate from the "typically" Mesolithic and Neolithic, including, among others, mental resilience in relation to the "proper" Neolithic. Of the many terms that these communities are sometimes called, perhaps the most appropriate is therefore the para-Neolithic, since it is the one that accentuates the alternativeness to the "proper" Neolithic. Should we treat the para-Neolithic in general prehistoric schemes more as Neolithic or Mesolithic? The answer to this question is not simple and obvious (however, to describe the past we have to classify it somehow). Perhaps there is no need at all to match the para-Neolithic with the Mesolithic or Neolithic. As a matter of fact, it depends on the accepted classificatory perspective. Let us remember, for example, that not only the notion of Neolithic but also of Mesolithic is defined differently. In any case, the idea of the para-Neolithic better illustrates that not all phenomena in prehistory closely match the discrete concepts generated by modern prehistorians, like for

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\*Speaker



example Mesolithic or Neolithic.

**Keywords:** Eastern Europe, EastCentral Europe, late Mesolithic, Neolithic, proto Neolithic, cultural interactions, archaeological classifications

# Ancient genomes from Iberia reveal regional- and local-scale population dynamics of Mesolithic hunter-gatherers

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Recent archaeogenetic studies have revealed that Mesolithic hunter-gatherers in the Iberian Peninsula carried two lines of genetic ancestry, suggesting a chronologically and geographically complex process of population admixture. One of these lineages was previously identified in late Pleistocene individuals dated to 19,000-14,000 BP (Spain, France, Belgium, Germany), associated with the Upper Palaeolithic Magdalenian complex in western Europe. The second lineage, which was predominant in western and central Europe, is defined by post-Last Glacial Maximum (LGM) individuals associated with Azilian, Epipaleolithic and Mesolithic contexts in Spain, France, Italy, Switzerland Luxembourg, and Hungary, dated between 14,000 and 7,000 BP. While in Iberia the late Pleistocene lineage survived during the Mesolithic, throughout western and central Europe it became largely unrepresented, as a post-LGM ancestry became dominant and widespread.

In this study, we investigate the hunter-gatherer populations living in Iberia after the Last Glacial Maximum, c. 9100-7300 cal BP during the Early and the Late Mesolithic. We combine newly generated genome sequences with previously published data from Mesolithic Europe to estimate the extent of population admixture, continuity and isolation across time in different subregions of the Iberian Peninsula. To better resolve the chronology of events leading to the survival of both genetic lineages in Mesolithic Iberia, all newly reported individuals were directly dated.

While previous investigations have focused on broad-scale patterns of genetic diversity in Iberia, our data density allows an in-depth study of population dynamics at the regional and local-scales.

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We integrated genetic and stable isotope data with archaeological evidence to explore sociocultural and micro-regional demographic patterns and its effects on broader population dynamics, by examining local genetic relationships. Archaeological evidence of diverse mortuary practices indicates great sociocultural diversity across Iberia during the Mesolithic, and in some cases suggests that hunter-gatherers were strongly rooted to limited territories. Stable isotope data indicates diversity of subsistence practices among neighbouring hunter-gatherer groups, further supporting the population clustering pattern. We investigate how these groups are genetically related by analysing intra- and inter- site kinship, levels of inbreeding and genetic diversity. Our study provides insight into the role of Iberia as a glacial refugium by further exploring the events that lead to the observed genetic patterns in this region during the Mesolithic. Our approach focuses not only on adding geographical and chronological resolution to supra-regional processes, but also on understanding local-scale dynamics of the last hunter-gatherers in Iberia.

**Keywords:** Ancient DNA, Stable Isotopes, Mortuary practices, Iberian Peninsula, Early Mesolithic, Late Mesolithic

# The Mesolithic genetic legacy in the first Neolithic societies sheds light on the processes of admixture in Europe

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In the past ten years, genomic data were obtained on hunter-gatherers from the Upper Paleolithic to the Mesolithic, from all over Europe. Although scarce and often with a poor DNA preservation, these data have led to a better understanding of the genetic substructure of the Mesolithic groups.

At the beginning of the Holocene, the Neolithic transition from foraging to farming spread as a new lifestyle towards Europe via distinct continental and Mediterranean routes, starting from 12,000 years ago in the Middle East. Both streams eventually overlapped in Western Europe. Here, a complex scenario of contact, interaction and exchange with autochthonous hunter-gatherers resulted in a mosaic pattern of the material culture between the Mesolithic and the Late Neolithic that is well-known in archaeology.

Investigated in greater detail using genomic data, incoming farmer groups have been shown to have a clear Near Eastern/Anatolian cultural and genetic background with only limited genetic contribution from hunter-gatherers for at least two millennia from the south-east to Western Europe, despite evidence of mutual material exchange. However, so far, no genomic data was available from modern-day France, the key region where both routes converged.

Here, in the framework of the collaborative project INTERACT (ANR/DFG), we present new genome-wide data covering today's France and Germany from the Mesolithic to the Neolithic (7000-3000 BCE). Utilising the genetic substructure observed in hunter-gatherer groups across Europe, we are able to trace characteristic patterns of admixture between incoming farmers and indigenous hunter-gatherers in different regions, which are consistent with both routes of the Neolithic expansion. In particular, Western European early farmers show a higher proportion of specific Western Hunter-Gatherer ancestry compared to those linked to South-eastern or Central Europe. The proportion of Hunter-Gatherer component also varies regionally, and the highest values can be found in the French Mediterranean coast (up to 55%). Here, we were able to estimate the initial admixture date to have occurred about four generations back in time, i.e. about a century after the first Neolithic farmers settled on the coast.

Our data shed a new light on the complexity of biological interactions between human groups during the Neolithic expansion and establishment in Western Europe, echoing the archaeological knowledge and confirming major regional variations. This increasing resolution paves the way for a finer, multi-scale approach to better document the processes implied in the mobility and evolution of prehistoric groups.

**Keywords:** Mesolithic, Neolithic transition, ancient DNA, Western Europe, interactions

# Investigating sociocultural patterns of the Mesolithic hunter-gatherers of Tévéc and Hoëdic, Brittany, France: an archeogenomic approach

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The Mesolithic sites of Tévéc and Hoëdic in southern Brittany, France are known for the unusually well-preserved human burials, along with the Mesolithic coastal cemeteries of southern Scandinavia and Portugal. They are crucial for investigating sociocultural and demographic processes in the Late Mesolithic of Atlantic Europe and critical in any discussion about the expansion of the Neolithic in Brittany.

We conducted a palaeogenomic study of nine human burials in Tévéc and Hoëdic. All individuals yielded authentic ancient DNA, which reflects the good preservation of the human remains at these sites. We present the results of ancient DNA analysis along with new and direct radiocarbon dates and stable isotopes of carbon and nitrogen.

We use this new dataset to revisit the 2001 paper "Dating Women and Becoming Farmers" by Schulting and Richards[1]. In this pioneer study, the authors presented an inter- and intra-site analysis of the stable isotopic evidence and showed that while the individuals buried in Hoëdic obtained 70 to 80% of their protein from marine sources, the people in Tévéc consumed equal amounts of terrestrial and marine foods. Although the neighbouring sites were contemporaneous, they had different diets and potentially different subsistence strategies. To investigate

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if these results are reflected onto the patterns of genetic relatedness, we compare intra- and inter-site genetic similarity, by describing fine-scale population structure. We also analyse kin relationships of the buried individuals at Téviec and Hoëdic.

Furthermore, Schulting and Richards found that at both sites the diet of young females was more reliant on terrestrial protein, shifting towards the group's marine-terrestrial values at older ages. The authors suggested that the differences observed in the stable isotopes may result from an exogamous, patrilocal marriage pattern, with women marrying in from other locations, including some more inland communities. Due to the chronological overlap between these hunter-gatherer burials and pioneer farmer sites in the region, it was also suggested that some of these women could originate from Neolithic groups. We test this hypothesis by addressing potential differences in ancestry of biologically identified males and females at both sites, by comparison with previously published datasets, to investigate potential patrilocal marriage systems and Mesolithic-Neolithic contacts.

This paper follows on the footsteps of pioneer studies at Téviec and Hoëdic and aims to provide new elements about sociocultural behaviour patterns of the last hunter-gatherer societies in western France.

Rick Schulting and Michael Richards, 'Dating Women and Becoming Farmers: New Paleodietary and AMS Dating Evidence from Breton Mesolithic Cemeteries of Téviec and Hoëdic', *Journal of Anthropological Archaeology* 20 (2001): 314–44.

**Keywords:** archaeogenetics, stable isotopes, hunter, gatherers, Late Mesolithic, Brittany France, Téviec, Hoëdic, sociocultural dynamics, Mesolithic, Neolithic transition

## Session: Cultural and regional identities (varia)



# Mesolithic-Neolithic transition in Southern France: can archaeological evidences attest a possibility of interaction between different human groups?

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The neolithisation process is a historical moment in the evolution of societies that results from multiple phenomena: displacement of pioneer groups, territorial expansions, cultural recompositions, but also interactions between local hunter-gatherer groups and incoming farmer populations. Following A. Gallay's work, at this pivotal moment it is possible to identify several types of human groups: hunter-gatherer groups in the strict sense; hunter-gatherer groups with Neolithic features showing transfer of know-how; conversely, agro-pastoral groups with Mesolithic reminiscences; agro-pastoral groups that at certain times and in certain places do not present characteristics usually encountered in Neolithic contexts (agricultural practices and animal husbandry); or groups whose activity is exclusively oriented towards agricultural practices. Archaeologically, it remains very difficult to perceive the multiple scenarios of interactions that may have occurred between Mesolithic and Neolithic societies. However, the study of some technical innovations and the transfer of know-how that may have taken place between several human groups is an effective tool for shedding light on the modalities of these interactions. To clarify these scenarios in the south of France, two study areas have been selected: the lower Rhône valley, notably with the Montclus rock shelter, and the southern margins of the Massif Central, notably with Combe-Grèze and Roquemissou. These two areas, on the periphery of the Mediterranean coastline which records the first Neolithic impacts corresponding to pioneer colonisations, seem to be privileged places where it is possible to highlight the existence of contacts during the middle of the 6th millennium BCE. The analysis of the lithic industries, of both the last hunter-gatherers and the first farmers, will constitute the privileged observation prism of this possible transfer of know-how. Thus, on the basis of these scarce data, we can formulate different hypotheses: technical innovations of the hunter-gatherers have been reemployed by Neolithic hunters ; they could also have been Neolithic sites used for specific functions, there also could have been cultural recompositions. These different local scenarios may be enriching ways of understanding globally the neolithisation process.

**Keywords:** Neolithisation process, lithic industries, transfert of know, how, cultural interactions,

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# Filling the gap: Evidence from Dvoynaya Cave on the Pleistocene-Holocene boundary in the North Caucasus

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Evidence on the human occupation during the Younger Dryas remains scarce both in the South and in the North Caucasus. The number of stratified sites with layers radiocarbon dated to the Pleistocene/Holocene boundary and the initial Holocene being extremely small, this lead to the idea of the Northwest Caucasus depopulation during the mentioned periods (Golovanova et al, 2012; Golovanova, 2016). The existing chrono-cultural schemes based on the materials from Mezmayaskaya Cave and the Badynoko Rockshelter suggest that the geometric microliths - predominantly backed lunates - gradually became widespread in the region around 15-13 cal kyr BC (Golovanova et al., 2012; Seletsky et al., 2017), with the pressure technique emerging synchronously (Seletsky, Shnaider, 2018; Nedomolkin, 2019), several millennia earlier than in the Near East.

An entirely different picture emerges due to the analyses of Dvoynaya Cave materials (Leonova, Aleksandrova, 2012; Leonova, 2014; Alexandrova, Leonova, 2017). The site, located in the Gubs Gorge in the foothills of the northern slopes of the Western Caucasus, produced a stratigraphic sequence with three layers ranging in dates from the Upper Paleolithic to the Late Mesolithic and locally divided by horizons of small rock debris. A tool-kit dominated by the backed lunates and notched blades is characteristic of the second ‘Early Mesolithic’ layer, the lunates being concentrated at the bottom of the layer. The dates from the lower part of the second layer are within the interval of 12.1–9.2 cal BC. We tend to see the occurrence of two lunates in the underlying Upper Paleolithic layer as a minor contamination, not as evidence on the genesis of a new tradition. Lithic technology of the second layer is characterized by the strictly unidirectional debitage aimed at the production of narrow blades and bladelets, with probable usage of indirect percussion. There is no evidence of pressure technique use in the second or in the underlying third Upper Paleolithic layer. It is only in the uppermost first cultural layer, tentatively dated to 8.8–7.1 cal BC, that evidence of pressure blade making (Mode 3) is found.

No roots of the lithic technology characteristic of the occupational episode dated to the Pleistocene-Holocene boundary could be found in the local Upper Paleolithic. On the other hand, the pre-dominance of a specific armature type - the backed lunates - might point at a possible connection

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with the synchronous cultural units: the ‘Caspian’ Mesolithic in the southeast of the Caspian Sea and the Late Natufian in the Near East.

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**Keywords:** Caucasus, the Younger Dryas, Mesolithic, lithic technology, geometric microliths, lunates, pressure

# Hunters in transition through the Pleistocene-Holocene boundary: a historical view from northern Iberia.

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Cantabrian Spain, in the north of the Iberian Peninsula, is a key region for studying the late Palaeolithic and Mesolithic in Europe. The importance of the cultural manifestations that have been conserved and the intensity of research during over a century favour such studies. Cantabrian Spain has repeatedly been considered a valid unit of analysis for the study of the last hunter-gatherer societies. However, advancement in research makes us beware of raising ‘frontiers’ and advocates approaches that take into consideration the circulation of people, objects and ideas across different natural areas. This communication analyses the historical process that led, in about 8000 cal BC, to the start of a new era, clearly distinct from the late Palaeolithic. Environmental changes and their influence on the cultural transformations identified in the Pleistocene-Holocene transition will be assessed, paying special attention to the population patterns, subsistence, technology and symbolic expression.

**Keywords:** North Iberia, Late Palaeolithic, Mesolithic, Transition

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# Investigating the Early to Late Mesolithic transition in North-Eastern Italy: a multifaceted regional perspective

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The Early to Late Mesolithic transition represents the main large scale cultural event occurred at the times of last European hunter-gatherer-fishers, although not necessarily homogeneous from the point of view of its origin and diffusion. Such transition was recognized since the earliest researches on the Mesolithic and was identified through changes recorded by lithic assemblages. Still it continues to be almost exclusively discussed on the base of the lithic evidence although in the last years a wider techno-economical perspective has been adopted.

This paper does not seek to identify the origins of this transition but to focus on its effects and in particular on the dynamics and features describing its development on a regional perspective. In order to investigate the underlying phenomena of this technological transition the main archaeologically visible shifts in the daily life of hunter-gatherer-fisher groups were monitored, as well as the relations between them and the change pace (i.e. gradual vs. abrupt).

Our work explores the evidence from North-Eastern Italy, where Early and Late Mesolithic are represented by the Sauveterrian and Castelnovian cultural facies. This area represents one of the European regions with the richest Mesolithic record, despite the limits imposed by the still small number of available radiocarbon dates. In the absence of any genetic record this issue is tackled from a wide archaeological perspective by discussing different orders of data: technological (implications related to the adoption of the new knapping techniques in the Late Mesolithic, raw materials requirements and itineraries related to provisioning), economical (especially in relation to subsistence strategies), territorial (settlement patterns and organization of mobility), social and ritual (evidence of stability versus shifts in the social organization of human groups and their symbolic world).

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**Keywords:** northeastern Italy, Sauveterrian, Castelnovian, technology, settlement patterns, mobility, social organization

# ‘Bearers of civilization’ or ‘useful idiots’. The southern Baltic coast Mesolithic and its relation with the Neolithic. The case from Dabki, Poland.

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The Mesolithic occupation of Polish territory during the second half of 6th and 5th millennium BC, i.e. during the time of the first appearance and further development of the Early Neolithic Danubian societies, was intensive and diversified. The Mesolithic groups primarily inhabited the areas most suitable for hunter-gatherer-fisher style of life, environments which were rarely interesting for the early farmers. The southern Baltic coastal territories (nowadays called northern Pomerania), with its rich marine and terrestrial environs, witnessed the appearance of the most advanced foraging societies that ever inhabited Polish territories. A unique example of these types of groups is an aggregation of sites on Dabki Island. Twenty years of archaeological research provide evidence of a developed economy that was based on the diversified exploitation of fresh-water (also, occasional marine) and terrestrial resources. The people at Dabki maintained long-lasting relationships with Neolithic groups that approached this area from the south. The nature of these interactions as well as the potential implications for the development of some Neolithic societies is discussed in this paper.

**Keywords:** Late Mesolithic, Early Neolithic, transition, exchange

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# Late Mesolithic or Early Neolithic: was there the "Neolithic hiatus" in the North Caucasus?

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The excavations of two sites the Chygai Rockshelter and the Dvoinaya Cave produced the long Late Pleistocene and Early Holocene archaeological sequence allowing us to follow the cultural and environmental changes that took place in the North-Western Caucasus. (Leonova, 2014). The sequence of the Chygai Rockshelter consists of 14 layers: 10-14 were attributed to Late Palaeolithic, 9-3 - to Mesolithic, and the uppermost (1-2) – to Chalcolithic. The upper Mesolithic layers (3-5) yielded fireplace, *Helix* middens, animal bones and lithic artefacts. The lithic assemblage is very poor and consists of a few cores, microblades and blades, one burin, two trapezoids (transverse arrowheads) and two parallelograms (bladelet truncated obliquely at both ends). The sequence of the Dvoinaya Cave was subdivided into three cultural layers: Upper Palaeolithic (layer 7); Early Mesolithic (layer 6) and Late Mesolithic (layer 4/5). The last ones yielded *Helix* middens, animal bones and chipped flint. The stone artifacts represent cores, microblades and blades, end-scraper, burins, oblique truncated points and series of the high (narrow) trapezes (transverse arrowhead), including the "horned" ones. Underlying Layer 6 yielded several fireplaces, the *Helix* spp. mollusk shells and lithic artefacts, among which are mainly lunates and notched bladelets. Several radiocarbon dates allow to estimate the age of the layers with *Helix* middens, geometric microliths and evidence of pressure flaking technic. We have no radiocarbon date for the layer 3 of the Chygai Rockshelter. Four dates of the underlying levels 4-5 are between 9,5 – 10,5 k.y.a. (8,6-8,9 ; 9,5-10,1; 10,5 and 11 k. y. cal BC). Three dates of the layer 6 of the Dvoinaya Cave are between to 11,8-8,9 k.y.a. (11,7; 10,2-9,7; 8,3-8,1k.y. cal BC). Three more radiocarbon dates were obtained from the test pit of central part of Dvoinaya Cave: 8,3; 8,8; 10,2 k.y.a. (accordingly 7,3; 7,8-8,0; 9,9 k.y. cal BC). The first two dates are from the upper layer 3 and the last one can probably be associated with the layer 4/5. Similar sequences were followed in Central and South Caucasus and Crimea sites (Biadgi, 2016; Chataigner, et al., 2014; Zamyatnin, Akritas, 1957).

The phenomenon of "Neolithic hiatus" in the North Caucasus stays unsolved until now (Trifonov, 2009). There are only four Neolithic sites separated from each other at a great distance: Kamennomostskaya and Mezmayaskaya Caves (North-West Caucasus), Cmi (Central Caucasus) and Chokh (East Caucasus) (Amirkhanov, 1987; Formozov, 1971; Rostunov et al., 2009). The main Neolithic feature of these materials is the presence of pottery fragments. Domesticated species were identified in the fauna material from Neolithic layers of Kamennomostskaya Cave and Chokh, and the last one providing evidence for cereals cultivation. But both Neolithic layers of these sites are overlain the Chalcolithic or Bronze Age occupations. Only Mezmayaskaya Cave

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and Cmi have radiocarbon dates: three dates between 8,7-6,5 k.y.a. (8000-4200 cal BC) for Mezmay and six dates between 7,0-6,9 k.y.a. (6000-5700 cal BC) for Cmi. But on the one hand, the presence or the absence of pottery can't be essential condition because we know aceramic Neolithic. The domestication is not necessary as an economic, not archaeological, feature on the other hand. The same group of populations can have a different lifestyle depending on the environment (plain, foothills, mountains). Only chronology combined with specific lithic assemblage features could serve as universal indicator of the involvement in the Neolithic world. The main common features of lithic industries on wide territories including North and South Caucasus, Crimea, Central Asia is the emergence of pressure technique and high/short trapezoids (transverse arrowheads). The above features appeared at about 8,5-10 k. cal BC in NW Caucasus. We can trace the development and transformation of the trapezoidal transverse arrowhead type in Neolithic industries with complete "package" including pottery and domestication.

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**Keywords:** Late Mesolithic, Early Neolithic, Mesolithic – Neolithic transition, North Caucasus, trapezoid transverse arrowhead, pressure technique, Chygai Rockshelter, Dvoinaya Cave

# Stone tools production from the Mesolithic levels of Grotta del Romito (Calabria, Italy): new insights on the Sauveterrian of Southern Italy

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Grotta del Romito (Cosenza, Calabria) is located at the southern margin of Pollino National Park, in the inner region of the Low-Tyrrhenian side of Italy. During the recent archaeological researches carried out by the University of Florence, new excavations performed in the rock-shelter area, brought to light a pre-Neolithic sequence which attests a human frequentation during the Early Holocene. The stratigraphic succession consists of several Early Mesolithic levels overlaying an Upper Palaeolithic (Late Epigravettian) deposit. Mesolithic stone assemblages show "typical" Sauveterrian techno-typological features; some elements seem to be rooted in the local Late Epigravettian tradition.

At Romito the uninterrupted sequence from Palaeolithic to Mesolithic, supported by several AMS radiocarbon dates (from  $\sim 13,3$  to  $\sim 11$  Ky cal. BP), allows us to follow the evolution of the chipped stone productions (tools typology, technical systems, raw materials procurement) at the Late Epigravettian-Sauveterrian transition.

New data from Romito provide new insights on both the emergence of Sauveterrian techno-complex in Southern Italy and the role, in its formational process, of the local Epigravettian tradition, also in order to reconsider the model of a North to South diffusion of Sauveterrian in Italy

**Keywords:** Early Mesolithic, Sauveterrian, stone tools assemblages, Southern Italy

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# The Time of the Last Hunters: Chronocultural Aspects of Early Holocene Societies in the Western Mediterranean

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In the Western Mediterranean Basin, the last hunter-gatherer societies fall within a chronological range between the 9th and 5th millennia BCE, that is, between the climatic oscillation of the recent Dryas and the expansion of the first Neolithic societies. The variability of cultural expressions is very high, as shown by the variability of the lithic industries, a technical field which, from a historiographical point of view, is the preferred approach of archaeologists to address these issues. However, convergences in technical choices or typological features show the existence of major currents of diffusion and exchange between many of these Mesolithic groups, which are still too often imagined as small family units shut away in their clearings. The appearance of pressure flaking, for example, is a symptomatic feature. This technical innovation appeared somewhere in the eastern part of the western Mediterranean basin in the middle of the 7th millennium BCE and then spread very rapidly. Combined with other elements of the technical system, this diffusion suggests a possible displacement of populations from North Africa to Europe, independently of the climate changes at work during this period. This model implies mastery of navigation, rapid long-distance travel, numerous interactions between distant human groups, knowledge of common languages, etc. The discussion of such hypotheses implies to know precisely which human groups are present at the time of this diffusion and what are the detailed characteristics of their material productions. The precise chronological positioning of the sites and cultural groups involved in all the evolutionary dynamics and cultural exchanges of the early Holocene in the western Mediterranean and the very definition of these cultural groups are then indispensable preambles to any discourse or modelling. However, these two questions, chronological and cultural, are too often treated in a not very rigorous way or are the subject of too many neglect and accommodations with the reality of the data, especially chronological ones, all the more for this period of the Early Holocene when the absolute dating methods used are not very precise. This paper reports on work aimed at improving our knowledge of these issues, to better identify the time of the last hunters in the western Mediterranean, and to discuss the nature of the variability of lithic production.

**Keywords:** chronology, lithic industries, radiocarbon, bayesian modeling, Mediterranean, cultural

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# Transitions in Mesolithic Societies of Baltic Scandinavia

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Mesolithic societies of Scandinavia and the Baltic has been viewed upon as dull and static characterized by cultural continuity and only slow gradual changes - until the neolithisation. In this paper we oppose this perspective by presenting recent research that account of several major cultural transitions in Mesolithic Scandinavia. The transitions that we will address, derive from analysis of genetic and proteomic data and archaeological materials, i.e., lithic technology and bone point typology, and consider human migrations from western Russia into Fennoscandia and subsequently southern Scandinavia during the 9-8th mill. BC. Further, we argue for a decrease in human population during the onset of the 8th mill. BC in regions of southern Scandinavia and northern Europe, that are linked to regional climatic and environmental factors, i.e., low precipitation, drying out lake-systems and forest fires,. The introduction of the trapeze horizon c. 6800 BC, concern another transition that is most likely connected with pan-European Mesolithic influence, and finally do the introduction of ceramic technology c. 5000 BC from eastern Baltic Mesolithic societies mark a technological transition with economic perspectives. Our point is that these transitions evidence trans-regional communication within Mesolithic societies of northern and eastern Europe, meaning that the contact and the communication with Neolithic societies, and the ongoing neolithisation process of western Europe was, limited until c. 4000 BC, when the first farmers made their way into Scandinavia.

**Keywords:** human migration, genetics, proteomics, lithic technology, trapeze horizon, ceramics, climate

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**Topic: Animal and Plant Resources**

# Multidisciplinary approaches to the uses of plants as food, medicine and raw material by Mesolithic communities

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Either for food or as a raw material, plants were probably the most important resource for past hunter-gatherer communities in the temperate regions of the globe. Therefore, the investigation of human-plant relationships is necessary in order to understand the economic and social organization of past societies. The management of this resource and the applied processing techniques can be carried out in a variety of ways and scales, which have important social and economic implications. Whilst plant macroremains are generally better-preserved in anaerobic deposits, notably waterlogged/submerged localities, a suite of techniques now enables us to identify otherwise invisible remains. All together, molecular and isotopic techniques, analysis of phytolith, use-wear analysis of tools and archaeobotany, allow us to investigate the past use of plants, including nuts, berries and seeds, wood, underground storage organs (USOs), as well as fungi. It would be interesting to compare what different remains show about the use of plants and assess how these methodologies complement each other. Under this framework, several approaches might be relevant, from archaeobotany to ethnobotany, including experimental work. Methodological papers dealing with the recovery of wild plant remains or their interpretation are equally suitable for the session. It is likewise of interest to discuss the use of plants in different types of environments and to try to identify and define patterns and the relevant socio-economic and environmental variables affecting them.

**Keywords:** plant management, plant as raw material, plant, foods, archaeobotany, isotopic technics, phytoliths

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# Beyond the nutshell: diet, cooking and cuisine in the Mesolithic

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Approaches to the study of Mesolithic foodways and foodscapes have rapidly advanced in recent years. Enriched by a wide range of scientific investigations, increasingly integrated, recent research is demonstrating the varied ways Holocene hunter-gatherer-fishers prepared, consumed and valued foods; from fermenting fish to the flavouring of broths with aromatic plants or the expression of dietary taboos and preferences. New avenues of research are beginning to directly explore the symbolism, preferences and meaning that food held across different Mesolithic societies shifting an agenda traditionally focused on modes of procurement and measuring calories. Rethinking food as a cultural expression rather than a natural resource offers new interpretative perspectives often on data already collected. Food is closely linked with identity, power and politics but what evidence do we have to link consumption to the individual in Mesolithic society? Social aggregation and feasting are frequently observed in accounts of hunter-gatherer-fishers but what evidence is there of this in the European Mesolithic? How were novel, exotic or traditional foods valued in the Mesolithic? What are the major technological or cultural transitions in the ways that food was prepared and eaten? How is the ‘foodscape’ linked to mobility and territoriality? With these questions in mind, this session calls for contributions that take Mesolithic food studies to the next level.

**Keywords:** Ancient diet, Hunter, Gatherer, Mesolithic, Europe, Food processing

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# Living on the coast: maritime hunter-fisher-gatherers, shell middens and the use of marine resources in Mesolithic Europe

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One of the main characteristics of the Mesolithic in Europe is the occupation of coastal locations. The abundance of coastal sites in the Atlantic and Mediterranean regions shows clear evidence of the importance of these areas for human settlement and the significance of coastal resources in subsistence strategies. Understanding themes such as: environmental and climatic conditions, the process of formation and erosion of shell middens, settlement patterns and mobility, symbolic activities, as well as the role played by marine resources (molluscs, fish, crustaceans, echinoderms...), are key to gaining a better knowledge on the occupation of the coast by the last hunter-fisher-gatherer societies. These topics can be approached from a wide range of theoretical and methodological points of view, which promotes the enrichment of discussion and debates. The session is intended to gather together presentations on maritime hunter-fisher-gatherers and shell middens (e.g. chronology, micromorphology, macro and micro-spatial analysis...), in addition to multidisciplinary research from a range of methodological perspectives (archaeomallacology, ichthyoarchaeology, geochemistry, use-wear analysis...). All geographical locations and chronological frameworks within Mesolithic Europe will be considered. In summary, this session aims to bring together a wide variety of scholars to discuss the role of maritime hunter-fisher-gatherers, shell middens and marine resources in Mesolithic Europe. It will provide a forum for discussion of different approaches to understanding human use of coastal areas and resources.

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**Keywords:** shell midden, marine molluscs, crustaceans, fish, echinoderms, marine mammals, coast

# Striving for affluence - Active resource management and natural storage in hunter-gatherer societies

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The severe environmental changes in the Early Holocene resulted in an ever-changing landscape of resources and differentiation of habitats. New resources like hazelnuts became a common element while others such as elk emigrated from previously occupied areas. Such changes must have had severe impact on Mesolithic hunter-gatherer-fishers, leading to adjustments of lifeway, seasonal strategies and also social relations. A specific field concerns seasonally abundant resources that reliably recur every year, which can be regarded as "natural storage" to be counted on by the human groups in their yearly cycle. Ethnographic evidence provides abundant information on strategies incorporating and also managing such "naturally stored" resources by hunter-gatherer-fishers. However, within the archaeological record, available data is scarce, and seasonality information is only preserved under specific conditions.

In this session we want to discuss the relevance of seasonally available resources, the strategies to exploit these naturally stored provisions, and the impact their incorporation into the subsistence system has on life ways, mobility patterns and also social systems, addressing various questions:

- What was the role of seasonally available resources such as migratory fish and birds, fish accumulation in specific water bodies in winter, mammals with seasonally varying behaviour and nutrition status, plant resources such as nuts and berries?
- Were such resources actively managed, and if so, how? Did niche construction strategies (e.g., forest management, directing fish flows, hunting strategies impacting on herd structure, etc.) play a role?
- How did seasonally abundant reliable resources and their exploitation impact on settlement systems and mobility, and can they be connected to increasing sedentism?
- What are the societal implications when creating and using long term and large scale storage (e.g., increasing territoriality and intragroup conflict, accumulation leading to aggrandization of individuals, feasting as prestige and as a levelling mechanism, cooperative and communal solutions)?

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- Which impact can such mechanisms and strategies leave in the archaeological record, which method can be used to identify them, and which models can help to understand the underlying economic and social mechanisms?

To address and discuss these questions, we invite archaeological as well as ethnoarchaeological studies that provide approaches to trace storage and resource management in hunter-gatherer-fisher societies and that also reveal pitfalls and scrutinies of our interpretations of the past.

**Keywords:** Hunter gatherer fishers, Mesolithic, seasonal resources, natural storage, active management, storage technologies, societal implications

# From animals to osseous remains: recent advances in the study of human-animal relationships in the Mesolithic

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In Mesolithic archaeology the relationships between groups of hunter-gatherers and animal populations are mainly described by the study of osseous remains. According to whether the assemblages mainly reflect hunting, butchering or crafting activities, these studies are often conducted by zooarchaeological and technological specialists.

The tools with which questions have recently been addressed are becoming more and more precise, but also diverse (e.g. experimental archaeology, isotope analysis, ZooMS, dental microwear analysis, aDNA analysis, use-wear analysis, ethology, etc.). However, although numerous links between these different studies exist, systematic studies of a global approach towards animal exploitation have only rarely been presented for the Mesolithic. Such studies cover the entire operational system from the living animal through to the final discard of its remains.

The need to fill this research gap is reinforced by the fact that the suite of animals changed at the Pleistocene/Holocene border and with them we see an adaptation of their role for the life of hunter-gatherers during the early-mid Holocene. Not only a redistribution of animals took place but moreover we see alterations of biotopes. Within this framework, and for societies based on hunting, animals are at the crossroads of dietary, technical and symbolic systems. Thus, environmental changes necessarily had a huge impact on socio-economic structures.

Consequently, the study of human-animal relations must be considered on multiple axes in order to reflect the numerous implications that animals had on past human societies. The application of global approaches to human-animal interactions can be fulfilled by multi- and transdisciplinary approaches that are – in particular – based on sites with multiple high-resolution datasets as regularly offered by excavations of Mesolithic sites.

We therefore welcome zooarchaeologists, technologists, and natural scientists to contribute to

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our session. Contributions involving innovative methodological approaches and joint studies are particularly welcome. The overarching aim of this session will be to present regional syntheses of the global approach to animal exploitation during the Mesolithic in Europe.

**Keywords:** human, animal relationships, zooarchaeology, osseous technology, global approach

Session: From animals to osseous  
remains: recent advances in the  
study of human-animal relationships  
in the Mesolithic



# Understanding European Mesolithic dog domestication

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Dogs are the earliest domesticated species globally, and as such, occupy a unique position in the archaeological record, domestication studies, and evolutionary genomics. Our understanding of early dog populations is still limited, and we have little understanding particularly of whether European dogs were independently domesticated, as well as their phenotypic characteristics (i.e. what early dogs may have looked like), or of human-dog interactions. Here we present the first results from a new project focused on European Mesolithic dogs, which utilises ancient DNA analysis to help to answer questions surrounding the evolution and origins of the European domestic dog. By combining genetic data with archaeological information, our aim is to gain a deeper understanding of population differentiation, domestication processes, Mesolithic population movements and diversity. The project also allows for a broader consideration of human-animal interactions and engagements in early prehistory, particularly when set within a social zooarchaeological framework.

**Keywords:** Dogs, domestication, human, animal relationships, Europe

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# Heads They Lose: investigating the modification of animal skulls in the British Early Mesolithic

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In this presentation we will explore the role of modified animal skulls in the Mesolithic of Britain. Best known of these are the antler frontlets from Star Carr, described by Grahame Clark as anthropologically modified red deer skull caps, with perforated parietals and truncated antlers. The trimming of the antlers has been noted to mimic the appearance of young, male deer, the main prey demographic (Conneller 2011). However, recent excavations at the site have revealed considerable variability in the animal skull material present at the site (Elliott et al 2018). There is a continuum from frontlets similar to those recovered by Clark, to unperforated frontlets, to skulls with only initial modification. The new material does not simply encompass male red deer skulls, but includes female red deer, and raises important questions concerning the strikingly similar form of several roe deer, elk, and auroch crania from the site. Modified animal skulls have also been reported from other sites in Britain, such as Thatcham II and III. We report here on the results of a new project which aims to investigate the technical process of skull modification and the role of modified animal skulls in the Mesolithic.

**Keywords:** Early Mesolithic, Britain, human, animal relations, material culture

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# Human bone points, ZooMS identifications from the Dutch North Sea

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Barbed osseous points originally deposited in Doggerland are regularly collected from the beaches of the Netherlands. Many of these barbed points ought to be of Mesolithic age based on their typology, and because of direct  $^{14}\text{C}$  dates of six of them. The bones transformed into barbed points are heavily modified during the manufacture process. The points themselves are also often modified again during use, re-sharpening and as a result of post-depositional processes. Hence, it is generally impossible to identify the species of the bone used to manufacture barbed points based on visual inspection. Here, we use mass spectrometry to taxonomically identify the barbed points. We present the ZooMS identifications,  $^{14}\text{C}$  ages and  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  measurements of nine barbed points from the Dutch shore.

Our results demonstrate that *Cervus elaphus* and/or *Alces alces* as well as *Homo sapiens* bones were regularly used for the production of barbed points. The uncalibrated ages of the barbed points range between 9.5 and 7.3 ka  $^{14}\text{C}$  BP. The *Cervus* / *Alces* bone points  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values fall within the range of values for herbivores recovered from the North Sea. The  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values for the human bones signal a freshwater diet and/or a terrestrial fauna diet.

Our study shows that objects conserved over time in a marine environment have sufficient levels of unmodified collagen preserved for mass spectrometry-based taxonomic identifications. Selection of the species of the bone used to manufacture bone points during the Mesolithic was likely not opportunistic, and seems to have involved strategic selection. The wide-scale application of ZooMS is a critical next step toward revealing the selection of species for bone-tool manufacture that are otherwise uncommon in the faunal assemblages. By highlighting the potentially regular transformation of human bones into barbed points – possibly used as weapons – our study suggests a complex manipulation of human remains in Doggerland during the Mesolithic.

**Keywords:** ZooMS, barbed points, Doggerland, North Sea, bone, point, human bone, stable isotopes

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# Macrofaunal remains from the Cuzoul de Gramat (Lot, France) during the Late Mesolithic: archaeozoological preliminary results

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The objective of this communication is to present the preliminary results of the archaeozoological study of the predominate large mammals (wild boar, red deer, roe deer and aurochs) exploited by the hunter-gatherers of the Cuzoul de Gramat during the Late Mesolithic period (between 6.000 and 5.200 cal BC). The pooling of data on carcass exploitation, acquisition strategies and the prey slaughtering season, combined with data from other archaeological records, allowed a first draft model of the site's occupation and function outlined. Comparisons with other relatively contemporary sites in the Quercy area, for which we have hypotheses of functionality and occupation season, have contributed to the development of a model of hunter-gatherer mobility for the Late Mesolithic. The archaeozoological study of the faunal remains from the Cuzoul de Gramat has been performed on three main sectors and some structures, though is incomplete as the quantity of remains to be treated is considerable. Therefore, the results presented are not fully representative of the hunting activities and the exploitation of animal resources. In order to meet the set objectives, two complementary methods of archaeozoological analysis were applied to bone and dental remains: the standard archaeozoology method and the dental cementum analysis. The first method considers all the bone and dental remains and searches for: determination to species and if not to an ungulate body size category, identification of the element and anatomical portion, lateralization, and age. Indeterminate remains are assigned to the type of bone tissue. Eruption ages and degree of tooth wear were used to attribute slaughter ages of game animals. When epiphyses were conserved, an age according to the degree of epiphysation supplemented the information obtained from the teeth. The classical quantitative units in archaeozoological study were used including the total number of remains, number of identified specimens taxonomically and anatomically (NISPt and NISPa), and the minimum number of elements and of individuals (MNE and MNI). In order to assess the impact of biological agents consequences (carnivorous and anthropogenic) and post-depositional processes on the composition and state of conservation of the faunal deposit, the origin and type of breakage as well as the surface modifications of the bones and their origin were investigated. The rate of chewing and ingestion by carnivores was compared to the quantity of fragments with butchery traces (striae and percussion impact). The burnt bones were classified according

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to their heating color. To infer the seasons of death of the hunted prey and, more broadly, the times of occupation of the Cuzoul de Gramat during the Late Mesolithic, the teeth of wild boar, red deer and roe deer were used. Seasonal information from eruption dates and degree of occlusal wear surfaces of the teeth is accurate for the youngest cervids due to a single, short yearly birthing period. However, this method is not sufficient for wild boar because of the spread of births throughout the year and the possibility of two annual litters. Being dominant in the diet of the Late Mesolithic hunter-gatherers of the Cuzoul de Gramat, it seemed appropriate to view the question of the seasonality of hunting of wild boar and adults individuals through the prism of cementum analysis. All of the teeth from the Late Mesolithic stratigraphic layers were selected from all sectors. A dental MNI (MNId) was applied based on the eruption sequence and the degree of occlusal wear surfaces of the teeth. Only adult individuals were considered, as the greater accumulation of cementum increment made them easier to observe. One tooth per individual was selected depending upon the state of preservation of the roots. The teeth roots that were fragmented or showed traces of heating, dissolution, root marks, cracking, digestion, manganese, pathologies, or marking references on all the roots were not considered since these alterations may strongly degrade the conservation of the cementum bands. Thus, the corpus comprises twenty-eight premolars and molars, corresponding to eleven individuals for wild boar, ten for red deer and seven for roe deer. Forty-one slides were taken from this sample and sixty-four Regions of Interest were analyzed.

**Keywords:** Archaeozoology, Late Mesolithic, Quercy, Cementum analysis, Model of hunter gatherer mobility

# Contribution of archaeozoology to the characterization of the mobility systems of the latest nomadic societies: a combined approach of classical archaeozoological methods, cementum increment analysis and three-dimensional dental microwear texture analysis

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The question of forms of mobility is central to understanding the lifestyles of prehistoric societies (economic behavior, subsistence strategies, cultural and social complexity or the intergroup relationships of hunter-gatherers, adaptation to their environment, etc) and contributes to the possibility of reaching a micro-regional scale of socio-economic systems. The characterization of these forms of mobility is most often based on the ethnographic models of L. R. Binford (1980), which oppose two theoretical extremes within the same continuum, the logistical mobility (i.e. collectors) and the residential mobility (i.e. foragers). Both models postulate that relocation dynamics are partly related to the distribution and seasonal and spatial accessibility of resources. Specific archaeological signatures are supposed to differentiate them and thus allow the identification of these rhythms of movements and the types of sites occupied. In prehistoric archaeology, territorial movements and their rhythms can be perceived through different remains providing data on the seasonal acquisition of certain resources. For wildlife, the occupation season of sites is inferred from the bone remains that provide information about the seasons of acquisition and slaughter of the hunted prey. The function and duration of occupation are established through a multidisciplinary approach combining archaeozoological data and other archaeological proxies. For the Mesolithic in France, little work has addressed the issue of hunter-gatherer mobility. Based on this observation, my thesis project proposes to complete these works by developing a diachronic and micro-regional approach on the scale of the Quercy Causses and its margins. The high density of deposits, which are generally well documented, particularly through recent excavations, provides a reliable radiochronological framework. The environment is characterized by a strong geographical compartmentalization, which may have favored a compartmentalization of human groups undoubtedly accentuated over time by the densification of the forest cover

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leading to the installation of the large primary forest. The Quercy Causses are an excellent field of investigation to document the exploitation of the territories by the Mesolithic. The objective is then to develop one or more mobility models by following an inductive approach, on both a spatial and temporal scale of analysis. Considering the entire period opens up the possibility to question at a certain level the causes of changes if they are proven. Parameters related to the environment and culture could therefore be tested including: Did the gradual increase in forest cover influence forms of mobility? Are these changes synchronous with the changes recorded in material cultures, especially during the passage between the Early and Late Mesolithic periods? Finally, an extra-regional comparison based on the same methods, questioning the possible forms of mobility, will be carried out from three sites along the Breton coastline. This comparison will only be applied for the Late Mesolithic and will question the relationship between human groups and their environment as well as the seasonal complementarity of land and marine resources, which are abundant throughout the year.

Three complementary archaeozoology methods will be applied including: classical archaeozoology methods, cementochronology analysis and dental microwear analysis. The first method considers all bone and dental remains. It allows us to question the origin of the accumulation of remains, hunting strategies and the exploitation of carcasses. In addition, it provides data on the seasonality and duration of sites occupation, particularly from dental remains. Seasonal information from eruption dates and degree of occlusal wear surfaces of the teeth is accurate for the youngest cervids due to a single, short birthing time during the year. However, for adult cervids, aurochs and wild boar, this method is not efficient because 1) it implies invariance in time and space of the eruption and wear processes of the teeth; 2) it is not precise enough for adult individuals; 3) aurochs is an extinct species; 4) the spread of births over the year and the possibility of two annual litters for wild boar makes its use irrelevant. Therefore, it seems appropriate to view the question of season of hunting through the prism of dental cementum analysis. This method is based on the study of microscopic marks of seasonal and regular growth included in the thickness of the acellular cementum covering the first third of the dental roots. Correlated to seasonal variations, they appear as two distinct alternating bands: a fast growth deposit called "Zone" referring to the time of year from mid-spring to autumn and a slow growth deposit called "Annulus" referring to wintertime. The identification of the nature of the last deposit and the evaluation of its relative thickness compared to other bands of the same nature allows the estimation of the animal's death season. Moreover, this method is also effective in specifying animal acquisition strategies since it specifies the slaughter ages of the prey. Since a pair of bands (a zone and an annulus) represents a year, counting the pairs of bands plus the age of root formation makes it possible to assign an age to the death of the animal. These cementochronology studies will be supplemented by the three-dimensional dental microwear texture analysis (3D-DMTA) to answer the question of duration of sites occupation. This method aims to quantify the microscopic wear characteristics observed on enamel wear facets on occlusal surfaces of teeth. The microscopic features result from a combination of attrition (tooth to tooth contacts), abrasion (tooth to food contacts, including exogenous particles that stick to food) and erosion (from acidic food). Microwear surfaces therefore reflect the mechanical properties of ingested foods as well as chewing dynamics and tooth morphology (on the microscopic and macroscopic scales). Their recording is continuous and renewed at each "feeding event" leading to the observation of the "Last Supper" since the exogenous and endogenous abrasive particles of the chewed elements continuously erase the old microtraces of the previous meal. The information about the diet and local and seasonal environmental conditions of the last days (or weeks) of the animal's life is therefore available. Its application in archaeology has been tested by studies, particularly in the search for the duration of site occupation, considering that a significant variation in dental microwear signals can signify long or repeated occupation at different periods of the year. On the other hand, a small variation seems to define short and/or seasonal occupation. Finally, due to frequent turnover of dental microwear and as most animals show

significant seasonal variations in their diet, the season of death of the animal may be recorded. Therefore, this method has great potential for reconstructing the season of site occupation. These three methods will be applied in Quercy on all the reliable sites that have yielded faunal remains, a total of 6 deposits representing 32 stratigraphic levels covering the entire Mesolithic sequence. Also in Brittany, where 3 sites attributed to the Late Mesolithic will be summoned.

**Keywords:** Archaeozoology methods, Cementochronology analysis, Three dimensional dental microwear texture analysis, Mesolithic, Quercy, Brittany



# The last hunter-gatherers of the Swiss plateau. Zooarchaeological approach of the Mesolithic rock shelter Arconciel/La Souche (Fribourg, Switzerland)

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The rock shelter of La Souche (Arconciel, Fribourg Canton, Switzerland), excavated between 2003 and 2012, yielded an exceptional quantity of bone material. Five very well preserved archaeological levels offer the possibility of reconstructing many aspects of the occupation of the site and the exploitation of fauna and the evolution of behaviour between 7200 and 4800 BC. The unpublished results of the archaeozoological study shed new light on the populations of the Swiss Plateau during the Second Mesolithic period. At the end of this period, a large part of Central Europe adopted the Neolithic way of life, with the exception of a vast pocket of resistance between the Jura, the Italian Pre-Alps and Lake Constance. Situated in the heart of this area, the Arconciel/La Souche site is a formidable witness to the way of life of the last hunter-gatherers. The study of more than 400,000 faunal remains, highly fragmented but very well preserved, has enabled us, among other things, to analyse in all its dimensions the acquisition and use of animal resources. From the choice of the species hunted to the destiny of the bone remains after consumption and all of the stages of the transformation of animal carcasses, we can follow the evolution of the way of life of the inhabitants of this rock shelter during the First and Second Mesolithic. The red deer is by far the main resource exploited. Wild boar and roe deer significantly complement the meat supply. A wide variety of small fur-bearing mammals also play an important role. Each occupation phase is systematically concluded by an intense combustion phase.

**Keywords:** Zooarchaeology, Switzerland, Second Mesolithic, Neolithization

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\*Speaker

# The pressure flaking retouchers in the hunter-gatherer North Eurasian archaeology and the Inuit ethnography

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The remarkable group of tools was detected among the hunter-gatherer-fishers' archaeological materials of the Russian Plain central part dated 3500–2700 BC. The so-called 'crooked items' were initially interpreted as ritual phallic depictions, but now after conducting the more detailed analysis of their morphology, technology and use-wear, there is no doubt that we deal with retouchers, used to perform the pressure flaking of flint. The most astonishing fact is that the straight parallel to these retouchers exists, coming from the opposite side of the globe, namely the Bering Sea region – Kamchatka, Chukotka and Alaska, where the same tools are known both in archaeological and ethnographical collections.

Sixteen elk antler retouchers and one wooden were found at the hunter-gatherer-fishers' settlements of Central Russia and North Belarus. At least three retouchers made of ivory (walrus tusk) were found at the settlements and in burials of Kamchatka and Chukotka dated the 1st mill AD. A bunch of retouchers is known from the Inuit ethnographical collections. It is an outstanding example of the convergent invention, but hypothetically, the presence of similar, probably more 'profane' wooden retouchers, all over North Eurasia during the mid-Holocene can't be fully neglected. All pieces are carefully made, polished and usually have linear decoration at the handle. Fragmented items clearly witness the unintentional breakage, caused by the intensive pressure at the curve of the handle and lever junction, during the enhanced pressure flaking.

The elk antler and ivory were the most durable raw materials in forest and Arctic zones respectively. It seems, however, that the presence of wooden retoucher with use-wear traces, could point at the probable special meaning of at least elk antler retouchers, as in the Arctic zone the lack of appropriate wood caused the wider use of bone. The major lever form is tongue- or beak-shaped, but at six items from Central Russia is has the form of a sculptured swan (or sometimes, probably, goose) head. The special symbolic meaning of these tools, both with or without waterfowl head, is signified by some unusual finding contexts. They were deposited at the settlement zone either in the vicinity of burials (inside the so-called 'ritual hoards', broken and/or burnt), ore inside cultural layers, intact, painted by ochre, seemingly reflecting the high social role of the skilled flint-knapping specialists.

The morphological similarity of elk-head staffs and swan-head retouchers, both crooked and made of elk antler, recalls the special role of elk and swan/waterfowl in mythology and cosmology of indigenous North Eurasian peoples, connected with notions of creation, procreation, seasonal calendar and well-being. The cosmological aspect was probably expressed by the special retoucher swan-handle, as the tool itself was literally used to create a new flint item.

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\*Speaker

**Keywords:** hunter, gatherer, fishers, North Eurasia, Alaska, retoucher, ritual

# Mesolithic Jewelry at Skateholm: Local and Long-distance

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The excavations in a former lagoon at Skateholm, southernmost part of Sweden resulted in the find of two cemeteries dated to about 5000 BCE. In order to reach a better understanding of the movement of the inhabitants and their prey, analysis of strontium isotopes have been undertaken. A number of human teeth both from Skateholm I and Skateholm II have been analysed. They show a low variation among the interred. Most or all of them have had the same adolescent residence. The population shows no marked differences from the strontium isotope values of small animals from the Skateholm area. This indicates a generally stable settlement for several centuries in and around the lagoon. The analysis has now been extended to measure strontium isotopes in teeth from different animals - both the teeth from animals found in the refuse as well as teeth used as pendants or jewelry have been sampled. Most have a value similar to the humans. However, among the tooth pendant samples from red deer and elk significant differences in the strontium isotope values were found. On the contrary tooth pendants from the aurochs, that is not represented in the hunted remains of the settlements, provide local values. The society of hunter-gatherers in relation to game hunting as well as the existence of exchange networks will be discussed.

**Keywords:** social relation between humans and the prey, Late Mesolithic, Southern Scandinavia, animal tooth beads, strontium analyses

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# Zooarchaeological study of the Mesolithic site of El Collado (Oliva, Eastern Iberian Peninsula). Preliminary results and research perspectives

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Recent studies in the Iberian Mediterranean region show that postglacial adaptations were characterized by more diversified foraging strategies and the reduction of the exploitation of lagomorphs regarding the final Paleolithic. Diet broadening based on the diversification of ungulates' species and small prey has been consistently reported during the Mesolithic period. However, our current view on Mesolithic subsistence systems is overwhelmingly dependent on sites located tens to hundreds km away the Early Holocene Mediterranean coast. In this context, new research on faunal assemblages from coastal areas are required to (i) complete our current view about foraging strategies at regional scale, and (ii) study the impacts the post-glacial sea level rise on foraging adaptations.

In this paper, we present the preliminary results of an ongoing research project (CIDEAGENT/2018/040) focused on the faunal collections of the Mesolithic site of El Collado (Oliva, Valencia). This site, located 3 km away from the current coastline, contains an archaeological deposit with occupation evidences and a rich funerary record composed of 14 Mesolithic burials, (Aparicio 2008). Despite the interest of the site, no specific studies have been undertaken on the vertebrates' faunal assemblages. For the purposes of this work, we will focus on the analysis of a sample from the excavation units H1 and H2 that has been subject of a recent chronological revision (Fernández-López de Pablo 2016). The preliminary results show a rich and diverse taxonomic composition by ungulates (*Bos primigenius*, *Capra pyrenaica*, *Cervus elaphus* and *Sus scrofa*) and small prey (especially *Emydidae/Geoemydidae* and *Leporidae*). The taphonomic analysis mainly indicates anthropogenic accumulation and the anatomical profiles suggest the prey transport to the site for processing. The ongoing research in comparison with previous studies of littoral resources (Fernández-López de Pablo and Gabriel 2016) and human paleodiets (García Guixé et al. 2006) will open new perspectives for the knowledge of the occupation dynamics and economic strategies for the Mesolithic period in the Western Mediterranean.

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**Keywords:** Mesolithic, subsistence, open, air site, macrofaunal, Valencian Community, small prey

# Exploitation of osseous materials during the Mesolithic in the Iron Gates

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The Mesolithic settlements on the left bank of the Danube in the Iron Gates have yielded numerous artefacts made of osseous materials. Products and sub-products of the *chaîne opératoire* are present, suggesting *in situ* manufacture of the finished items. Among a restricted range of typological categories, the most characteristic are antler bevelled tools, bone pointed tools and boar tusk scrapers. Our research has focused on identifying both the manufacturing processes applied to the various raw materials and the marks left by use, which are key indicators of the function of the artefacts. The results of this combined approach suggest wood processing and hunting were the main activities performed. Contrary to some previous interpretations, there is no evidence for the use of osseous artefacts in connection with plant cultivation. We were also interested to know if a unitary technological scheme could be identified throughout the Iron Gates, or if there are features that were specific to individual sites or phases. Our findings suggest that despite a general unitary pattern, it is nevertheless possible to identify elements that are specific to individual sites but whether these were the result of economic or cultural factors is more difficult to assess.

**Keywords:** Iron Gates, manufacturing, function, regional and temporal variation

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# An update on the macromammal exploitation in the Cantabrian Spain during the Mesolithic (11.5 – 7.5 ky cal BP)

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The aim of this communication is to understand the subsistence strategies of the human groups that inhabited the Spanish Cantabrian Region during the Mesolithic by studying the macromammal faunal remains (11.5 – 7.5 Ky cal BP). For that purpose, we have studied several archaeological sites. In addition to this, we take into account the archaeozoological data available from published sites with radiocarbon information and faunal studies carried out by specialists. Thus, we will establish the prey ranking of the hunted species for Cantabrian Spain during the mentioned period, as well as the represented skeletal patterns and the energy supply each taxon would bring to the diet. Finally, we will point out the existence of intra-site changes and continuities in the faunal patterns of those sites that count with different levels associated with the same period. This information will allow us to point out some preliminary conclusions about the seasonal occupation of the Cantabrian Region during the Mesolithic regarding the seasonal hunting. Taking into account the biological, ecological and geographical conditioners of the macromammal species included in our study, we will use Digital Elevation Models (DEM) for establishing the faunal catchment areas of the human groups in the Past.

**Keywords:** Subsistence strategies, Mesolithic, Cantabrian Spain, Zooarchaeology, Macromammals.

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\*Speaker



# Tracing hide craft as human-animal relations in Stone Age Norway

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In hunter-gatherer anthropological research, animals are typically seen as food or alternatively serving as ‘food for thought’ for humans. When it comes to direct human-animal relational situations, the spotlight is put on the act of killing. The recent ‘animal turn’ in humanities and social sciences, and earlier ethnoecology and traditional knowledge accounts, however, suggest that ‘hunting’ construed as ‘killing for food’ provides a very limited view-angle into past hunter-gatherer realities. The growing debate in European Stone Age research as to how hunter-gatherer groups interacted and socially engaged with their environment provides an alternative, non-anthropocentric interpretation framework, suggesting that other-than-human beings should be seen as social actors with their own individuality, intentionality and consciousness. Understanding the potential of this turn to Mesolithic studies cannot be achieved without a broad understanding of ‘hunter-gatherers’, as socially and technologically diverse communities is necessary, depending among other things on a variety of products provided by wild animals, and engaging in them through a variety of actions other than killing.

In contrast to meat as food, which at least for shorter or longer periods could be replaced by other types of edible resources, northern hemisphere Stone Age hunter-gatherer societies did not have much alternatives to hide for clothes, sheltering and containing purposes. On the other hand, hide products are not very durable, and items and parts would have had to be replaced regularly. The broad use-spectrum, the lack of alternative materials and the constantly returning need for renewal places the material in a special position in northern prehistoric hunter-gatherer societies. In addition to these anthropocentric-based practical characteristics, one of the special properties inherent in hide and fur, more than for any other part of an animal, is how they provide to the experiences observer direct information about the animal from which the hide or fur has been obtained, sometimes down to an individual level. This paper uses archaeological data from Stone Age Norway to explore the potential of bringing hide and fur practices as expression of human-animal relations into broader narratives of Stone Age hunter-gatherer societies.

**Keywords:** hide processing, human, animal relations, north europe, coastal hunter gatherers, Norway

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\*Speaker

# Wild pig hunting in Mesolithic Ireland: investigating human-animal relationships

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This presentation will communicate the results from an investigation of Mesolithic human-animal relationships in Ireland, specifically the interactions between humans and *Sus scrofa* (wild pig). Wild pig were the dominant prey species for Irish Mesolithic hunter-gatherers, constituting 90% of mammalian bones in animal bone assemblages. Despite the prevalence of wild pig remains in the archaeological record, they have received relatively little research focus. This study implemented multi-isotope analysis on wild pig remains from five archaeological sites. Early Neolithic domestic pig remains were also analysed, in order to compare the relationship of hunter-gatherers with their prey to the relationship of farmers and domesticated species. Multiple approaches were used to investigate this relationship: multi-isotope analysis, faunal analysis and ethology. Multi-isotope analysis methods were used to explore different areas: carbon ( $\delta^{13}\text{C}$ ) and nitrogen ( $\delta^{15}\text{N}$ ) isotopes were analysed to determine the dietary structure of wild and domestic pig, whereas oxygen ( $\delta^{18}\text{O}$ ), strontium ( $^{87}\text{Sr}/^{86}\text{Sr}$ ) and sulphur ( $\delta^{34}\text{S}$ ) isotopes were analysed to assess their landscape mobility and origins. Wild pig ethology was used to provide a theoretical framework in which the isotope results could be interpreted, and traditional faunal analysis of these assemblages provided an archaeological background to the results.

This research has elucidated the dietary structure and mobility of wild pig, provided insights into Irish Mesolithic hunting strategies, and compared the patterns to early Neolithic domestic pig husbandry. Ultimately this research has moved beyond conceptualisations of wild pig as an economic resource, and considered their diets, behaviour, mobility, broader ecological niche and how this impacted hunter-gatherer communities.

**Keywords:** Mesolithic, Ireland, animals, isotope analysis, hunting

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# Deer hunting during the Mesolithic at Les Cabônes rockshelter (Jura, France): insights from dental remains

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The study of hunting practices is an important means of investigating prehistoric economic behaviour. Indeed, hunting provides an important part of the food and non-food resources such as skin, bone, sinew and antler which are used for daily activities. Since prey acquisition is intended to meet the needs of a group, its success depends largely on the effectiveness of projectile weapons, hunting tactics and decision-makings. Documenting prey choices and procurement patterns among foraging societies is thus an important step to understand subsistence strategies and mobility patterns in relation with resource abundance and seasonal availability.

Numerous studies have long shown that large and medium-sized game species such as red deer (*Cervus elaphus*), wild boar (*Sus scrofa scrofa*), roe deer (*Capreolus capreolus*) were systematically hunted in the inland regions of Europe during the Mesolithic period. Fewer studies, however, have examined the age structures of prey death assemblages. The present study aims to further research on mesolithic hunting in the Jura area, by analyzing age and season structures of a red and roe deer assemblage, as reflecting hunters' procurement decisions. The abundant archeofauna (ca. > 4500 NISP) from Les Cabônes (Ranchot, Jura), layer 3, offers the opportunity to conduct such a study: the red deer is one of the two main species along with the wild boar (Leduc et al., 2015), the roe deer being the third one in number of remains.

The site is located on the western margin of the Jura range, on the right bank of the Doubs River, at 216 m asl. Test excavations during the 1950s and 1960s were followed by large-scale excavations from 1978 to 1989, directed by A. Thévenin, M. Campy, S. David and C. Cupillard. Mesolithic occupations were identified in layer 3 which is 60 to 70 cm in thickness. Two red deer bones from this layer were radiocarbon dated between 8200 and 7500 cal BC -2 sigma (Drucker et al. 2011; unpublished data). Variation in the microlith spectrum from the base to the top of layer 3 indicates a formation process of this archaeological layer by repeated occupations.

Deer jaw remains were retrieved from the excavated surface of Layer 3. 223 lower teeth for the red deer, 37 lower teeth for the roe deer were suitable for age at death estimates. Dental ages were recorded based on a macroscopic analysis of the lower teeth, using published modern eruption and wear referentials and the osteological collection of the UMR 7041 zooarchaeology laboratory in Nanterre. They were then distributed into age classes, each 6 months wide.

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\*Speaker

Red and roe deer mortality profiles differ from the age structure of a living population because the proportion of prime adults is better represented. For red deer, seasonality indicators based on juveniles are distributed over most of the year, except between February and April, with a noticeable peak between September and December. All the red deer antler remains discarded at the site are shed antlers from adult animals, suggesting a harvest between February and July. Antlers brought onto the site were used as raw material as showed by cut and fracture marks observed. Conversely, the few roe deer antlers recovered in the faunal assemblage are all unshed, indicating hunting of male adults between August and November. No intentional marks are observed on these elements.

Inferences about hunting choices and site occupation pattern will be presented.

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**Keywords:** red deer, roe deer, dental age, mortality profile, season

# Pioneer the frontier. Red deer antler headdresses and the beginning of the Mesolithic in the Lowlands

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So-called antler headdresses, red deer skulls with antlers specifically modified by humans are a phenomenon typical of early Mesolithic sites in the northern European lowlands. In addition to clearly processed pieces with artificial perforations, antlers split lengthways and heavy processing of the surface, there are also pieces that have only one type of these modifications and others in which human processing is hardly verifiable. Although a comprehensive study of these so-called deer antler headdresses has so far not been carried out, the various artefacts are often discussed functionally depending on other findings from this group. We present here a synthetic study of corresponding objects from 10 sites and layers, among them finds from Star Carr, Friesack 4, and Bedburg-Königshoven.

Based on zooarchaeological assessment of the assemblages and possible headdresses, their technological description, and experimental work, we propose a polythetic headdress definition based on morphometric and technological features. Applying this definition allows for the identification of only a handful of artefacts from five sites that can well be distinguished from otherwise treated cranial deer bones (e.g. butchering waste (Wild 2014), so-called (bone or deer) ring-frontlets (David et al. 2016), or the a wide range of other antler frontlets (Elliott et al. 2018)).

As chronological data was lacking, we directly dated finds from Hohen Viecheln and Berlin-Biesdorf. Further direct and contextual dates for Bedburg-Königshoven and Star Carr allow for modelling the headdress chronology and identifies them as a short-termed earliest Mesolithic phenomenon that can be correlated with the spread of Mesolithic lifeways into lowland Northern Europe after the Preboreal Oscillation 1 (PBO1).

Ultimately the new data offers potential for re-investigating the functional interpretation of this group of artefacts and help to better understand existing models on human-red deer interactions during the Early Mesolithic.

**Keywords:** Preboreal, Technology, Rituals, northern Europe, Typology

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# Relict traditions: Techno-typological analysis, direct radiocarbon dating and protein mass spectrometry of biserial harpoons from Denmark suggest Palaeolithic traditions continued into the Holocene

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The transition from the Late Palaeolithic to the Early Mesolithic in Denmark, was marked not only by a shift in climate but also a change in material culture. The most common remains encountered on archaeological sites are flints, while organic materials dating to these periods are exceedingly rare, but not unknown. Of the organic artefacts assumed to belong to the Late Glacial Ahrensburgian period, a characteristic type are the biserial harpoon projectile points made from bone or antler. Through chrono-typological comparison with finds in more southern areas, they are thought to be of Late Glacial age. However, this hypothesis remains untested. We, therefore, carried out a series of analyses on five such artefacts from Denmark to unravel their biographies. Firstly, we performed an in-depth techno-typological analysis of the artefacts. Secondly, each was directly radiocarbon dated to allow each to be firmly placed in chronological sequence. Lastly, we identified the species chosen for their manufacture through protein mass spectrometry (ZooMS and LC-MS/MS). The technological and typological assessment shows a close affinity for all artefacts to the Palaeolithic Ahrensburgian tradition, despite the AMS results showing that they date well into the Preboreal. The species utilized for the raw material for four of the five artefacts were of the elk (*Alces alces*), and the last and chronologically youngest was identified as being made from reindeer (*Rangifer tarandus*). This late date for the

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species in this region may indicate that the animal used may have been among the last, relict individuals present in the region prior to local extinction. Overall, these results indicate a delay in cultural change amongst certain groups of hunter-gatherers and potentially the coexistence of hunter-gatherer groups of Palaeolithic and Mesolithic tradition and the exploitation of the same species in Denmark during the Preboreal.

**Keywords:** ZooMS, LC, MS/MS, Zooarchaeology, transition, radiocarbon, technology

## **Session: Beyond the nutshell: diet, cooking and cuisine in the Mesolithic**



# Casa Grande Imiwaia – a 6000 yrs old hut for feasting (?) in Tierra del Fuego – and its relevance to European Mesolithic

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Casa Grande Imiwaia is a large shell midden structure, that is ca 10 times larger than the ca 800 common huts that surrounds Cambaceres Bay in the Beagle Channel in southernmost South America. The structure and adjacent middens encompass around 300 cubic meter of shell refuse. Dates from a 1.5 m deep test pit reveal that large amounts of shells, was deposited within a relatively short period prior to ca 6000 BP, as supported by the exceptional preservation of shells. Artifacts were utterly scarce, lithics absent, and the few bone artifacts that was found were peculiar. The midden content is still subject to zooarchaeological analyses. Obviously, it is a place for feeding a larger group of people, withdrawn from the settlement and outside daily chores. Casa Grande is similar to the large huts described in historical sources relating to the Yamana initiation rituals in recent times. However, it is unlikely that these rituals have remained unchanged through thousands of years. Probably, there are substantial changes in the cultural content of gatherings throughout this time. Nevertheless, Casa Grande is a telling example of the archaeological imprint of out-of-the normal aggregations that is valuable and illustrative to other parts of the world.

**Keywords:** Large shell midden structure, Rituals and feasting, Tierra del Fuego, Marine Ventures Project

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\*Speaker

# Cultural and food choices of ancient communities of the 6th mill BC in the forest zone of Eastern Europe (based on Upper Volga culture materials)

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The introduction of pottery as an innovation in a hunter-gatherer milieu was triggered by many factors, including cultural traditions, local economic systems, the resources of each geographical zone, and site function (fishing station, long-term settlement etc). Different archaeological cultures have been identified in the varied geographical regions of steppe, forest-steppe and forest zones of Eastern Europe, reflecting the historical reality which existed at the first occurrence of ceramics. The Upper Volga region encompasses a number of early ceramic sites dated to the 6th Millenium BC. The forest zone, with various resource-rich ecological niches, allowed for highly productive hunting, fishing and gathering, as clearly shown at the well-stratified wetland site Zamostje 2. Based on petrographic and technological macrotrace analyses, several chains of technological operational sequences can be identified. Different technological traditions in the region can be distinguished by ceramic decor and morphological groupings. However, the similarities with other ceramic complexes attest to the origins of these traditions elsewhere. It seems the process of transmission was facilitated by the elaborate river networks of the Upper Volga. In general, changes in ceramic traditions through time which seem to point to different

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\*Speaker

origins within Eastern Europe, also seem to correspond to changes in food processed in vessels. Lipid analysis suggests that vessels were primarily used for the storage or processing of both terrestrial and aquatic animal products. However, a particular importance, especially during the earliest occurrences of pottery, was devoted to plant products. This has also been demonstrated by SEM analysis of food crusts. Such a trend can be found on a number of sites from this region. In turn, this would suggest the existence of a cultural-alimentary tradition in the Upper Volga area and perhaps over the wider forest zone of Eastern Europe. GIS modelling of the landscape can identify how the sites form part of an ancient network through which knowledge of pottery was dispersed. Through gathering data on both pottery use and pottery manufacture techniques, we can show that cultural choices existed within ancient communities of the 6th Millennium, fulfilling their cultural, economic and household needs, including those of cuisine and taste.

**Keywords:** hunter, gatherers, earliest pottery, pottery function, lipids analysis

# Hidden foods, health and lifestyles in the Mesolithic Balkans: Data from dietary debris, microbiota and groundstone technology

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In the last decade, advances in bioarchaeology and ancient technology studies have provided new data for rethinking Mesolithic food and foodways. Within the scientific approaches most recently developed for exploring dietary strategies, the study of ancient dental calculus and the functional analysis of material culture have certainly emerged for their potential to unveil specific food preferences and modalities of food processing. In particular, micro-fossils preserved in the mineralized plaque and organic residues entrapped on different categories of tools involved in the preparation of food have challenged persistent narratives of hunter-gatherer-fisher diets as dominated by protein intake, revealing the persistent role of plants in the dietary strategies of Holocene foragers. Metagenomic studies of dental calculus have also provided insights into health status through the reconstruction of oral microbiota and its interaction with ancient human diet. However, only rarely bioarchaeological and material culture studies have been combined in the study of Mesolithic foodways. Here, we discuss the results of the microscopic and metagenomic analyses on the dental calculus record of 48 individuals from 4 different sites from the Danube Gorges area in Serbia. We take a long-term diachronic perspective-from the start of the Holocene up to the period of forager-farmer interactions at the end of the seventh millennium cal BC. Evidence from dental calculus is integrated to functional data obtained through the use-wear and residue analysis of ground stone technology used at the Mesolithic sites for processing foods. Our results indicate that in the course of the Early Holocene, local foragers used a specific range of wild edible plants. This familiarity with and knowledge of a spectrum of plant species might have played a role in enabling the introduction and swift acceptance of domesticated plant foods towards the end of the Mesolithic

**Keywords:** Diet, plant food processing, health status, lifestyles, dental calculus, microbiome, groundstone technology, Mesolithic Danube Gorges

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# Reviewing the palaeodietary reconstruction of the Mesolithic site of El Collado (Spain) with Compound Specific Isotope Analysis of Amino Acids

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Carbon and nitrogen stable isotope analysis of bone collagen from Mesolithic human individuals of the Iberian Peninsula typically reflects a substantial contribution of terrestrial resources, with variability likely related to environmental contexts. Unfortunately, bulk collagen stable isotope analysis lacks the necessary resolution to quantify dietary components or detect low, but still significant, marine consumption, a fact that could bias the dietary reconstruction of Mesolithic people. Carbon and nitrogen isotopic analysis of single amino acids offers a more direct means to discriminate different dietary sources, in particular marine from terrestrial sources of protein. By applying multi-isotopic statistical models, we can improve quantitative estimations not only of protein but also of caloric intake, as well as exploring levels of protein in diets and their socio-ecological implications. Here we present the many possibilities of Compound Specific Isotope Analysis of Amino Acids (CSIA-AA) to offer an unprecedented insight into the dietary reconstruction of the Mesolithic site of *El Collado* (Spain). Results will certainly shed light on the proper proportion of marine resources that this population, inhumed in one of the most impressive shell-middens of the NE Iberia, consumed on a regular basis.

**Keywords:** Compound Specific, Stable Isotopes, Amino Acids, Mesolithic, NE Iberian Peninsula

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\*Speaker

# Fowling and feasting (?) on middle sized-ducks at the peatbog of Dagsmosse, Östergötland, Sweden

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Birds have played an important role in many societies, from mythical, religious and prestigious to economic (e.g. Ericson & Tyrberg 2004; Mannermaa 2008; Mannermaa & Lõugas 2005; Serjeantson 2009). Mannermaa (2008) brought focus to Stone Age, and in particular Neolithic, fowling and the importance of birds in the Baltic region. However, low frequencies of bird bones from Mesolithic sites have been seen as an indicator of their relatively less significant role in the food economy (e.g. Guminski 2005). The presence in the faunal assemblages has also sometimes been interpreted as more recent contributions, since element representation often is similar to what could be expected when cadavers drift ashore (Ericson 1987).

During the recent year's surveys and trail excavation of a Mesolithic settlement in the bog of Dagsmosse have revealed relatively large quantities of bird bone from a rather small area (Hallgren 2015, Kennebjörk 2017, Gummesson 2019). The investigations are financed through the National Heritage Board, together with the County Administrative Board of Östergötland, since permission for peat cutting is already allowed for the area. The preservation conditions are excellent, proved by the huge number of fish and bird bones that have been recovered. These findings provide a unique opportunity to scrutinize the myth of the low significance of birds in Mesolithic society. The avifauna may be calculated to represent as much as 30-45% of the faunal material. With different ducks (Anatidae), for example Common goldeneye (*Bucephala clangula*), being the most common birds represented in the assemblage. Thrushes (Turidae) and also single bones of birds of prey are also present.

The Dagsmosse material is also rare, as it represents an inland site, where as many other sites with preserved avifauna in Sweden are costal sites (Ericson & Tyrberg 2004). This provides a special opportunity for studying differences between both sites and site locations. Indirect evidence for fowling in other areas may be found in the form of specialized arrowheads (e.g. Zhilin 1998, 162). An inventory of this type of artefact aids the discussions of fowling during the Mesolithic. Recently a finding of such arrowheads has been made in Motala (not far from Dagsmosse), from a site dating to roughly the same period or somewhat later than the Dagsmosse finds (Gummesson and Molin 2019). These were made of bone but from Denmark similar type of projectiles are also known made in wood (e.g. Andersen 2013:149). In Sweden a poorly preserved find from Ageröd V may represent this type of arrowhead (Larsson 1983: 54-55).

Birds are good indicators of seasonal activities as several species migrates and of ecological conditions. But the vast species diversity also provides a potential opportunity to study fowl-

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\*Speaker

ing strategy, ‘foodscapes’ and human choices. The role of avifauna during the Mesolithic may be scrutinized investigating the presence of bird bones in different contexts on the investigated site, but also through taphonomic analysis aiming to answer how the birds were processed and handled. Cutmarks on several of the bones from Dagsmosse show how the birds were processed after killing and the presence of burnt bones also reveals that bird bones were exposed to fire, before being deposited on site.

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**Keywords:** Bird bones, Fowling, Taphonomy, Osteoarchaeology



# There are not only pots: organic residues analysis applied to prehistoric hearths

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Cooking practices are a complex mixture of technical, social and cultural behaviours; yet little is known about them. Recently, research into cooking has been re-invigorated by chemical analysis of artefacts used in food preparation. These studies have largely focused on pottery, which are known to preserve organic signals related to their use for many millennia. While the success of these studies has changed our understanding of prehistoric cuisine, it is clearly biased towards those societies that had ceramic technology. Other forms of cooking have existed among non-pottery producing (aceramic) societies and these likely continued after the adoption of pottery.

Among the potential proxies for cooking activity are the thermally altered stones associated with hearth features, oftentimes overlooked as a source of information. Probably adopted during the Upper Palaeolithic, the use of rocks as heating elements represents a fundamental step in the evolution of culinary techniques. Indeed, stones have allowed the control and transfer of heat while offering the opportunity to develop various cooking methods (boiling, grilling, steaming). Stone cooking also enables an increase in the scale of food preparation that can enhance and conserve resources as well as facilitate feasting as part of social gatherings. Far from being anecdotal, stone cooking has a long history of use in many societies and is still practiced today in traditional cuisines in Mongolia, Oceania, and South America.

From experimental data and archaeological cases of study, we will explore the potential of organic residues analysis applied on thermally altered stones and hearth sediment to yield direct evidence of stone cooking technology and to inform us on the foodstuffs prepared and the cooking process.

**Keywords:** Cuisine, Organic Residues Analysis, Hearths, Isotopes, Thermally Altered Stones

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# On the border: pottery use in Bug-Dniester culture in the 7th-5th mill BC

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The territory of modern Ukraine represents the western edge of ceramic using hunter-gatherers in Eastern Europe. The area to the West of the Dnieper River was influenced by the neighboring early agricultural communities of Southern and Central Europe. Their impact is more clearly recorded in Bug-Dniester culture, broadly dated from the end of the 7th millennium BC till the middle of the 5th millennium BC, although the chronology remains problematic. Here we present the first investigation of the use of pottery by this cultural complex using lipid biomarkers and compound-specific carbon isotope analysis from organic residues associated with pottery in comparison with the results from more eastern and northern territories. A large variety of commodities were identified in the vessels with a frequent occurrence of ruminant products and some plants and aquatic input. Controversially, considering no domesticated animals were present in the faunal assemblage, putative dairy fats were identified in some vessels. Located on the border between the hunter-gatherer and farmer worlds, we will discuss the implications for these data in regards to broad spectrum economy and possible interaction with agricultural communities.

**Keywords:** Bug Dniester culture, Ukraine, Pottery, Organic Residues Analysis, Isotopes

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# Para-Neolithic pottery use: Organic residue analysis of ceramics from Dudka and Szczepanki

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Dating from ca. 4500 to 2500 cal BC, the Zedmar culture is one of the latest ceramic producing hunter-gatherer communities of the Baltic region. It was distributed from the Prussian Lowlands (Kaliningrad Oblast, Russia) in the north to the Masurian Lake District (Poland) in the south. To date, only a handful of archaeological sites have been attributed to the Zedmar culture meaning that our understanding of this unique phenomenon is largely based on the extensive excavations undertaken at the sites of Dudka and Szczepanki in North-east Poland. To further our understanding of this ceramic producing complex, the molecular and isotopic analysis of lipids extracted from pottery was carried out. In addition, to assess whether exotic or novel commodities had been exchanged with other communities nearby, pottery attributed to the Para-Neolithic Neman culture as well as Middle and Late Neolithic Brześć Kujawski, Funnel Beaker, Globular Amphora and Corded Ware cultures were also sampled to ascertain temporal change. Moreover, to explore consumption practices at the two sites the stable isotope data obtained from human remains was taken into consideration.

**Keywords:** Para, Neolithic, Zedmar culture, hunter, gatherer, organic residue analysis, lipids, stable isotopes

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\*Speaker

**Session: Striving for affluence -  
Active resource management and  
natural storage in hunter-gatherer  
societies**

# Exploiting fish migration and seasonal agglomeration in connection to long-term storage at Norje Sunnansund – Strontium isotope analyses on fish teeth through LA-MCICP-MS

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Hunter-fisher-gatherers subsistence strategies are often related to optimal foraging theory. This often implies a close connection to mobility patterns where it is assumed that once a particular part of the landscape is beginning to run low on resources people use mobility, i.e. moving from the area, as a risk-reducing strategy. However, among societies that are largely depending on aquatic resources for sustenance, mobility is often less important. For these groups of people certain favourable spots in the landscape increase in importance, e.g. where fish is available all year round and where it is possible to exploit massively increasing numbers of fish during limited periods (i.e. during fish migrations or spawning activities). The ability to utilize increasing fish abundance during periods of agglomeration is often considered a mobility reducing factor and if it is also connected to large scale and long-term storage the prerequisites for sedentary foraging societies have been met. On the south Scandinavian Early Holocene site Norje Sunnansund, evidence of fish fermentation as the means of creating this type of storage has been presented. The vast majority of the fish in the fermentation pit belong to freshwater fish (roach in particular) and less than a per mille of the identified fish bones belong to migrating anadromous species. Because salmonids, in particular, are normally connected to hot spots and delayed-return foraging societies among known ethnographic sources it is important to understand where the massive amounts of freshwater fish that were fermented at Norje Sunnansund came from. It has previously been suggested that the large amounts of roach that were caught and fermented, to provide the long-term storage, was caught during spawning agglomerations. However, up until recently no means of proving this nor any means of detecting the origins of the fish found in the fermentation pit have been sought. Here I will present the result of recent laser ablation multi-collector inductively coupled plasma mass spectrometry (LA-MCICP-MS) runs on fish teeth from Norje Sunnansund. The evidence presented will highlight the mobility of the fish and show how the humans at Norje Sunnansund used their agglomeration during spawning to catch fish from remote areas agglomerating in the shallow lake close to the settlement site. The ability to trace migration in non-diadromous fish species and connect it to human exploitation is promising and suggest that it will be possible to trace similar type of fish exploitation elsewhere. These results will thus enable us to detect past foraging societies ability to benefit from natural occurring fish agglomerations to catch a large amount of fish during e.g. spawning activities. This ability is on Norje Sunnansund connected to the ability to create large scale

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\*Speaker

storage. However, since storage is typically difficult to detect in archaeological remains the typical strontium mobility signal seen among the roach found in the fermentation pit could be used elsewhere as a model to detect similar utilization of fish spawning. If this is also connected to mass catching devices or substantial amounts of fish bones it might be an indication of resource management in an active strive for affluence.

**Keywords:** Fish fermentation, spawning, Sr analysis, affluence

# Pottery use within a specialized shell-midden site in the southern part of Eastern Europe: a case-study of Rakushechny Yar settlement (6th mill BC)

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The multilayer settlement Rakushechny Yar, situated in the lower Don River, is one of the sites with the most ancient pottery known in Eastern Europe. The subsistence strategies and the life cycle of these communities describe a particular system of resource management determined by specific economic, environmental and cultural conditions. Rich fish remains, shell middens, site location, specific toolkit with restricted categories, and incomplete context of tool production testify all that it was a specialized site for aquatic resource procurement. However, faunal remains indicated the use of resources from other ecological niches as well. In such a particular milieu, pottery was expected to fulfill a range of different tasks, but organic residue analysis of pottery, alongside SEM-analysis, has revealed a rather restricted set of ceramic functions, oriented towards specific aquatic resources processing, particularly the treatment of migratory fish, such as sturgeon.

Clay pots offer an effective means for the slow simmering of foods to extract rich lipids, such as the rendering of fish to produce storable oils. This would have helped to deal with the seasonal surplus of migratory sturgeon, available only during the late spring, and provided a valuable supply of storable food, consumable all year round and especially during the colder seasons when resources were more scarce. These valuable commodities could also have been accumulated and exchanged, with potential implications for social organisation and the creation of ownership and inequality.

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\*Speaker

Geochemical analysis has shown that early pottery was made from local raw materials, which suggests that the pottery was mainly produced on site. However, some pottery samples were made from non-local raw materials, indicating that part of the pottery was brought to the site. One of the samples belongs to the "import" category, which implies movement over even longer distances.

Rakushechny Yar appears to have been an attractive place for the procurement of sturgeon, and pottery technology appears to have played an important role in resource management for the hunter-gatherer communities of this region or even on a wider geographic scale.

**Keywords:** Pottery, Hunter, gatherer, Lipid residue analysis, Scanning Electron Microscopy (SEM), Geochemical analysis, Subsistence strategies, Resource management, Rakushechny Yar, Russia



# Archaeological evidence for freshwater fish exploitation during the Mesolithic: a case study from the Doubs catchment basin (Jura, Eastern France)

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Research focusing on post-Pleistocene adaptations has since the mid-1960s evidenced two recurring trends: a general diversification of the array of species that are exploited, and an efficient use of small-bodied, highly productive food sources. Binford (1968) argued that in the Old World, archaeological evidence for the Terminal Palaeolithic and Mesolithic periods suggests a widespread dependence on aquatic resources associated with a higher degree of sedentism, population growth and food storage. Some fifty years later, the few ichthyo-archaeological studies still leave such hypotheses open to further investigations.

Fish bone remains originating from four archaeological sites of the Doubs hydrographical basin (Jura, France), including one very large assemblage ( > 9300 NISP) dating from the Boreal chronozone, were analyzed by D. Frontin. The study aimed to characterize fishing practices and their role in human subsistence in a context of inland sites in which fishing was always associated with large game hunting.

The results highlight that cyprinids (including roach and bream), salmonids (probably trout), grayling, burbot, perch and eel were caught and eaten directly on site, apparently without any prior preparation. The refuse was discarded in the immediate vicinity, often around hearths. By

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reconstructing the size and weights of the prey, it was possible to estimate the fishing techniques and the food contribution of the different fish taxa. Fishermen seem to have favoured intermediate river environments, such as shallow banks or side channels, most suitable for setting fish-traps. Fishing appears to have been optimized to maximize yield-to-effort ratios. Binford, L.R. 1968. Post-Pleistocene adaptations. In Binford, S.R., Binford, L.R. (Eds), *New Perspectives in Archeology*. Aldine, Chicago, pp. 313-341.

**Keywords:** Fishing practices, food resource, foragers, Les Cabônes Ranchot, cyprinids, *Salmo*, *Thymallus*, *Perca*, *Lota*

# The rational resource management as the key to successful livelihood strategy of the population of the Dnieper Rapids Region during the Late Mesolithic

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The Dnieper Rapids Region is situated between the lower and middle reaches of the Dnieper river between Dnipro and Zaporizhya cities (Ukraine). This stretch of river is a section of the break through the Ukrainian crystalline shield, which had resulted in the formation of a unique ecological niche with natural borders, a large number of islands and huge rocks in the riverbed and a landscape similar to canyon.

Archeological evidence points to long-term inhabitation of several sedentary ancient groups within the territory. This is confirmed by numerous settlements and burial grounds. Though, some mobility of population was characteristic inside the region, but entire displaces were cyclical, stable, systematic and repetitive from year to year. The settlements during the warm season were generally located on islands and large rocks. Each of those settlements was populated with a group of people (family, clan) that has provided itself and was engaged in supplying. During the cold season, a commune of several "island groups" was located in coastal settlements uniting their work and accumulated resources. Each commune has had a fixed system of seasonal movements on the controlled territory by movement back to already habitable places from past seasons depending on the season.

The livelihood strategy of the Dnieper Rapids Region inhabitants was qualitatively different from the societies that occupied the neighboring territories (referring to technology and raw materials for tools, economy, settlement strategy etc.). Certainly, these differences were related to the peculiar landscape and resource base of the region. The rational integrated use of resources, as well as deliberate livelihood strategy guaranteed stability while minimizing the risk and without the need for long-way resettlements. Advantages of the selected strategy can be confirmed by transition to producing type of economy in region later than in the surrounding areas. Key components of the local economy (fishing, hunting, catching river game, gathering) have remained for a rather long time even after ceramics appearance.

Paleogeographic characteristics were causing the availability and accessibility of raw materials, which were unevenly represented in the region. For example, the lack of local deposits of high quality flint caused the widespread use of local rock materials (steatite, granite, amphibolite, migmatite, quartz, etc.) and bones for the manufacture of tools (one of the highest indices for Mesolithic and Neolithic cultures in Ukraine). The availability of large quantities of wood

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(according to palynological data) and type of economy have led to the development of wood-working tools.

Based on archeological data, annual climatic fluctuations, ethology of animals and fish, archeological and ethnographic parallels, we offer detailed models of annual cycle of settlement and economy and strategy of resource management in the Dnieper Rapids region during the 8th-7th millennium BC.

**Keywords:** Late Mesolithic, Dnieper Rapids Region, ecological niche, resource management, livelihood strategy, annual cycle of economy

# Just getting nuts...? Consequences of new research at ancient Lake Duvensee and Friesack (Germany)

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Ancient Lake Duvensee has been one of the first sites where Mesolithic hazelnut roasting facilities have been excavated. Due to the large number of roasted and unroasted nut shells at different sites, the hazel had become a commonly known staple food of the Mesolithic. This even led to the coining of the term "nut Age" for this period. While the use of hazelnuts was also proven for several other Mesolithic sites, ancient Lake Duvensee still stands out with several short-term used camps and plenty specialised hearths for processing the fruit. As a consequence of the long excavations in Duvensee bog, the sites from the area have several times been contrasted with other sites where more remains of hunted animals were found. This went, more or less explicitly, hand in hand with interpretations of a site's function and its position in a settlement system. In this presentation we want to critically assess the implications which build the basis for interpreting a site's function with selected cases from our current research projects. It will be shown that oftentimes the comparisons are hardly based on solid or common ground and thus obscure the interpretational potential. Furthermore, we will present current findings that extend our understanding of how ancient Lake Duvensee was integrated into a wider settlement system and which consequences arise from a more diversified perspective on the archaeological data. Additionally, indications for niche construction and resource use from the eastern German site Friesack will be discussed with respect to landscape modifying actions by Early Holocene hunter-gatherers. As will be shown, we find clear patterns in several hunted animals that indicate prey selection and active influence on reproduction patterns.

**Keywords:** source criticism, niche construction theory, subsistence, settlement systems, human-environment interaction

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# Seasonal abundance and resource management: A view from the northern forests

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In the temperate and subarctic forest zone of the northern hemisphere, most Post-Glacial hunter-gatherer economies are associated with delayed return strategies, exploiting various seasonally abundant resources over the course of the year. Pillars of this "taiga economy" are hunting, fishing, and collecting of plant and other food stuffs. Storage plays a role in such economies both as "natural storage" of reliably recurring seasonal resources that just have to be harvested every year, and as storage in the sense of preserving the accumulated seasonal resources over longer periods of by various means such as drying, freezing and smoking.

While some of these harvesting and storage practices can leave clear traces in the archaeological record, e.g. as shell middens, remains of fish traps, and hazelnut shell layers, others might be much less well detectible. Ethnographic information and ethnohistorical accounts from contemporary Siberian communities provide valuable insights here, showing that a certain bias on the role of fishing in archaeological interpretations is notable and that other species such as migratory birds might have played a more prominent role also in past hunter-gatherer societies than often presumed.

In the talk, information from Western Siberian communities will be evaluated on various active resource management and niche construction strategies such as the burning of forests to boost the abundance of berries and game, the temporary keeping of fish in artificial ponds or cages, and landscape shaping connected to bird hunting. Within a framework of social zooarchaeology it becomes clear that the underlying human-nonhuman interaction systems are by no means mere instances of economic exploitation but that complex multi-species ontologies and inter-species engagements can influence the acquisition, interaction and use, and also disposal or deposition of resources and their remains.

**Keywords:** Seasonal resources, resource management, niche construction, Siberian ethnoarchaeology

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# Deep pits, large game exploitation and isotopes: converging evidences of very early sedentarism during the Mesolithic

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The site "Le Parc du Château" is located in the central part of the Paris Basin, close to Auneau, about 20 km east of Chartres (Eure-et-Loir - France). Excavations covered an area of 200 m<sup>2</sup>, leading to the discovery of a high density of features with 70 pits dug into the Fontainebleau sands. The typological analysis of microlithic flint arrow-heads and the radiocarbon dates suggest that the site has been occupied at several times between 9500 to 5500 cal BC but a large majority of features is attributed to the Middle Mesolithic (8200-7000 cal BC).

## Features

Among the 70 dug structures excavated on the site, the primary function of about twenty of them is attested by the remains or arrangements still present: 3 burials, several intentional deposits (aurochs skulls, deer antlers), post holes and some fireplaces. Nearly half of the other pits were used as dumps and contain more or less abundant material, corresponding to domestic waste (flint and sandstone artefacts, animal bones, burnt fragments of limestone and sandstone) but their primary function remains to be determined.

A large part of these structures shows a homogeneous filling, but about ten of them display a stratified filling with several distinct layers. After they have been dug and then used, these pits were abandoned and a first phase, maybe relatively short, of anthropogenic dumps took place corresponding to the material located at the base of the filling. One or more phases of erosion and pit walls collapse followed, sometimes during relatively short and brutal episodes, marked by the deposition of layers of almost pure sand. A new phase of anthropogenic garbage, often more significant than the first, is contemporary with the erosion of the upper part and edge of the structures. These kind of filling and the dimensions and profiles of these structures make it possible to compare them with the small or medium-sized storage pits like silos well-known in

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many Neolithic or protohistoric sites.

### **Faunal remains**

Most of the 70 Mesolithic pits yielded very well-preserved faunal remains, forming an assemblage of at least 2500 fragments. Aurochs (*Bos primigenius*) and roe deer (*Capreolus capreolus*) are largely predominant followed by red deer (*Cervus elaphus*) and wild boar (*Sus scrofa scrofa*). Carnivores are less represented with fox, canids, pine marten and wild cat. A few bird bones have also been identified, probably from the anatidae. No fish bone was identified though the site is located on a low mound near a small river.

Seasonality data are particularly interesting in one of the deepest pit with a stratified filling. A young calf was killed in late winter-early spring and a subadult aurochs in early winter. A young 15-month-old red deer was killed during summer, while a young wild boar must have been killed in winter. Such evidence points to different hunting events throughout the yearly cycle. Considering the stratigraphic data, the presence of wild boar and red deer bones at the bottom of the pit suggests first use during autumn-winter, while the main concentration, in the middle of the pit, could reflect discard events from spring to summer. These data could be an argument in favour of a relative long-term use of the garbage pit, maybe throughout the year.

### **Isotopic analysis**

The faunal remains dating from the Boreal period provide values of  $^{13}\text{C}$  in accordance with an open type environment. The remains of large canids gave results close to each other and compatible with the consumption of the remains of large herbivores at the site. The human subject in Grave 6 is distinguished by a  $^{15}\text{N}$  content higher than that of the large canids which is consistent with the consumption of local herbivorous species but in different proportions. In any case, the consumption of aquatic resources does not appear to be significant for this individual.

For the Boreal-Atlantic transition the species show relatively distinct isotopic signatures with deer showing some of the lowest values of  $^{13}\text{C}$  and  $^{15}\text{N}$  and wild boar showing relatively high values of  $^{13}\text{C}$  and  $^{15}\text{N}$ . Roe deer and some aurochs provide  $^{13}\text{C}$  values at or below -22 reflecting dense forest habitat. With slightly higher  $^{13}\text{C}$  values, deer reflect a more open, probably more edge-scoured environment. Wild boar is less likely to reflect a dense canopy effect because it feeds either on fruit from the upper canopy, unaffected by the lower light levels of the undergrowth, or on tubers. The human individual in Grave 7 has a  $^{15}\text{N}$  content consistent with the consumption of large herbivores at the site, and a  $^{13}\text{C}$  content reflecting the consumption of either a mixture of forest species such as roe deer and wild boar, or edge-living species such as deer and some aurochs.

The analysis of  $^{34}\text{S}$  shows similarities between animals and human bones and indicates that its abundance is maintained at the human trophic level. As the isotopic signature of  $^{34}\text{S}$  in plants is linked with the sulphate in the soil and is specific to a given territory, it means that human beings have lived sustainably in the same environment as the game they have hunted.

### **Discussion and comparisons**

In this paper we will discuss these data about pits, huge mammals exploitation and isotopic analysis from Auneau and other Mesolithic sites in Europe where such pits were discovered. Then we will examine the hypothesis of nut storage and sedentary lifestyle in hunter-gather societies.

$^{13}\text{C}$  and  $^{15}\text{N}$  analysis show that open landscape game were especially exploited at Auneau during the first Mesolithic. These data are consistent with the palynological analysis carried out in the valley that classically show a strong development of hazelnut during the Boreal. From the end of the Boreal to the ancient Atlantic the environment surrounding is still relatively open



although dense forest expand.

The consumption of hazelnuts may have represented a significant part of the human diet. The volume of the deepest structures discovered at Auneau can be estimated at about 1.5 m<sup>3</sup>. If they were used as storage pits they could have contained 800 to 900 kg of hazelnuts each, which corresponds to only a few days of gathering for a human group of about 20 people. But in terms of consumption, the quantity of hazelnuts contained in a single one of these pits could feed the group for a month and a half. Cumulated with other nutritive contributions (one-off hunt, other plants resources...), this allows this population to get through the food-scarce season without any problem. Data from isotopic analysis, especially <sup>34</sup>S, and observations relating to seasonality support the hypothesis of a reduction in the mobility of certain human groups during the Mesolithic.

Hazelnuts were thus able to play a major role in ensuring food security until the following spring and enabling groups of hunter-gatherers to choose locations for permanent settlements, particularly near the hazel-wood. Hazelnuts could provide an abundant seasonal resource, naturally renewing itself each year, without any human intervention, that could be mass harvested and easily stored. The conditions defined by A. Testart for large-scale food storage were in place and linked to the very first sedentarisation of hunter-gatherer groups.

**Keywords:** storage pits, seasonality, isotopic analysis, hazelnuts, sedentary lifestyle

# Mesolithic lifeways on the shores of Skadar Lake: the evidence from Seocka pećina, Montenegro

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Apart from notable exceptions, such as the Danube Gorges and the Adriatic coast, the evidence of Mesolithic occupancy in the Balkan Peninsula is generally scant. Consequently, the eastern Adriatic and its hinterlands (the territory of present-day Montenegro), where several caves and rock shelters with Mesolithic sequences have been discovered, represents one of the key areas for understanding regional Early Holocene adaptations and lifeways. However, previous archaeological research has mainly been focused on karstic features in the northern, mountainous parts of Montenegro. Over the course of the ERC Project *The Transmission of Innovations: Comparison and Modelling of Early Farming and Associated Technologies in Europe (EUROFARM)*, Mesolithic deposits were recorded for the first time in the Skadar Lake area, at the cave site of Seocka pećina. The cave is located on a small, low peninsula defined by a meander of the Rijeka Crnojevića (the River of Crnojević) flowing into the northern part of the lake. Various site-formation processes at play (the erosion linked to human-induced deforestation) led to the disturbance of sediments, i.e. to the mixing and redeposition of materials from layers originally located towards the entrance of the cave. Nevertheless, a certain stratigraphic coherence was noted, including chipped stone tool finds (including bladelets) and faunal remains originating from wild animals (red deer, roe deer, chamois, wild boar, beaver, badger; some of them with butchery marks) and fish. The bones were dated by an extended series of AMS dates between 8750 and 7080 cal BC, which, along the total absence of domestic species, suggests that the bulk – if not all – of faunal material and the occupancy of the cave can indeed be related to the Early Holocene. Moreover, Seocka pećina is currently the only known Mesolithic site in the Balkans located in a lacustrine environment, thus providing unique opportunities to explore particular, site-specific adaptations of local hunter-gatherer-fisher communities and their interactions with the landscape. In this paper, we present the results of the analysis of the faunal assemblage from Seocka pećina, with a special focus on fish remains. Given the complex taphonomic history of the site, we look into the taxonomic composition of the fish faunal sample, the skeletal element distribution, fish size classes and bone taphonomy, in order to determine whether the accumulated remains can be unequivocally attributed to organized fishing activities. Due to the wide variety of aquatic habitats, the ichthyofauna of Skadar Lake and its catchment area is characterized by great biodiversity and an extraordinary high degree of endemism, being

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one of the most notable Balkan ecosystems in that respect. The north-western part of the lake and its floodplains, including the mouth of Rijeka Crnojevića (where the site is located), historically represented some of the best fishing spots in the region. Numerous deep lacustric springs with consistent water temperature attract various cyprinid species to aggregate in autumn and winter, whereas the swift Rijeka Crnojevića represents an optimal habitat for salmonids, which migrate to the lake in spring. The representatives of these two families have been identified in the fish faunal assemblage from Seocka pećina. In case of some cyprinid species (namely the common nase), the occurrence of sporadic clustering of bones of uniform colour, originating from several individuals of similar size, indicate that shoals of fish were targeted during the spawning season and that their remains were deposited in a single or closely related events. It seems plausible that the location of Seocka pećina was chosen by Mesolithic communities precisely because of its proximity to prolific fishing spots and ample opportunities for seasonal fishing. In addition to providing new evidence of Mesolithic fishing practices, seasonality and settlement within a specific lacustrine landscape, this study has important implications for exploring the regional diversity of Early Holocene adaptations in the Balkans.

**Keywords:** Seocka pećina, Skadar Lake, Mesolithic, fish remains, fishing, seasonality, lacustrine environments, Montenegro, the Balkans

**Session: Living on the coast:  
maritime hunter-fisher-gatherers,  
shell middens and the use of marine  
resources in Mesolithic Europe**

# The technological system of the maritime hunter-fisher-gatherers of the Atlantic façade: a preliminary approach through use-wear analysis on knapped industries

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The adaptation to the coastal environment of the maritime hunter-fisher-gatherer populations has being long time discussed by the archaeologist as a human and non-human relationship, in which the technological system is the link and the way to understand the human choices facing those particular biotopes. Indeed, archaeological and ethnographical data shows that specific techniques are implemented by these groups and are one of the motors of their socio-economical system and subsistence strategies. The question that arises then is if these choices are only due to a proper response to the coastal environment, different from the inland areas, or if there is also a cultural input foundation to these techniques. In this research we aim to address the question of the maritime hunter-fisher-gatherers technological choices, through the functional study of their knapped industries.

In the Atlantic European façade, around the Bay of Biscay, the Tévécien (Brittany, France) and the Asturian (Cantabrian region, Spain) Mesolithic cultures are good laboratories in which approach these questions. Using the methodology of the use-wear analysis based on the macro and microscopic examination of a large number of samples, the lithic assemblages from several shell-middens from Brittany (Beg-er-Vil, Tévécien and Hoëdic) and Asturias (El Mazo and El Toral III) have been studied. Furthermore, analytical experimentations were carried out in order to infer the mechanics of the formation of the archaeological use-wear in those contexts. This study has led us to numerous functional results of these knapped industries. For example, the work of the vegetal matters seems to be as present as in other Mesolithic terrestrial contexts, but with a certain variability of these wears. As for the tools associated to the animal resource activities, the hunting and butchering of large mammals were carried out with particular productions, with, again, certain variability in the patterns of the wears. No clear use-wear pattern could be related to the fishing or shell-fishing techniques. These variabilities observed in the use-wears are the basement of the discussion around the technological choices of the maritime hunter-fisher-gatherer groups.

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**Keywords:** Mesolithic, shell middens, technology, lithics, functional analysis

# Symbolism of the Red deer appears among Coastal (Mesolithic) people

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One of the most accomplished anthropological research on symbolism based on the relationship between human societies and subsistence (Hell, 2012) indicates the high cultural value of the use of wild animal. Regardless the chronological frame in Europe, going back to the 1st century BC (Ménier 1988), wild game represents only a tiny part of our meat diet despite all attempts at economic profit that have recently been achieved to consume it more (from the breeding of deer or bison, for instance, etc.). Thus, culture is more important than food : some animal species reach a specific meaning for Humans when others that are also consumed never bear any particular status, remaining "just" as food. This dichotomy, it seems, is already shaped in the practices of certain communities of the Later Mesolithic (6e millennium BC – Schulting 2005), notably in the Téviec culture (Marchand 2005). There, whereas the subsistence is mainly turned towards coastal animal resource for protein diet (Bailey et al. 2013, Dupont et al. 2009), only the game from the inland participate to social representation. In the use of bone material from the Téviec and Hoëdic sites (Brittany), it will be argue for an archetypal symbolism through the need to gain from a specific (psycho-pump) animal species -the red deer-, used to ensure a secure afterlife.

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**Keywords:** Animal, Symbolism, Red deer, Hoëdic, Téviec



# Why have Mesolithic populations eaten crabs only in the last 15 years?

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Shell middens are celebrated Mesolithic archaeological sites along the European Atlantic coast and have been known and excavated for a long time. The shells which are so abundant in these sites have often been considered merely as the sediment. Renewed research over the past twenty years has led to re-excavation of these sites. A closer look at midden sediment composition made possible because of the use of fine mesh for sieving combined with laboratory sorting which together have opened up a new scale of description. We can now identify a significant number of exploited animal classes: marine and terrestrial mammals, fish, marine and terrestrial birds, molluscs, crabs, sea urchins, goose-barnacles and barnacles. Within these there is also a significant diversity of species. Although crabs have always been described as present in shell middens, little attention had been paid to their potential archaeological information. For example, crabs have been identified in past publications at Portuguese sites such as Cabeço da Amoreira and Moita do Sebastião, but were described for the information they provided on climate rather than for their nutritional value. Isolated crabs were also regularly collected during excavations but rarely determined, or quantified.

Among the recently excavated sites is Beg-er-Vil in north-western France. Excavations in the 1980s had yielded a few crab fingers, but the 5mm dry sieved sediment had been stored without being sorted. A first study of the samples was carried out in the early 2000s, when four species of crab were identified. The determination of their sizes indicated fishing of large individuals. New excavations in 2012, are describing a completely different story. Three new species of crabs are determined thanks to the sieving of the sediments at 4mm and 2mm. These identifications increase the known diversity of exploited crustaceans and also the fishing techniques of Mesolithic groups. The discovery of spider crabs could well correspond to the collection of these decapods during their regular stranding in the spring. This activity complements the numerous ones already described for the site, as well as those inherent to the collection of products left behind by the tide. Reconstitution of the original sizes is also raising questions. Based on data from the 1980s, fishing of the largest crabs indicates capture of all individuals from the smallest to the largest. In the new scenario, the fishing pressure is more significant, unless food is mixed with algal inputs. If sieve mesh size can influence our assumptions about the exploitation of marine resources, the taphonomy can also be fundamental to modifying our understanding. Indeed, we observed differential conservation of the faunal remains that appears to show a greater degradation of the elements of 2010 compared to those of 1980. Thus, the crabs are also a tool to discuss the theme of the degradation of these shell-middens; they do not seem to be a closed

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and stable system.

After ten years, the exhaustive sorting of some sediment samples has led to a review of the importance of these ten-legged crustaceans. Although many parts of the skeletons are sometimes found, for example the mandibles, the extremities of crab claw fingers are the best preserved and most numerous parts observed at the Mesolithic shell-middens of the European Atlantic coast. These fingers, whether fixed or mobile, are informative. They have protuberances or teeth whose shape, number and arrangement vary according to the species. Thus, with a comparative collection and new methodological developments these fragments give allow us to identify the represented species, their numbers and their dimensions. These species and their quantities mean we can identify the exploited environments (substrate and position on the foreshore). Theoretically, the data can also permit us to calculate the quantities of crab meat consumed by these prehistoric populations. Crabs are among the most profitable animals if the mass of produced flesh is compared to that of their skeletons. They may therefore account for a significant portion of the diet of fisher-hunter-gatherers of the Mesolithic Atlantic European coast.

**Keywords:** shell, midden, crabs, marine invertebrates, Atlantic

# Stable oxygen isotope analysis and the seasonal exploitation of *Patella depressa* Pennant, 1777 during the Mesolithic in the Cantabrian region (N Iberia)

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Investigations conducted during last few decades in the Cantabrian region (N Iberia) have greatly increased our knowledge in relation to littoral resources exploitation patterns during the Mesolithic period (ca. 10,500 - 6,700 cal BP). Stable oxygen isotope ratios ( $\delta^{18}\text{O}$ ) can act as powerful recorders of the seasonal seawater temperature variations experienced by a mollusc in the past, enabling us to accurately establish the period of the year when it died/was collected by humans. Recent studies applying this methodology to mollusc shells have allowed us to properly determine seasonal exploitation patterns of the topshell *Phorcus lineatus* (da Costa, 1778) and the limpet *Patella vulgata* Linnaeus, 1758 in the Cantabrian region. Results obtained so far have reported differences collection strategies depending on the species, with *P. lineatus* collection patterns being driven by a cost-benefit principle. However, while the limpet, *Patella depressa* Pennant, 1777 is one of the most common mollusc species found in Holocene archaeological assemblages along the Atlantic façade of Europe, seasonal collection patterns in relation to this species have been under-studied. Here, we apply stable oxygen isotope analyses to *P. depressa* shells recovered from the shell midden site of El Mazo cave (Asturias, Spain) to determine if there are seasonal patterns in its exploitation by humans. We also undertake a modern experimental programme, collecting *P. depressa* individuals all year round from N Iberia, in order to establish whether the observed seasonality (if any) is caused by cost-benefit principles or other cultural factors. The results obtained allow us to better understand patterns of littoral resource exploitation and overall subsistence of some of the last specialized hunter-fisher-gatherers in western Europe.

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**Keywords:** Atlantic Europe, Shell middens, Stable oxygen isotopes, Mollusc shells, *Patella depressa*, Seasonality

# Maritime hunter-fisher-gatherers in northern Iberia during the Mesolithic: new perspectives from the shell midden site of El Mazo (Asturias, Spain)

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The Asturian Mesolithic, one of the classic periods in the prehistoric investigation of the Iberian Peninsula, is characterised by the formation of large shell middens. Research on this period began in the early 20th century by the Count of Vega del Sella, although it was during the second part of that century when there were significant advances for the knowledge of this period. Recently, new projects have stimulated the study of the last hunter-fisher-gatherers in northern Iberia. Excavations at the shell midden site of El Mazo (Asturias, Spain) have been carried out since 2009. The archaeological intervention has been crucial to determine the formation and erosion processes of the shell midden, the existence of significant climatic changes during the Mesolithic, as well as the technological characteristics, subsistence strategies and the symbolism of human populations. The analysis of the remains of the cemented shell midden, together with the stratigraphic and micromorphological analysis, have been essential for establishing the formation and erosion processes of the mesolithic deposit, as well as to infer its original morphology. In this sense, the shell midden occupied most of the rockshelter, with human occupations progressively occurring from the inside to the outside of the shelter as the shell midden grew. On the other hand, this multidisciplinary perspective has also provided relevant information on the post-depositional processes that have affected the different strata, the different occupation events and the activities carried out on the site. Using various analytical techniques, it has been possible to establish the evolution of climatic conditions, as well as vegetation, throughout the period of occupation of the site. Within the supposed climatic stability of the Early Holocene, various episodes of climate change have been identified, including the cooling event that occurred between 8,200 and 8,000 years ago. The research developed from the study of different archaeological materials has also been essential for understanding the ways of life of the hunter-fisher-gatherers that occupied the site, and especially to introduce new elements of reflection in the interpretation of this period, as in the case of the lithic industry, the shell tools and the use of plants. In general, the pattern of subsistence strategies shows a diversified economy, taking advantage of the various resources available around the site (marine molluscs, fish, crustaceans, echinoderms, terrestrial mammals, plants). This pattern, together with the procurement of fundamentally local lithic raw materials, indicates the existence of reduced mobility, which would probably take place along the coast on the east-west axis, following the natural pathways with that orientation, provided by the coastal platform of this littoral region. The seasonality of mammals and molluscs indicates an intense use of the site, either as a result of continued occupation for several months of the year or of several visits throughout the annual cycle.

**Keywords:** Prehistory, Cantabrian region, Subsistence strategies, Climate change, Shell mound

# How maritime can you get? Conceptualizing adaptive shifts from coastal opportunism to maritime specialization in Early/Mid-Holocene Arctic Norway

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The initial colonization of Norway occurred by a coastal route that relied on complex maritime transportation and subsistence technologies. Evidence suggests a strong reliance on marine resources throughout the Holocene and testifies to the significant time depth of maritime adaptive strategies in the area. Recent human ecodynamic research, however, questions the timing and evolutionary pathway responsible for bringing about fully maritime adaptive strategies in Arctic Norway. Consequently, this paper highlights the issue of how to conceptualize adaptive shifts within an already established maritime economy. By combining palaeodemographic modelling with archaeological and environmental records, significant synchronous changes are demonstrated across parameters including population size and packing at coastal sites, increasing investment in maritime subsistence strategies and a particular productivity increase in the marine environment. Contrary to established predictions, the increasing reliance on marine resources does not appear to be a response to decreased terrestrial productivity necessitating intensification through reduced diet breadth. The adaptive shift in Arctic Norway rather appears to have taken advantage of favorable ecological conditions that facilitated human population growth. This adaptive success was mediated through higher-cost/higher-yield procurement strategies that included mass-harvesting and –processing, proliferated through technological innovations such as deep-sea fishing and ground slate technology. The results therefore challenge the concept of “intensification” as a negative risk-reduction strategy and goes some way in explicating the hallmark demographic and adaptive properties of high-latitude, maritime hunter-gatherers in the ethnographic record.

**Keywords:** Arctic Norway, maritime adaptation, human ecodynamics, intensification

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# Living on the Brittany coast in the Mesolithic period: from formation processes of shell middens to the socio-economic practices of the last hunter-gatherer-fishermen, the case study of Beg-er-Vil (Quiberon, France).

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Because they particularly concentrate the faunal remains and artefacts, shell middens aroused the curiosity of archaeologists very early to document the socio-economic as well as funerary practices of Mesolithic communities. During the 2000s, archaeological research in Brittany focused on the faunal assemblages of the four available shell middens (Hoedic, Téviec, Beg-an-Dorchenn and Beg-er-Vil) variously excavated and preserved, as well as on their contributions to the understanding of the use of maritime spaces. Nevertheless, it remained difficult to appreciate the diversity of human behaviour involved in the formation processes of shell middens and their role in the spatial organisation of settlements.

This is the whole interest of the geoarchaeological approach, which involves soil micromorphology. This approach recently pointed to important advances at sites in the Tagus and Sado valleys in Portugal and across the Atlantic in Brazil. Indeed, applied to this type of context, it makes it possible to specify the diversity of human activities that took place there and their rhythmicity. For the first time in France, we were able to develop this approach on the shell middens of Beg-er-Vil (Quiberon, Morbihan). Following the first surveys carried out in the 1980s by O. Kayser, a multi-year program was carried out between 2012 and 2018 to continue the excavation of the shell middens and its adjacent sectors. Located on the edge of a cliff, this site has been

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partly eroded and destroyed, limiting our knowledge definitively. However, the archaeological excavation has revealed imposing fire structure and post blocking from two housing units in the direct vicinity of the shell middens. By applying an adapted recording protocol (plan survey and recording of the remains with a total station) and a cross-approach of the various preserved remains - including the sediments considered here as cultural archives - this site constitutes a true study laboratory. All of the sediments in the shell midden were systematically sieved with water, followed by dry sieving. In addition, systematic sampling by stratigraphic units and by 50x50 cm quad for pH and chemical analysis was carried out. A strategy for spatial sampling of stratigraphic sections and evidence berms for oriented blocks samples was implemented as early as 2013, in order to carry out soil micromorphology analyses.

Based on micromorphological and microstratigraphic results, the objective of this paper is to present a synthesis of the geoarchaeological data acquired to determine the nature and intensity of the human activities that led to the formation of the shell midden. These results will be put into perspective with archaeological data such as those obtained on crabs and marine molluscs, for example. Thus, they will make it possible to discuss the relationship between the use of fire structures and the shell midden and, more generally, the place of the latter within the occupation. In the same way, by specifying the rhythms of the formation of the shell midden, the occupation dynamics of the site and more broadly the mobility of these last communities of hunter-gatherer-fishermen of the French Atlantic Coast will be discussed.

**Keywords:** Shell midden, Mesolithic, Brittany, Geoarchaeology, Soil micromorphology, Chemical analyses, Formation processes, Spatial analyses, Malacology

# Below the threshold: the importance of shell middens' sedimentary context to recognize Mesolithic shellfish cooking

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The high reliance on marine resources and associated harvest of mollusc is common in the European Mesolithic. While it is clear that shells are associated with subsistence strategies, it remains unclear if, and how, these dietary items were processed. An important aspect is to know if molluscs were commonly cooked or eaten raw. If we look at ethnographic studies, there are several examples of shellfish processing and roasting practices in the absence of ceramic containers, and these often involved the displacement of the original combustion residues to retrieve the opened shells. Few studies have, however, focused on establishing shell roasting signatures in archaeological datasets. One way to tackle the question of fire use to process shellfish is to investigate mineralogical changes of archaeological shells. Mineralogical transformations – namely the loss of organic components and the CaCO<sub>3</sub> polymorphic conversion from biogenic aragonite to calcite phases – occurs progressively with increased temperatures from ~250°C until 450°C. However, it is hard to reconcile exposure to temperatures above 250°C with cooking since this would most probably entail the burning of the eatable meat.

To distinguish between cooking and burning, here we investigate mineralogical temperature related alterations of biogenic aragonite alongside studies of site formation processes. We combined micromorphology analyses – providing microstratigraphic and site formation data – with contextualized micro Fourier Transform Infrared spectroscopy (microFTIR) data taken directly on shells in thin section. We focused on both modern and archaeological shells of *Cerastoderma edule* and *Scrobicularia plana*, as these are commonly exploited species in the Portuguese Mesolithic shell middens and are both originally aragonitic.

Our results confirmed previous data on modern specimens exposed to different controlled temperatures, namely that: (1) the CaCO<sub>3</sub> conversion is gradual, with both aragonite and calcite phases persisting on shells from both species at the temperature interval of 250°C-450°C; (2) a complete conversion to calcite occurs at ~450°C for both species, but starts at slightly different temperatures for each one, ~250°C for *C. edule* and ~350°C for *S. plana*. The microFTIR mapping allowed to obtain several FTIR spectra within a shell in thin section, and showed two

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further aspects: (a) that spectra of aragonite, calcite, and both polymorphs mixed co-exist in a same shell in the temperature conversion interval, revealing that the conversion is heterogenous; (b) it showed a markedly abrupt conversion point at  $\sim 400^{\circ}\text{C}$  for *S. plana*, while *C. edule* shows a progressive conversion throughout the  $250^{\circ}\text{C}$ - $450^{\circ}\text{C}$  interval.

Our study on archaeological shells in micromorphological thin sections measured the mineralogical conversion of shells in their microstratigraphic context using intact sediment samples from two Mesolithic shell middens in Portugal: Cabeço da Amoreira (Muge) and Poças de São Bento (Sado). Our results revealed several key aspects for recognising burning and possible cooking of shellfish. First, episodes of in-situ fireplaces that were invisible macroscopically could be identified. These invisible fires were revealed by the distribution of the microFTIR spectra with a gradual transition from calcite spectra in the above shells, with spectra mixing both polymorphs in a transitional zone, and only aragonite spectra in the lower shells. This evidence suggests that the conversion occurred in-situ, produced by a fire placed on top of the shell heap. Second, shellfish cooking residues were inferred from the association of charcoals in secondary position and associated shells yielding aragonite spectra, thus were not burnt above  $\sim 350^{\circ}\text{C}$ . This relates to discard of embers and shells from a nearby hearth without burning the shellfish, and this association is interpreted as debris from shellfish roasting fires.

This study reveals often invisible aspects of Mesolithic shell midden development and formation dynamics. The polymorphic conversion of shells within their microstratigraphic context, allowed for the recognition of shells burnt in-situ by a (macroscopic) invisible fire, even if charcoals and ashes are absent. Cooking residues were identified by charcoals in secondary position with shells exposed to temperatures high enough to open the bivalve but not to burn it. This evidence highlights that it is not expectable to recognize cooking by analysing individual shells' mineralogical properties, but rather by considering them within their original stratigraphic context.

**Keywords:** Shell middens, Cooking, Microstratigraphy, FTIR

# Animal, Vegetable or Mineral? Identifying tool use in British Mesolithic woodworking

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The British Mesolithic archaeological record has suffered from a comparative scarcity of wooden artefacts. Finds in the last decade from sites such as Goldcliff, Star Carr and Bouldnor Cliff are presenting new opportunities to study this missing aspect of Mesolithic material culture. The 2017 identification of the first Mesolithic fish-trap structures found in Britain at the late Mesolithic site of Goldcliff East, Wales (Bell *et al.* 2020, forthcoming), has led to the identification of atypical toolmarks on pointed stakes with characteristics previously unknown in the British Mesolithic record. On-going PhD research is focused on understanding the extent of this evidence in the archaeological record as well as the manufacturing process and tools used to shape these artefacts.

Comparative toolmark analysis on wooden pointed end assemblages from Mesolithic Goldcliff East (Newport, UK), early Neolithic trackways of the Sweet Track (Somerset, UK) and unpublished Walpole Landfill site (Somerset, UK) has suggested the presence and use of a distinctive non-lithic tool type and working method that appears to span the cultural divide between the late Mesolithic and early Neolithic communities. Given current aDNA debates about the Mesolithic to Neolithic transition in this area of northern Europe understanding the complexities and similarities in prehistoric woodworking presents a useful mechanism to assess the technological variability and change between disparate prehistoric cultural groups.

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**Keywords:** woodworking, tool, function, experimental archaeology, wetland edge

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**Session: Multidisciplinary approaches  
to the uses of plants as food,  
medicine and raw material by  
mesolithic communities**

# Dendro-antracological approaches applied to Mesolithic contexts in NE Iberia: the exploitation of Montane Pinewoods

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This work focuses on the reconstruction of firewood exploitation strategies during the Mesolithic-Neolithic transition in NE Iberia. The study is based in the measurement of dendro-anthracological parameters, as minimum diameter and growth rate, in montane pine (*Pinus sylvestris* tp.) wood charcoal fragments from archaeological contexts which reaches around 90% of the studied assemblages (Alcolea, 2017). Pith location tool (Dufraisse et al., 2020) and dendrometry by image analysis software combined with modern dendrological reference datasets allows to classify charcoal fragments in 4 groups or anthraco-types (Dufraisse et al., 2018). First results suggest the exploitation of both trunks and branches but a high use of small calibres, probably related to the gathering of natural pruning produced by conifer trees. The studied archaeological sequences barely show differences in the human management of forest resources by the last hunter-gatherers and the first farmers in seasonal occupations in rock-shelters.

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**Keywords:** Dendro, antracological tools, wood charcoal analysis, athraco, typology, fuelwood exploitation, *Pinus* tp. *sylvestris*

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# Fishing nets and string at the Final Mesolithic and Early Neolithic site of Zamostje 2, Sergiev Posad (Russia)

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The site Zamostje 2, located in Sergiev-Posad (Russia) on the west bank of the Dubna river, has provided two Mesolithic and one Early Neolithic occupations dated from 7000 to 5400 cal BC. The archaeological excavations extended along a 160 m<sup>2</sup> stretch and 80-90 m<sup>2</sup> in an area that is today underwater. Nearly 250 objects and more than 140 underwater piles made of perishable materials have been recovered. The site has yielded fish-screens, fish-fences, wooden fish traps and several small cordage remains, pine bark floats, fragments of paddles and other wooden objects. In this work we will present the study of the fragments of ropes and fishing nets with the objective of providing new insights into the production and use of implements made of plant fibres.

Ropes, strings and cords were extensively used tools during prehistoric times. Plant fibres constituted, until the appearance of synthetic fibres, one of the main raw materials for the elaboration of strings and ropes, that were used for a number of purposes structures' construction, means of transportation, clothing and ornament, as well as the elaboration of fishing nets or as bowstring, among others. However, due to their perishable nature they are seldom recovered at archaeological contexts. For this reason, the case of Zamostje 2 is ideal to study this particular topic.

We have characterized the production process by analysing the morphological and technical characteristics of these cordage remains. According to the technique of cord making, a distinction has been made between knots and twisted cords. In order to characterize the type of production, the number of strings or elements used to produce the cords, the direction of the torsion as well as the type of twist have been analyzed. Likewise, the length, width and thickness or diameter of remains have been recorded. Raw material has been identified by comparing their anatomy with modern material and specialized bibliography. Finally, function of cordage is discussed in the frame of the site context.

The analysis of 78 knots and 20 fragments of strings have allowed to determine that they were elaborated with single threads, with a weak twist or without it, from 0.5 to 1.5 mm thick, which

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\*Speaker

is noticeable smaller than most examples from other sites. Regarding the direction of twists, we have seen that it prevails the S type. All of them were elaborated with woody bast fibres. According to the size and shape of the knots and strings of Zamostje 2 we suggest that this remains may have formed part of fishing nets, involved in the intense exploitation of water resources carried out at the site, where hooks, harpoons, taps and thousands of remains belonging to 11 fish species have been recovered.

**Keywords:** Plant fibres, waterlogged preservation, cordage, archaeobotany, ancient handicraft



# Pine, birch and hazel: Early Mesolithic plant management systems at Krzyz Wielkopolski 7 (Poland)

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Within most archaeological sites, Mesolithic plant exploitation strategies are generally inferred from the study of carbonized plant remains of ligneous origin, providing some insights about plants used for fuel or subsistence. As a result, our perception of Mesolithic plant use has long been biased, this being particularly true for Western European contexts. Peatbog sites represent rare opportunities to better understand the role plants played in the closing landscapes of the Preboreal-Boreal. Krzyz 7, located in Greater Poland, is such a site with exceptional preservation conditions. The aim of this paper is to present our first results on plant use provided by the analysis of botanical macroremains (wood and bark, seeds and fruits, charcoal) and organic chemistry (GC-MS). Subsistence, woodworking and adhesive production systems are then discussed in the light of relevant archaeological, paleoenvironmental, experimental and/or ethnoarchaeological data.

**Keywords:** Early Mesolithic, Poland, peat bog archaeology, multi, proxy archaeobotanical analyses

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\*Speaker

# There is no Smoke without Fire: Anthracological Analysis of the Feature A, Cabeço da Amoreira, Muge Shell-middens, Portugal

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This poster presents the anthracological results from a rather unique and spatially confined context called Feature A, in the Mesolithic shell-midden of Cabeço da Amoreira, Muge, Portugal, radiocarbon dated to  $6633 \pm 20$  BP. Through taxonomic and taphonomic analyses, the main objective was to contextualize and characterize the presence of charcoals in this specific context and to assess the ecological past.

The totality of collected charcoal fragments was analysed and the identified taxa were: *Pinus* sp., *Pinus pinaster*, *Pinus* cf. *pinaster*, *Pinus pinea*/pinaster, *Pinus* tp. *sylvestris*, *Quercus* sp., *Quercus* subg. *quercus*, gymnosperms and angiosperms, corroborating with other studies regarding Mesolithic landscapes in the surrounding archaeological sites in the Tagus valley.

The results point to the use of specific wood as fuel and the late deposition of charcoal by natural or anthropic means in this particular context, or deposited together with the other artefacts, namely red deer remains (*Cervus elaphus*) and lithics. As suggested by the spatial analysis study from Gonçalves (2017), this context was probably the place of a specific economic activity of carcass processing and extraction of bone marrow content and later used as a deposit zone, justified by the presence of charcoals and other materials.

**Keywords:** Anthracology, Taxonomy, Taphonomy, Landscape, Mesolithic, Muge

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# Site formation and use of wetland plant resources in the Mesolithic occupations of La Fragua Cave (Cantabria, Spain).

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La Fragua is a small cave on a vertical cliff at ~130 m directly above the shoreline of the Bay of Biscay, in northern Spain, with Upper Paleolithic and Mesolithic occupations, separated by stratigraphic layer 3, radiocarbon dated to 10 000 cal BP. Layer 3 is a distinct and exogenous deposit of algal carbonate mud rich in marine organisms, closely packed with phosphatic bird guano, non-edible small crustaceans and gastropods, and an outstanding presence of *Phragmites* sp. pollen. The deposit exhibits micromorphological signatures of structural compaction and is located at the base of a Mesolithic succession of lenses corresponding to combustion features, where fibrous charred organic matter, resembling grassy material, is recognizable along with algal sedimentary materials. The hypothesis of the grassy material being linked with the wetland reed pollen identified is addressed combining micromorphological, palynological and malacological data. This interdisciplinary micro-contextual approach allowed to characterise the functionality of the Mesolithic fires at the site. This hypothesis implies behaviourally relevant aspects suggesting activities like site maintenance, reuse of hearths and middening. The use of such wetland resources furthermore reflects coastal adaptations of the early Holocene hunter-gatherers, besides the shellfish exploitation widely documented for the Cantabrian Mesolithic, in a moment of sea level rise, when the coastal wetlands were starting to develop in the surroundings of La Fragua cave.

**Keywords:** Shell midden, archaeobotany, micromorphology, pollen, malacology

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# The exploitation of wild plant resources in Can Sadurní Cave site (Begues, Spain) during the last hunter-gatherer occupations (11.000-6000 cal BC)

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The site of Can Sadurní (Begues, Spain) is a cave located in the calcareous Garraf Massif near the Mediterranean coast. The site has a long sequence of occupation that cover approximately 11000 years. In this communication, we will present the study of the plant remains of the layers 19, 20, 21 and 21EVI, that correspond to the Mesolithic occupations dated between ca. 11000 to 6000 cal BC. The goal of the study was to characterize the environment during the Mesolithic occupation and the main plant resources gathered. The data obtained will cover a gap in the region since very few sites covering these chronologies have been excavated in the region until now.

The sediment of the site has been systematically sampled and floated in order to recover plant remains; moreover, the remains of big size were picked out by hand during the excavation. The sampling strategy has allowed to recover a high diversity of plant remains, all of them carbonized.

Charcoal fragments are the most abundant type of remain. Most of them come from the oldest layers (21 and 21EVI). Among them, *Acer* sp., *Quercus* sp. deciduous, *Prunus* sp., and *Pinus* sp. are the best represented, the presence of Mediterranean taxa as evergreen *Quercus* is also documented.

Regarding other plant macroremains although they are present in every layer, only the *Pinus* scales are documented in all the sequence. It is noteworthy the presence of fruits, especially in the oldest layers (21 and 21 VI), among them *Prunus* sp. and other Rosaceae. Finally, it should mention the presence of some fragments of plant underground storage organs, which are practically absent in the archaeological record of this area.

These taxa suggest the presence of a mixed forest in the cave surroundings. These forests pro-

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vided of firewood but also of food. According to the macrobotanical remains identified at Can Sadurní, fruits and underground storage organs were intentionally gathered, although their contribution to the diet is difficult to evaluate their presence provides new insights into the economic strategies of the last hunter-gatherer in the region.

**Keywords:** Firewood, Fruits, Underground storage organs, Iberian Peninsula, Hunter, gatherers

# Plants as materials in ritual practice

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While there is a significant body of evidence for the ways that plants were used in economic and craft activities, their role in ritual practice has received very little attention. This is surprising given that plant materials, or indirect evidence for their use, occur frequently in mortuary and other ritual contexts. Wooden posts and post-built structures, for example, have been recorded within or around graves, and in association with disarticulated human remains. And plant materials (including wood and fungi) occur alongside animal bone, antler, and osseous artefacts that have been intentionally deposited into bogs and pools of water. However, when we come to interpret these contexts the significance of the plant materials is often overlooked. This paper argues that by incorporating plant material in our interpretations of these assemblages, we can show that particular plants played an active role in ritual practice, were intentionally selected for use in certain ritual contexts, and were subject to prescribed forms of treatment and disposal. Taking this as a starting point it will discuss the ways in which plants were perceived by Mesolithic communities, and how interactions between humans and plants were structured through prescribed forms of behaviour.

**Keywords:** Plants, Archaeobotany, Ritual

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\*Speaker

## Topic: People in their Environnement

# Environmental Change, Cultural Landscapes and Human Adaptations in the European Mesolithic

Daniel Groß <sup>\*† 1,2</sup>, Harald Lübke <sup>\* ‡ 1</sup>, Nicky Milner <sup>\* § 3</sup>, Björn Nilsson <sup>\* ¶ 4</sup>

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Like any other living being, humans constantly influence their environment, be it intentionally or unintentionally. By extracting natural resources, they shape their environment and also that of plants and other animals. A great difference setting people apart from all other living beings is the ability to construct and develop their own environment. While human's unique tool for this is cultural behaviour, they are also closely entangled with their natural surroundings. The Early and Mid Holocene are periods of significant change in terms of both the environment and archaeological material culture in Europe. The warming of the northern hemisphere after the Last Glacial Maximum triggered environmental changes which would have had an impact on the lives of Mesolithic hunter-gatherers. Climatically induced changes in the vegetation, for instance, formed different habitats which resulted in changes in the faunal communities. The melting of the Weichselian inland glaciation led to sea level rise along European coasts and land uplift especially in Northern Europe.

This might have led to social consequences which can be seen in transformed hunting and fishing strategies and necessary changes in the toolkit, might have impacted the socio-cultural sphere as well. Furthermore, changes in mobility patterns and settlement strategies and consequently infrastructural alterations of networks have to be regarded as relevant parameters for social relations in these epoch.

In recent years there has been a resurgence of studies focusing on the effects on people during this time:

What climate events occurred?

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What and how significant were the impacts on the environment?

Did people react to specific events or did they cause specific events?

How were people impacted by environmental changes and what is the evidence for that?

We would like to invite researchers dealing with human-environment interactions from the end of the last Ice Age to the introduction of farming. It is preferred if the contributions actively relate to the topic and bridge different scientific disciplines or approaches. The session further aims at sharing information on cutting-edge scientific methodologies and to evaluate the potential of interdisciplinary and multi-species approaches as well as ethnoarchaeological analogies.

**Keywords:** Human Adaptation, Environmental change, Human Environment Interaction, Cultural Transformation, Environmental Archaeology

# Enculturating landscapes

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General session grouping together papers dedicated to Mesolithic sites, landscapes and territories that do not fall within the scope of the other sessions of this topic.

**Keywords:** sites, landscape, territories, colonization

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\*Speaker

**Session: Environmental Change,  
Cultural Landscapes and Human  
Adaptations in the Mesolithic**

# Doggerland dynamics. Exploring the characteristics of human-environment interaction and adaptability in the Mesolithic of the North Sea area 9000-5000 cal BC.

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In recent years both off-shore investigation and on-shore discoveries of finds and human remains have greatly added to our understanding of the Mesolithic occupation of Holocene Doggerland. This area in the current North Sea was a major hunter-gatherer heartland from c. 9000 cal BC, until it drowned some 3000 years later. An important aspect of the mesolithic occupation of this landscape was the fact that it gradually and sometimes rapidly changed. This also led to important changes in the environment and its resources. Recent results, including stable isotope analysis has more and more shed new light on the characteristics of mesolithic occupation as well as on the adaptability of the Doggerland inhabitants to deal with the changes taking place. In this paper I will highlight some of the recent finds and discoveries and discuss the current information on human-environment interaction and the potential of this drowned European heartland for the future study of the Mesolithic.

**Keywords:** Doggerland, adaptability, stable isotopes, submerged, mesolithic

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# Environmental Change and the Neolithization of the Balkans

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Any discussion of Neolithization in the Balkans south of the Danube has to confront two seemingly long-established and incontrovertible 'facts' - the abrupt appearance of a fully developed Neolithic 'package' c. 6200/6000 cal BC, and the virtual archaeological 'absence' of a pre-Neolithic substratum. This paper focuses on three inadequately discussed aspects of the ongoing debate surrounding the spread of farming across Southeast Europe: 1) the environmental potential of the region for pre-Neolithic hunter-gatherer settlement against the background of substantial climate and vegetational change during the Terminal Pleistocene and Early Holocene, 2) the appearance of a distinctive raw material ('Balkan Flint') and blade-based toolkits that are one of the hallmarks of the supra-regional Karanovo I – Starčevo – Criș – Körös cultural complex, and 3) the lack of Mesolithic sites in a large part of the eastern Balkans (ie Bulgaria) is 'absence of evidence' or 'evidence of absence'.

**Keywords:** Balkans, Mesolithic, demographic change, Neolithization, exchange networks

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# Ice Patch Hunters in the Mesolithic? An exploratory review of the current evidence

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In recent decades, many spectacular archaeological discoveries have been recovered from melting ice patches in the high alpine, in both Scandinavia and in the Alps. The frozen conditions mean that prehistoric organic objects are sometimes well-preserved. These glacial finds have provided us with new insights into the different way people utilized the high alpine in the past; whether it be hunting and trapping on ice patches, or following transport corridors. Until now, the oldest finds recovered from high-alpine glacial sites in Europe date to the Neolithic. The purpose of this paper is to examine the evidence from different disciplines as to whether Mesolithic populations might have hunted on alpine ice patches or not. The analysis focuses mostly on Norway and Sweden, but draws from and is also relevant too the European Alps and other alpine regions.

This form of logical modeling is not only useful for thinking about future ice patch surveys and analyses. It is a fine heuristic for synthesizing some of the archaeological, glaciological and paleoclimatic factors we have learnt in recent years about glacial archaeological sites and past adaptations. These include the role of paleoclimate in past-use of the high alpine, post-depositional processes and prognosis for future melts and discoveries.

**Keywords:** Mesolithic adaptation, mountain archaeology, glacial archaeology

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\*Speaker

# The Eastern Link – a link to the past

Tom Carlsson <sup>\*† 1</sup>

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My poster is a introduction the largest infrastructure project ever in Sweden. The railway project starts just outside Stockholm and ends some 150 kilometers to the south, in the town of Linköping, in Eastern Middle Sweden.

The railway affects more than 500 prehistoric sites: settlements, grave fields, celtic fields, pre-historic castles and so on. Since the first field surveys started in the early 2000's hundreds of Mesolithic sites have been discovered. Now, more extended excavations just have started, and we expect some hundred Mesolithic sites to give us new information for the first pioneers to the arrived at the scattered islands in the peninsula ca 10 000 cal BC to the Neolithic farmers to settle in 3900 cal BC.

Except the many excavation there also is a vast paleoecology project giving a helping hand to understand land uplift and landscape transformation.

The Eastern Link project gives us a great opportunity to really understand people acting and reacting to the constantly transforming Mesolithic landscape in Eastern Middle Sweden.

**Keywords:** Eastern Middle Sweden, infrastructure project, pioners, neolithic farmers, transformation

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# Towards a history of the British Mesolithic

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The British Mesolithic has often been treated as a period without history, where the only significant change is from an early Mesolithic characterised by highly mobile big game hunters to more sedentary marine-focused late Mesolithic. This presentation presents the results of a new British Academy funded project which has aimed by contrast to understand temporal change over this period on a centennial scale. This has involved collating all existing radiocarbon dates for the period and commissioning new dates for certain key sites. The patterns that have emerged are illuminating. In the early Mesolithic, different waves of colonisation can be discerned by groups with different cultural practices. A new Middle Mesolithic phase emerges, characterised by new ways of engagement with the landscape including the erection of large buildings and monuments. Similarly, significant temporal and regional differences can be seen in the late Mesolithic. As well as broader scale temporal patterns, smaller shifts took place on a centennial scale: for example mortuary practices change over the few centuries between the early and middle Mesolithic, relating to changing beliefs surrounding death and the afterlife.

**Keywords:** Radiocarbon dating, typochronologies, social transformations

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\*Speaker



# Reconstructing palaeolandscapes: new perspective combining geophysics and excavations

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Geophysical surveys for archaeological research became very important for detecting key targets and also environmental changes. Modelling the results can be useful to imagine and reconstruct the environment and conditions at the time of occupation. We present an examples of a 3D reconstruction of the environment using geophysical methods. The case study is the ancient lake Duvensee, one of the best known archaeological sites of the Mesolithic in Germany. The comparison between archaeological excavations and geophysical GPR surveys has allowed a reconstruction of the palaeoenvironment during the Preboreal and Boreal helping the archaeological research to understand the evolution of the lake basin. From the GPR reflection data we created a 3D model of the lake area showing five islands hosting Mesolithic camps. The locations of the islands and their estimated dive-up times agree with the spatio-temporal pattern of the previous archaeological finds. The model shows where Hunter-gatherers could settle and move from one island to another following the shorelines of the overgrowing lake. Moreover, the combined use of different geophysical methods (GPR, ERT and SH Seismics) and stratigraphic information from corings provided the results to identify almost the complete stratigraphy of the basin.

This study will also provide a very important planning tool for searching large scale palaeolandscapes and a multidisciplinary approach to reconstructing prehistoric landscapes and cultural transformations.

**Keywords:** Geophysics, Mesolithic, 3D reconstruction, settlement archaeology, corings

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# Organic chemistry and magnetic susceptibility to characterize Late Mesolithic (ca. 8400-7000 cal BP) palaeoenvironmental conditions in the Sado Estuary, Portugal

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Late Mesolithic hunter-gatherer communities (ca. 8400-7000 cal BP; ca. 6450-5050 cal BC) occupied the inner areas of the Tagus and Sado rivers (Portugal) during the Early-Middle Holocene transition. At that time both river valleys were flooded by marine ingression due to the rapid Holocene sea-level rise that occurred until ca. 7000 cal BP, forming large estuarine areas with favourable conditions for occurrence of marine/estuarine species.

The palaeoenvironmental characterization of the Tagus estuarine system shows that, during the Mesolithic occupation, shell middens were placed in the proximity of saltmarsh environments and near the upstream limit of tidal influence. The deceleration of the sea-level rise at ca. 7000 cal BP led to a relative increase in the fluvial sediment supply. However, despite the fluvial influence, estuarine conditions prevailed in the area of the Tagus that was occupied during the Late Mesolithic (e.g. Muge tributary) until ca. 6000 cal BP, long after the disappearance of these hunter-gatherer communities.

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In the Sado estuary, the information is scarce thus far. Electrical Resistivity Tomography (ERT) profiles were performed to characterize the Late Quaternary palaeovalley morphology. Results revealed a deep channel reaching ca. 40 m below mean sea level (MSL) while tributaries accomplished shallower valleys. Analyses performed in sediment cores collected in the Sado channel show that estuarine conditions prevailed in the area until ca. 3300 cal BP at Arapouco (the most downstream studied area ca. 50km upstream the river mouth), and were identified ca. 4400 cal BP at Laxique (the more upstream studied area ca. 65 km upstream the river mouth).

According to the ERT profile, the Carrasqueira tributary palaeovalley, located near the Arapouco shell midden, reached ca. 15 m depth near its mouth. A 13.5 m sediment core (Arez) was collected on the alluvial plain of the Carrasqueira stream at ca. 2 m above MSL with the aim of characterizing the palaeoenvironmental conditions in the Sado valley during the Mesolithic occupation and its evolution through the Holocene.

In this work we present the preliminary results of the multi proxy analysis (texture, magnetic susceptibility and organic chemistry) performed on the Arez core combined with  $^{14}\text{C}$  dating.

Radiocarbon dates performed on bulk organic material at 10.5 m (median value of 8860 cal BP) and 7.5 m (median value of 7120 cal BP) below MSL indicate that sedimentation occurred since the Early Holocene and the sedimentary column covers the timespan of the Late Mesolithic occupation.

Modern materials such as plastic occur on the top 50 cm of the core pointing to recent anthropogenic influence probably related with rice planting known to occur in the valley at least since the 18th century.

The sediment is essentially composed by mud ( $< 10\%$  of sand).

Magnetic susceptibility (MS) values lower than  $50 \times 10^{-5}$  SI were measured in almost all samples, with exception of a peak reaching ca.  $560 \times 10^{-5}$  SI at ca. 10 m below MSL and of several ( $n=10$ ) other peaks reaching values between ca.  $100 \times 10^{-5}$  SI and  $200 \times 10^{-5}$  SI scattered over the sedimentary column. The higher MS values are most probably the result of the input of terrestrial magnetic material brought by the fluvial system to the studied area during periods of higher river flow.

Stable carbon isotopes ( $\delta^{13}\text{C}$ ; varying between -26.1 and -23.0) and the C/N ratio (varying between 10.8 and 17.0) point to the prevalence of estuarine conditions in the entire sedimentary column until, at least, 2 m core depth (top 2 meter sample analysis still on-going). The estuarine conditions are accessed by comparison with values determined in different environments of the present-day estuary.  $\delta^{13}\text{C}$  presents higher values between the core base (10.5 m below MSL) and ca. 7.5 m below MSL pointing to important environmental changes since ca. 7100 cal BP most probably as a response to the deceleration of the sea-level rise.

Although estuarine conditions are known to occur at upstream areas of the Sado valley, the maximum extension of the estuary is still unknown.

**Keywords:** Early, Middle Holocene, Palaeoenvironmental conditions, Landscape evolution, Sediments

# Fire, fuel and food: perceptions of the environment in early Mesolithic Arctic Norway

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Starting from the evidence for Early Mesolithic fireplaces (9500-ca 8000 cal BC) along the Norwegian coast, this paper will discuss the extent and purpose of the fires, the implication for interpretations of food preparation and the wider relevance of the conclusions for how these early foragers perceived the environment, in particular the emerging boreal vegetation. The charcoal from fires indicates extensive use of brushwood and some driftwood. There is little evidence of substantial use of bone or blubber as fuel. The fires appear to have been small, which suggest that food preparation only to a limited extent depended on open fire. Instead raw, fermented, dried or possibly smoked fish, blubber, fat and meat must have dominate food preparations. These food habits dominated northern Fennoscandia well into historical time. If food preparation required limited actual cooking, and wooden fires for also heating and light were limited, then this had impact on the perception of the surrounding vegetation, which was not predominantly interacted with for fuel, but rather for wayfinding, shelter and tools.

**Keywords:** fireplace, fuel, food preparation, perception, coastal, Arctic

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\*Speaker

# A multi-proxy research program to evaluate the relationship between Mesolithic occupation patterns and Early Holocene environmental dynamics in the Upper Vinalopó Valley (SE Iberian Peninsula)

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Understanding the variable impacts of Early Holocene climatic and environmental changes on Mesolithic communities is often challenged by the paucity of integrated projects analyzing human and climatic systems. In this paper, we present a synthesis of a multi-proxy research program designed to evaluate the relationship between human occupation patterns and Early Holocene environmental dynamics at local scale in the Upper Vinalopó Valley, one of the most arid areas of Iberia. Two open-air Mesolithic sites -Arenal de la Virgen and Casa Corona- placed on aeolian sand deposits have been extensively excavated in the context of the ERC project PALEODEM (Ref.683018). Particularly, the open-air site of Arenal de la Virgen has produced well stratigraphically constrained radiocarbon chronologies of Mesolithic occupations featuring domestic structures and lithic assemblages during the Early to Middle Holocene transition. In addition, a multi-scale research line, including geochronology and high-resolution geoarchaeological techniques, has been developed to (i) study the genesis the formation process of the continental aeolian deposits and its paleoclimatic significance and (ii) analyse the site formation processes of both archaeological sites and structures. Finally, palynological, geochemical and micro-fossil evidence obtained from the investigation of two off-site records -Villena Paleolake and Salines Playa lake- is provided to clarify changes in vegetation cover and the paleohydrological regimen in the area of study. Our results indicate a persistent influence of aridity throughout the Early Holocene in this area with punctuated peaks around the 8.2 kya cal BP affecting vegetation dynamics and lowered hypersaline lake levels. This environmental change is correlated

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\*Speaker

with a significant decrease on the archaeological signal as inferred by the interruption of the Mesolithic occupations at the Arenal de la Virgen site and decline of artefact accumulation rates in Casa Corona.

**Keywords:** Mesolithic, Settlement patterns, Paleoecology, Geoarchaeology, Iberian Peninsula

# Hunter-fisher-gatherers and the changing environment, c. 9000–7600 cal BP. A case study from central Scandinavia

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The prominent and short-lived 8.2 ka event and its impact on hunter-fisher-gatherers populations has been discussed by many scholars in recent years. Studies from various regions across Europe link changes in the archaeological record to the climate induced changes in the environment following the 8.2 ka event.

This paper presents a case study from central Scandinavia – a geographically diverse area encompassing rugged coastlines, inlets and narrow fjords, large river and valley systems, lakes, high mountains and mountain plateaus, marshlands and lowland plains. The area is characterised by highly seasonal environments and the local climate conditions vary considerably. The 8.2 event is detected in several palaeoenvironmental proxy records in central Scandinavia and inferred temperature reconstructions indicate a temperature drop around 8200 cal BP. Further, there is a reduced pollen production in a number of thermophilous broad-leaved tree species due to unfavourable climatic conditions. These conditions affected the resource availability in the case study area, as well as reducing the carrying capacity in certain environments.

Recent archaeological studies from various parts of Scandinavia indicate an increasing regionalisation during early Holocene and that the hunter-fisher-gatherer population was structured into several subgroups characterised by a low-residential mobility, diverse cultural adaptations and vast social networks. By applying a multilateral approach, this paper will explore differential strategies for dealing with climate induced changes in the environment among hunter-fisher-gatherer groups in central Scandinavia.

**Keywords:** 8.2 ka event, central Scandinavia, human responses to climate change

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\*Speaker

## 8.2 ka event in the Cantabrian region (N Iberia) from marine (oxygen isotopes on gastropods) and terrestrial (palynology) proxies: implications for Mesolithic populations

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One of the most prominent short climatic events occurred during the Early Holocene was the so-called ‘8.2 ka cal BP event’. However, the information about this abrupt climate change and its implication for human groups in Iberia is still very scarce. This paper aims to improve our knowledge of climate variability in the northern Iberian littoral area, as well as the impact of this abrupt climate change for the last hunter-fisher-gatherers that inhabited the coastal areas during the Mesolithic period. To achieve this,  $\delta^{18}\text{O}$  values were obtained from subfossil shells of *Phorcus lineatus* (da Costa, 1778) recovered from the Mesolithic site of El Mazo (Asturias), a shell midden site with a high chronological resolution. The radiocarbon dates place the formation of the site between 9 and 7.5 ka cal BP, while palynological data contributed to add details on this study. Results showed that shells from units dated to around 8.2 ka cal BP recorded slightly cooler winters and summers than the rest of the sequence, suggesting thus that the 8.2 ka cal BP event had a certain impact on the oceanographic conditions in this area. The pollen record showed that the vegetation was clearly affected by this abrupt climatic change, showing a decline in arboreal taxa and the increase of herbs due to colder and drier climate conditions. Archaeological data showed how this abrupt climate change affected to demography of these forager groups along a narrow littoral platform, giving rise to changes in coastal resource exploitation patterns.

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**Keywords:** 8.2 ka event, N Iberia, Stable oxygen isotopes, Mollusc shells, Palynology

# The Early Mesolithic at ancient Lake Duvensee: Past, present and Future

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Ancient Lake Duvensee is one the prime areas for Early Mesolithic research in northern Germany. In this contribution we will give an overview over the past research and current investigations that are conducted within the Collaborative Research Centre 1266 "Scales of Transformation. Human-Environmental Interaction in Prehistoric and Archaic Societies". We will present results from archaeological and environmental research and show how the understanding of the area has changed over time.

With more than 20 sites from the Stone Age with a majority from the Early Mesolithic ancient Lake Duvensee presents itself as a pristine area for understanding Early Holocene human behaviour in the landscape. Due to good preservation conditions not only lithic artefacts were recovered but also several bark mats and different facilities for hazelnut roasting. This enabled us to develop high-resolution chronological and land use models.

We will show that a sole perspective on ancient Lake Duvensee is not sufficient for understanding the cultural landscapes Mesolithic people were living in. Rather the sites must be seen within a larger settlement system that was bridging beyond the lake. While only single and short occupation remains were left within the former lake area. Eventually, we plan to provide some perspectives for future studies at ancient Lake Duvensee and beyond and discuss a few aspects that already show great potential for future research.

**Keywords:** Early Holocene, land use, settlement systems, chronology

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\*Speaker

# Business as usual? Fishing, hunting and gathering through 3 millennia of climate change at the Mesolithic wetland complex Dagsmosse, eastern Central Sweden

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During the last decade, surveys and small-scale excavations at a peat extraction site in the bog Dagsmosse, Östergötland, east Central Sweden has unearthed a series of Mesolithic sites with well preserved organic remains. The encountered sites varies in character, while some can be classified as settlements, other are best described as activity areas, either on the shores or on the bottom of the former lake. The activity areas include both short-term sites like the spot where a specific animal was butchered, others contain the remains of repeated activities like fishing with nets, bone leisters or wooden fish traps. The material from the Dagsmosse complex, complemented by isotope data from the surrounding region, is discussed in relation to local, regional and global environmental changes.

**Keywords:** mesolithic wetland sites, fishing, gathering, hunting, bone tools, fish traps, fish nets

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\*Speaker

# Kožený Zámek: Archaeological and Paleoeecological Insight from a Late Paleolithic site in Kokořínsko, Central Bohemia

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Understandings of landscape use and environmental practice during the Late Paleolithic and Mesolithic of Central Europe are complicated by several geographical gaps in knowledge. One under-studied area is the regions adjacent to the Elbe corridor that would have connected Bohemia to a dynamic and changing world during the post-glacial transformation of Europe. Since 2017, we have been conducting systematic survey, which has identified several important sites in Kokořínsko – a landscape which drains into the Elbe river near to its confluence with the Vltava. In this paper, we present results from the excavation of Kožený zámek, a key site that we identified during this work, and analyzed through collaborative archaeological and paleoeecological perspectives. The site is a well stratified rock shelter located in an enclosed valley and has occupations that span the Modern period to the Late Upper Paleolithic. In our presentation, we focus on stratigraphic interpretations and C14 dating of a series of superimposed hearth features that date from about 9800-10,800 cal BC. Analysis of lithic, malacozoological and archaeozoological collections from these layers at Kožený zámek offer a rare glimpse into local practice and environmental changes during the Pleistocene/Holocene transition. Late Paleolithic contexts are quite rare in Bohemia. From a regional perspective, we consider the insight that Kožený zámek offers for questions of continuity between Late Upper Paleolithic and Mesolithic in Central Europe.

**Keywords:** central Europe, rockshelter, hearths, C14 dating, environmental data, stratigraphy

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\*Speaker

# Pressure lamellar production as an adaptive choice in Mesolithic-Eneolithic of south-western Ukraine

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The origin of pressure technique in Mesolithic was actively discussed during the last decade. Several hypotheses were put forward. On the other hand pressure technique plays a certain role while detecting "Mesolithic heritage" in Neolithic contexts.

Most authors search for origin of pressure technique in terms of centers of innovative discoveries. However, reception of new technological hint could not be a mere adoption. This technique should find some systematic correspondences in technical sphere of a recipient society. There should be an internal need for application of innovative technique even if it was already used by some neighbors.

Several collections from Mesolithic-Eneolithic Ukraine were studied from this point of view. It appears that pressure technique originated quite early here, at least, in VIII mill. BC as evidenced by materials of Myrne, Kamyana Mohyla 1 etc. Bearers of Criș and Linearbandkeramik cultures also employed this technique to limited extent, in peculiar, "frontier" contexts. A revival of pressure lamellar production is seen during Precucuteni expansion (4800-4400 calBC). This pattern of "blinking presence" is poorly consistent with cultural-historical explanations based on transmissions, inheritance and cultural contacts. It seems that pressure technique was recalled from latent technological repertoire of prehistoric craftsmen in a situation of need. Looking for common grounds in various episodes of pressure technique resurrection, one can search for common environmental and societal variables. At the moment it appears that pressure technique was needed to provide an economic and optimal (but labor-demanding) utilization of the smallest possible volumes of raw material. This feature was required under conditions of uncertainty of raw material acquisition and increased mobility of population. Such situations were observed 1) during the "green revolution of the Early Holocene; 2) in the "frontier" zones of expanding Neolithic communities; 3) during crisis of logistical networks for raw material acquisition at the fringe of Eneolithic.

**Keywords:** Lithic technology, social interpretation, environmental constraints, resources availability

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\*Speaker

# Eastern European Mesolithic in the forest-steppe of the Volga basin: new results

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The Middle Volga Basin is part of the Eastern European Forest Steppe Zone. For a long time, the Mesolithic period in this region remained poorly studied. Only a few places were known, neither absolute dates nor paleo-ecological data were obtained. The situation has changed only in the last five years, when new sites were discovered and natural science analysis was applied. Mesolithic assemblage of Staro-Tokskaya site was attributed to early Mesolithic based on stratigraphic observations (Mesolithic finds were deposited on the depth of 2 m in the clay loam layer) and technological features of flint complex. Fragment of bone knife was dated to  $9243 \pm 33$  (Hela-4487). Results of pollen analysis allowed reconstructing arid conditions and poor forest cover during Mesolithic period coinciding with Boreal time. Only about 5% of the pollen in the spectrum is represented by wood species, wormwood dominated, which corresponds to the semi-desert zone.

Flint assemblage includes 3000 objects, blades (more than 50%) dominated. They were used for manufacture of more than 90% of all tools. Cores were pencil-shaped, prismatic and conical. Different types of tools were identified: end-scrapers, borers, burins, blades with marginal retouch. A high number of medial parts of blades testify to a significant role of inset technique. The closest analogies for these materials can be found within the Southern Ural assemblages.

Krasny Yar I and Kochkari I sites are attributed to the Late Mesolithic. Kochkari I site can be dated to the beginning – middle of the 7th mill BC based on a number of radiocarbon dates. Significant climatic changes can be reconstructed for this time in the forest-steppe Volga area based on pollen analysis. Amount of wood species increased (30-40%), herbaceous species decreased, large areas were occupied by meadows (50-60%). Thus, climatic conditions became more humid and favorable in the beginning of Atlantic in this area. The number of blades decreased in the Late Mesolithic (30-35%). Medial parts, served as insets, still dominated. Conical and edge-faceted cores dominated. More than 50% of tools were produced on blades, also several tools were noted made on flakes, rarer – on generalized flakes. Wood-working stone tools became widespread.

The first Neolithic societies (Elshan Culture) appeared here in the first half of the 7th mill BC on a series of radiocarbon dates. It is assumed that their origin is related to the Central Asian region and the culture of the Celteminars. Thus, Late Mesolithic and Early Neolithic societies coexisted in this region in the first half of the 7th mill. BC. However, significant differences can be noted for the Neolithic Elshan and Mesolithic flint assemblages.

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\*Speaker

A small number of blades (about 7%) and blade instruments (about 10%) were recorded in the ensembles of the earliest monuments of the Elshan culture. Informs cores dominated. The greatest number of scrapers, pickles and drills were made on flakes. The arrows, not known in Mesolithic ensembles, were found in early Neolithic places. All this indicates a lack of significant contacts between Neolithic novices and local Mesolithic inhabitants in the first half of the 7th mill. BC. It is possible to assume that Mesolithic communities were gradually replaced by the Early Neolithic communities that arrived in the forest-steppe zone of the Volga region. This work was supported by the Russian Science Foundation (project 19-78-10001) "Ethnocultural interaction of the Middle Volga region population in the Stone Age (Mesolithic-Eneolithic)".

**Keywords:** Russian Eastern Europe, forest, steppe Volga region, Mesolithic period, paleoclimatic definitions, radiocarbon dates, flint industry

# The end of the "Epi-Mesolithic" and Mid-Holocene environmental changes in the Eastern Gulf of Finland

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Early and Middle Holocene environmental changes well-correlate with social and cultural transformations in the eastern part of the Gulf of Finland (Gerasimov, Kriiska 2017). Pottery appeared in the region after the Littorina transgression maximum (about 5500 BC), several centuries later than in the surrounding territories. But beside this innovation (although rather sufficient) all the main cultural characteristics remained unchanged, including lithic (and probably bone) industry(es), settlement pattern (and structure?), subsistence strategy and intro- and interregional communication networks. These characteristics of the "Early Pottery Time" were considered by some (mainly Western European) archaeologists better fitting to Mesolithic than to Neolithic units of periodization (e.g. Kriiska et al. 2018).

In the Early Pottery Time two different pottery traditions were presented in the Eastern Gulf of Finland – Narva and Sperrings cultures. In the beginning of the 4th ka BC the so-called Typical Combed Ware spread in the region. Rather high level of standardization in pottery-making technology, vessels' shapes and ornamentation within the whole region can be considered as an evidence of a kind of social integration of this territory by certain social processes which took place in the end of Atlantic period. Interregional exchange activity increased at that time. A large number of items made of Baltic amber appeared in the Gulf of Finland region, as well as far outside of its boundaries. Also amount of flint artifacts increase in collections from Typical Combed Ware contexts. Those and other obvious changes in archaeological records allowed considering the time of Typical Combed Ware as the beginning of the "real" Neolithic (e.g. Nordqvist 2018). Social and cultural transformations that accompanied spreading of Typical Combed Ware not only intensified and enlarged interregional exchange, but also somehow suppressed certain previously well-pronounced cultural peculiarities – decreasing of using of asbestos temper in pottery making is a good example.

Results of multi-proxy studies of more than ten multilayer archaeological sites in the Karelian Isthmus and in the Ladoga Lake area, also reference sites from the neighboring territories allow discussing the role of climatic events in the "undoubted end" of Mesolithic of the Eastern

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\*Speaker



Gulf of Finland. The abrupt climatic changes can be dated around 3500-2300 . It was a crucial period in the life of societies in this area.

The study was performed within the project "Phenomenon of Asbestos Ware in pottery traditions of Eastern Europe: making and use technology, structure of interregional contacts" supported by the Russian Science Foundation, #19-18-00375.

**Keywords:** Mid Holocene environment, Typical Combed Ware, asbestos, the Eastern Gulf of Finland, the Karelian Isthmus, climatic changes

# The archaeological evidence for fishing in the Mesolithic of North Angara (Baikal Siberia)\*

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Up to the present, the territory of North Angara was one of the most poorly archaeologically studied regions of Baikal Siberia, mainly a result of its large scale and inaccessibility. The rescue field work conducted by the Institute of Archaeology and Ethnography SB RAS Boguchan expedition (2007–2012) provided a large amount of archaeological data to study the historic and prehistoric heritage of this area. The region is situated on the north boundary of Baikal Siberia and includes the territory of Lower and Middle Angara and the Lower Ilim Valley. The North Angara belt is located between 55 and 60° N, and 90 to 105° E. Most of the territory is covered with boreal forests, larch being especially abundant. It features a dense network of rivers, small to large, the Angara providing the main artery fed by a large number of rivers. The Angara was characterized by incised braided channels (parallel-branching types) with many islands of different genesis, structural levels and morphodynamical types, many rifts, swift waters, and variables currents from fast to slow water. Up to now, 17 sites containing materials from the Middle-Final Mesolithic have been recorded in the North Angara region. Archaeologically recorded traces of fishery have been found at seven of them: Ostrov Listvenichnyi Points 1 and 2, Ust-Yodarma II, Ust-Keul I, Ust-Igirma, Ust-Kova I, and Vorobyievo. In the materials of last three sites, the finds traditionally associated with fishing are represented by a horn "beater" (Ust-Igirma), a fragment of a barbed point (Vorobyievo), and isolated remains of ichthyofauna (Ust-Kova I). At other mentioned sites, the evidences of fishery are representative and show the presence of this economic activity, and also its role in the subsistence system and strategies of the ancient population in the northern Angara region. The Final Pleistocene to Early Holocene horizons of these sites contained relatively numerous diagnostic remains of ichthyofauna and fishing gear. From the analysis of ichthyofauna remains, the relationships demonstrating two different fishing strategies between the recorded species have been plotted. The first one, combining materials from Ostrov Listvenichnyi, Point 2 (layer 5), Ust-Keul I (layer 8), and Ust-Yodarma II (layer 9) shows a predominance of sturgeons (*Acipenser*) in the composition of catches. The second strategy is observed with respect to the materials of Ostrov Listvenichnyi, Point 1 (layer 2). Here, the catches were dominated by burbot (*Lota lota*), sturgeons and pike (*Esox lucius*) took the second place. In addition, bone remains of taimen (*Hucho taimen*), perch (*Perca fluviatilis*), cisco (*Coregonus pidschian*), roach (*Rutilus rutilus lacustris*), ide (*Leuciscus idus*), and dace (*Leuciscus leuciscus baicalensis*) were recorded in this assemblage, whereas at other Mesolithic sites, the four last-mentioned species are absent. The data on layer 10 at Ust-Keul I, where an almost identical situation (though with a predominance of pike) is observed, can be assigned to the

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same strategy. Archaeologically recorded fishing tools at the sites where the first type of strategy has been revealed include barbed points, bait fish, and component parts of fish hooks. The functional connection between the barbed points and bait fish is described in detail and traced in numerous examples from the fishing practice of ethnographically recorded North Asian-North American communities of hunters and fishers. Owing to its small size, the composite fish hook from Ostrov Listvenichnyi, Point 1, is associated with catching fish with small mouth cavities. In this case, cisco and roach recorded at the same place can be assigned to such fish. However, a wide range of represented species points to the fishery with the use of enclosures and traps. It can be assumed that the second strategy was related to angling and setting traps. Thus, it can be assumed that the ancient population of the North Angara region had a complex system for the differentiated exploitation of fishery resources, which included various catching techniques in the Mesolithic. These fishing patterns can largely be explained as hunter-gatherers' response to minimize the risks of failure inherent to seasonal resource procurement in the boreal zone of North Asia. \*The reported study was funded by RFBR, project number 19-39-90006

**Keywords:** Baikal Siberia, North Angara region, Early Holocene, Mesolithic, fishing, hunter-gather adaptive strategies, ichthyofauna, resource procurement

# Environment and firewood use at Tourasse cave (South-West France) around the Late Glacial-Holocene transition

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The aim of this paper is to present new data on vegetation dynamics and firewood collection practices during the Late Glacial and the Early Holocene in South-Western France. Tourasse cave is located in the Pyrenean foothills, where the Azilian cultural complex was initially defined. Charcoal analysis was performed on its Azilian (ca. 13000-11500 cal BP) and Sauveterrian (ca. 10500-9000 cal BP) levels, excavated during the 1980’s and 1990’s and currently being revisited with additional multidisciplinary analyses. Our results evidence a closing environment with the gradual passage from an open shrubland to the mixed oak forest, speaking in favor of the biochronological coherence of this sequence. However, marked differences in taxonomic richness and state of the wood from one level to another, unrelated to the prevailing environmental conditions, suggest variable behavior towards wood that could result from differing mobility strategies, hearth functionalities or taxonomic preferences.

**Keywords:** Charcoal analysis, firewood, Late Glacial, Mesolithic, South West France

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# Forests, wild game and humans -paleoecological aspects of large herbivore foraging reflected in stable isotopes and dendrological indications of bark-stripping and its implications for Mesolithic hunting

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The submerged seascapes with refuse layers containing animal bones and *in situ* standing rooted pine trees from the low-stand sea level of the Baltic Sea at Haväng in southeastern Sweden reveals paleoecological conditions for animals and humans in the Early Mesolithic coastal zone. Stable isotope signatures ( $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ ) of bones from large herbivores (aurochs, moose and red deer) have been analyzed in order to study foraging habitats over time from the open woodlands of the Late Preboreal (ca 8 600 BC) to climax forest of the Late Atlantic Chronozone (ca 5000 BC), but also between the coastal and inland zones. The result indicates changes of foraging habitats related to increasing forest cover/canopy effect ( $\delta^{13}\text{C}$ ), but possibly a more open forests in the coastal zones. All three taxa of large herbivores seem to have responded differently to changes of forest environment reflected in their foraging ( $\delta^{15}\text{N}$ ). Dendrological damages on submerged pine trees reflecting bark-stripping by large herbivores have resulted in new approach to study densities of Mesolithic wild game populations and indicates relatively high abundance of large herbivores in the coastal zone during the Early Mesolithic. The impact of the environmental changes on the populations of large herbivores and its implications for the hunting by the Mesolithic hunter-gatherers will also be discussed.

**Keywords:** Paleoenvironment, wild game, stable isotopes, bark stripping, zooarchaeology, South Scandinavia

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# Accommodate or relocate. Adaption strategies to shore level displacement in eastern Norway during the Mesolithic

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Present-day global warming has great consequences, both for individuals and on a larger scale. However, environmental changes also affected people's everyday life in the past. The purpose of this paper is to discuss how Early Holocene populations coped with landscapes in transformation. In the Oslofjord area the shorelines moved from approximately 200 to 40 above present day sea level during the Mesolithic (c.9300–3900 cal BC), and shore line displacements and landscape changes were thereby also a key factor for the population that lived in the regions archipelago landscape. Based on analysis of 535 critically selected Stone Age sites and excavation results from the centrally positioned residential area Havsjødalen in Norway, the author discuss four common adaption strategies to a changing sea level, both for single sites and regionally; to accommodate, relocate, protect, or not respond to the changing environment.

**Keywords:** Adaption, environment, Scandinavia, shorelines

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\*Speaker

# Vegetation dynamics, landscape and climate change in northern Iberia during the Mesolithic: archaeobotanical data from the shell midden of El Mazo (Asturias, Spain).

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El Mazo rock-shelter (Asturias, Northern Spain) contains a Mesolithic shell midden with a high chronological resolution, which offers great possibilities as an empirical scenario to develop palaeoenvironmental investigation. This study aims to approach vegetation dynamics and the exploitation of plant resources during the Mesolithic in the Cantabrian region and to assess the existence of the 8.2 ka cal BP abrupt climate change on this period. The results presented here are the outcome of archaeobotanical interdisciplinary studies where micro-remains (pollen, spores and non-pollen palynomorphs) and macro-remains (woody and non-woody charred plant remains) analyses have been combined with archaeological knowledge.

The main results show the predominance of deciduous forests at the beginning of the sequence, with oak, birch and hazel as the main species. The almost exclusive use of oak wood and hazelnuts is a clear reflection of the surrounding forest. The units dated around the 8.2 ka cal BP event show how vegetation was affected by this abrupt climate change, showing a clear decline in arboreal pollen due to new drier and colder climate conditions. On the contrary, there is an increase of herbs and other elements that would indicate degradation processes in oak forests. Regarding forest resources, there are not significant changes, as oak wood is still the most used. However, hazel increased its values in this period. After the occurrence of the 8.2 ka cal BP event, most of the mesophyllous forest taxa and their characteristic floristic courtship recover to their initial values. Once the period of destabilization caused by the aforementioned abrupt climate change had passed, the forest recovers its initial state of equilibrium, once again dominating the deciduous woodlands.

**Keywords:** Archaeobotany, climate change, 8.2ka event, Mesolithic, N Iberia.

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\*Speaker

# Socioeconomic, Technological and Cultural Adaptation of the Mesolithic population in Central-Eastern Cantabria (Spain) in the Early and Middle Holocene

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Research in the centre and east of Cantabria has studied the adaptations of Mesolithic populations to the environmental changes that took place in the early and middle Holocene owing to the rise in temperatures after the Last Glacial Maximum. Deglaciation not only resulted in changes to the coast line, but also freed mountain areas of snow and ice, opening up new territories to be occupied and compensating for the loss of land on the coast.

256 shell-middens have been documented in the region between the Ria de Suances in the west, the limit with area of the Asturian Mesolithic, and the Ria de Ontón in the east, on the boundary with the Basque Country, and from the coast to the Cantabria Mountains in the south. In a chronological framework between the ninth and sixth millennia cal BC, 49 dates have been obtained for 31 sites.

The documentation of these sites and the information provided by archaeological excavations in 18 deposits has shown how the economic model adapted to the diversity of the new landscapes and the exploitation of marine and woodland resources. Variability is seen in the consumption of marine molluscs depending on the distance of the site from the coast and their replacement by terrestrial gastropods in inland and mountain areas.

Changes are also seen in the technology and settlement pattern; the latter connected with the use of different seasonal resources derived from the environmental changes and probably the population density, which led to certain sedentarisation. The distribution of the population was influenced by the cold climate events between 9.9 and 9.5 ka BP, related with the GS1, and in 8.2 ka (8.4-8.0 ka BP) (GRIP), which is identified by the abandonment of occupation sites.

**Keywords:** Keywords: Palaeoenvironmental change, economic strategies, sociocultural adaptation.

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\*Speaker



# Socio-ecological impact of last volcanic eruptions in the Iberian Peninsula in the Late Glacial- Early Holocene transition: multi-proxy analysis results from Pla de les Preses palaeolake (Vall d'en Bas, La Garrotxa, NE Iberia)

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Successive lava flows in the La Garrotxa volcanic region dammed the Fluvià river and lead to the formation of a lacustrine basin in the deepest part of the Vall d'en Bas valley (La Garrotxa, NE Iberia). The last flows were likely associated with the most recent eruptions from the Croscat (15,710-13,160 cal BP; Puiguriguer et al., 2012) and the Puig Jordà volcanos (17,000 BP; Bolós et al., 2014).

In this work we present the results of multi-proxy analyses (sedimentology, XRF geochemistry, pollen, sedimentary charcoal, and plant macrofossils) on a 15 m long sediment core (PdP; Pla de les Preses) from the Vall d'en Bas lacustrine basin that spans across the Late Pleistocene-Holocene transition. The analyses enabled both the identification and age assessment of volcanic eruptions in the La Garrotxa volcanic region, and the reconstruction of palaeo-environmental changes that are important to evaluate environmental constraints for the development of the last Mesolithic hunter-gatherer communities in NE Iberia.

We found that the most recent eruptions occurred around the Late Glacial-Holocene transition, i.e. some millennia later than previously thought. In addition, the record shows the local-scale environmental impacts of rapid climate change episodes and of volcanic eruptions, both in terms of changes in sediment composition and the occurrence of fire episodes affecting vegetation. The PdP core thus represents a key record to understand palaeo-environmental dynamics and ecological changes when the last volcanic eruptions occurred in the area of La Garrotxa.

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<sup>\*</sup>Speaker

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**Keywords:** Iberian Peninsula, vulcanism, vegetation, pollen analysis

# Time depth in changing environments – From Early Mesolithic coastal sites to strategic observation points in the hinterland in later Mesolithic times

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Throughout all of the Mesolithic, glacial retreat, isostatic rebound and sea-level changes have continuously changed the coastal areas of Southeast Norway. Constantly retreating coastlines led to the replacement of human activity connected to marine exploitation, manifested in an overall relocation of coastal sites following the shoreline. The significance of coastal resources for hunter-gatherer economy has been an important research topic in recent years. Little attention has however been paid to the marked growth of landmasses that took place at the same time, and to Mesolithic people's experience of the growing areas of dried out land. The use of these coastal hinterland areas and people's adaptation to them has hardly been studied. This talk deals with the emergence of the coastal hinterland and its archaeological significance. Starting point are a number Early Mesolithic settlements/occupational sites, which today are located inland, but which in Early Mesolithic times were placed directly at the coast and very close to deep sea beds. Radiocarbon dates from hearths on these sites exhibit often later Mesolithic dates – despite the typical Early Mesolithic artefacts. These late dates have hitherto been considered as outliers, interpreted as signs of later forest-fires. GIS-modelling of the topographic character of the placement of these sites against the backdrop of land-upheaval processes that transformed these coastal areas through time indicates that they were placed at potentially excellent view-points overlooking marked valleys (former sea beds, now placed several kilometres from the coast) at the times of these later Mesolithic dates. Thus, these later radiocarbon dates might indicate a pattern of Late Mesolithic hinterland sites with excellent views, which might have served as places in a communication system, such as observation spots of human and animal movement. As places with a deep human and natural history, they might also have served as places of memory. Setting the coastal hinterland on the agenda adds a new dimension to our understanding of the diversity of adaptive strategies of coastal groups, and opens up new paths for a better understanding of the use of and movement in Mesolithic environments in general.

**Keywords:** Environmental change, coastal landscapes, hinterland use, re, use of sites, time depth, communication system

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\*Speaker

## **Session: Enculturating landscapes**

# The formation of River Motala Ström – the beginning of a river landscape and human presence in the early Holocene

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In conjunction with the extensive archaeological projects conducted at the current outlet of Sweden's second largest lake, Lake Vättern, macrofossil-, pollen- and diatom data have been studied from 14C-dated lake- and river sediments from River Motala Ström in Motala and Lake Boren. These investigations have revealed sedimentary evidence of the Yoldia Sea regression, the Ancient Lake Vättern transgression, and the following stepwise river formation process. Around 9000 cal a BC, two small kettlehole basins at Strandvägen and Kanaljorden became isolated from the Yoldia Sea. As the ice sheet retreated further north, the isostatic uplift isolated the Vättern basin from the Yoldia Sea. Due to the uneven isostatic uplift, the basin tilted toward the south and the Ancient Lake Vättern transgression started in Motala. The threshold in Motala at 92.5 m asl was reached around 7200 cal a BC, and River Motala Ström was formed. 14C-dated diatom records from Lake Boren, and shoreline deposits in Motala, confirm this event. The water level in Lake Vättern initially fell around 1.5 m, and around 5800 cal a BC a second erosional event cut down the threshold to modern day level. At this time, the settlements at Strandvägen and Kanaljorden were established and expanded.

**Keywords:** River Motala Ström, Lake Vättern, river formation process, Strandvägen, Kanaljorden

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\*Speaker

# Marine Ventures – Comparing the Management of Resources, Mobility and Hazards in of Four World Corners

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In essence, ‘Marine Ventures’ is about the dichotomy that pertains to all human–sea enterprises: On the one hand, the marine realm is an affluence of affordances that humans strive to take part in. On the other hand, there are the hazards that follow in all human actions at sea. Human actions at sea depend on a vast repertoire of material devises, vessels to float, move and keep dry, and tools and facilities to acquire all that are sought in the blue deep. Likewise, all risk-minimizing strategies carry material memories, boats, garments, settlements in sheltered seas and adjacent to harbours. The deep-rooted dependency of ‘things’ in marine enterprises imply that *archaeology* and its enduring focus on human material remains and remedies offer feasible strategies to increase understanding and knowledge. Additionally, very few (if any) of marine ventures are independent of land support, bases to rest, maintain and supply equipment, procure resources. These are places of vital functions in most (if not all) marine endeavours, places that contain and concentrate things of human–marine relations, that also are places of archaeological interest and recognition. Land support sites are not randomly placed, but related to where resources are found, sea-faring routes or places of reduced hazards (sheltered waters, natural harbours, etc.). Thus, throughout deep time, large parts of human-sea relations have found their way to the archaeological record, and are possible to analyse by the discipline’s repertoire of scientific methods.

This is a point zero for all scientific enterprises in ‘Marine Ventures - Affluence and Hazards’. ‘Marine’ pertains to all that relates to the sea, ‘Venture’ to the fact that all human marine undertakings include risks, ‘Ventures’ in plural form in acknowledgement of a vast global variety.

Marine environments are extremely variable – amount and composition of resources, water temperature, weather and seasons, exposure and sheltering of seascapes and landscapes – and human-sea relations varies accordingly. This variation is at centre of our field of interest, and the base for the scientific network: Norway, Argentinean Tierra del Fuego, British Columbia in Canada and New Zealand. Deep-time studies of coasts and marine foraging suffers from the

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\*Speaker

global post-glacial sea level rise, that have submerged most shorelines prior to 5-6000 BP. The research areas are all regions where the archaeological record seems to reach the deep roots of marine foraging.

‘Marine Ventures’ embrace a number of specific and operational research packages aimed at designated data sets. However, research results all illuminate parts of the overall ‘machine’ that operates seascapes – humans as part of their environments.

**Keywords:** Marine Ventures, Seascape and Coastal Archaeology, Research network in Norway, Tierra del Fuego, British Columbia and New Zealand

# Diachronic trends in the Early Mesolithic site types of Norway

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The Post-glacial is a period of great changes in temperatures, landscape and resources. Studies of the conditions during the Early Mesolithic in Norway, show two important events: 1) A cold pulse, known as the Preboreal oscillation (PBO) c. 9300–9200 calBC, is identified by temperature drops on land and at sea, readvancing ice sheets and retreating forests. 2) Midway through the Early Mesolithic period, c. 8800 calBC, the Norwegian Atlantic Current was established, bringing warmer watermasses along the coast. This changed the marine environment and brought stable conditions for a new range of species. At the same time the fjords become ice free, air temperatures increase and larger tree stands establish on land.

Recent studies of adaptive strategies related to these climatic and palae-oceanographic developments along the coast of Norway have suggested that the toolkit used by the Early Mesolithic hunter-gatherers remained unaffected throughout the whole period. The settlement pattern, however, changed from being almost exclusively connected to the outer coastal zone in the first half of the Early Mesolithic, to being relatively more related to the mainland coast and sheltered coastal locations during the second half. It thus seems that generalized toolkits and flexible mobility systems were ways of coping with the changing environment.

In this paper, I explore if *site type* was also an active variable of their adaptive strategy within this period.

**Keywords:** Site types, Early Mesolithic, Norway, Marine environment, Coast

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\*Speaker



# Colonization and the enculturation of landscapes. A case from Mesolithic southeast Norway

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The concept of colonization includes not only the first scouting trips to unfamiliar landscapes. It also includes the gradual process of learning a new environment, incorporating it into the cycle of resource procurement and transforming it into a social landscape. People's knowledge of and connectedness to a particular environment is suggested to affect the ways in which they use a landscape and, ultimately, the archaeological remains of that use. Recent archaeological and genetic studies indicate a dual-route colonization of the Scandinavian Peninsula at the end of the last Ice Age: one from the south and a second from the northeast. In southeast Norway, these events took place within two very different contexts. Whereas the first included the settling of previously unoccupied landscapes, the second involved the occupation of areas already settled by local groups, factors that are suggested to affect the rate of landscape learning among hunter-gatherer populations. So far, however, for southeast Norway there have been few attempts to discuss what the consequences of colonization and enculturation processes would entail in a mobile Mesolithic society and in different contextual settings. In this paper, we will focus on intra site studies of lithic remains (MANA) from 30 sites dated between c. 9500-7000 BC, in order to discuss long-term variation of the technological organization, spatial behavior and land use among colonizing Mesolithic groups in southeast Norway. Further, it provides a basis for discussing the complexity of landscape learning and human-environment interactions.

**Keywords:** Colonization, Landscape use, Technological organization, Lithics, Mesolithic, Norway

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# Deep pits and Schlitzgruben in the Mesolithic in the northern half of France, crossed approaches

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Recognize deep Mesolithic excavations (cylindrical, conical profile, etc.) on preventive archaeological has been a remarkable achievement over the past ten years. These features are added to the precedently investigated U-, V-, Y-shaped pits / *Schlitzgruben* of later age (Late Mesolithic to Metal Ages) whose study benefited to these newly mesolithic excavations. Regional as national research projects published in two volumes (Achard-Corompt and Riquier 2013 and Achard-Corompt, Ghesquière and Riquier 2017) have highlighted the scale of the phenomenon. Geographically, even if the whole country is concerned, the majority of finds come from the northern half of France, notably the Grand-Est region. Faced with features providing little if any archaeological artefact except a few archaeozoological remains and microlithic tools (flake and bladelet), scientific advances were made only with the implementation of a precise search and sampling protocol supported by hundreds of radiocarbon dates.

Thus, a typo-chronology attempt was conducted from the corpus of 280 pits excavated in Recy (Marne) in 2013 and 2014. To date, the aim of mesolithic features is still debated, opposing the trapping of wild game to the storage of collected foodstuffs (shells...). As far as *Schlitzgruben* are concerned, the former is preferred.

Several peaks in the summed radiocarbon probability curve appear to reflect periods of high pit presence and others where they are almost absent. They have developed as soon as the Holocene transition period begins. Their appearance in the Mesolithic era coincides with the return of mesothermophilic edible fruit species (acorns, hazelnuts, chestnuts) that are potentially storable in pits. In the case of traps, their development in the Mesolithic period is certainly linked to the disappearance of large game herds (reindeer, horses, bison) in favor of more dispersed temperate species (deer, wild boar, aurochs, deer) and significant changes in the hunting activities. The transition from a cylindrical/conical pit shape to a slit shape, made during the First/Second Mesolithic transition, is also probably remarkable. At this time, the number of sites is strongly decreasing and we know that it would never reach again its level obtained during the early/middle Mesolithic. Climate change, drastic demographic decline (leading to climate change?), European-wide epidemic (as part of arrhythmic model of neolithization proposed by J. Guilaine?)?

Several hypotheses can accompany this transition to the trapeze lithic industries and diggers of *Schlitzgruben*.

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\*Speaker

Discussing about these features and the related social organization of mesolithic communities is at the root of this communication. Their impact on the implied sedentary lifestyle of these groups is also a matter of debate. Clearly, building structures of several cubic meters used to store food reserves and/or hunting pits (visible from the camps or the site catchment areas) has strong sociological consequences; at least it signs a possible emancipation from the food survival and an evolution towards more extensive and sustainable domestic settlements.

**Keywords:** Deep pits, Schlitzgruben, Mesolithic, sedentary, hunting, storage

# Depositionary Practices in the Landscape: New Research from the Vale of Pickering, UK

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There is now a significant body of evidence for the deliberate treatment and deposition of certain artefacts and materials during the European Mesolithic. In Britain, much of the evidence comes from the early Mesolithic site of Star Carr (N. Yorkshire), where large assemblages of animal bone, antler, and osseous material culture were deliberately deposited into wetlands adjacent to an area of settlement. The lack of comparable assemblages from sites in the surrounding area has led to Star Carr being seen as unique in its local landscape, which has influenced the way that we have come to understand the depositionary practices that were taking place. New excavations at the nearby site of No Name Hill have recorded evidence for the deliberate treatment and deposition of animal remains and other materials that are contemporary with the occupation of Star Carr. In addition, previous work by the authors has identified a suite of other practices at sites in the surrounding area. Bringing these together, we argue that practices of deposition extended across this landscape and formed part of people's daily interactions with plants, animals and other aspects of the Mesolithic world.

**Keywords:** Ritual, deposition

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# The defense residential complex Kayukovo 2 of the turn of VII – VI BC in the North of Western Siberia. Experience in reconstruction of architecture and planning structure.

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From the VII millennium BC, dozens of settlements, the number of which had been constantly growing without declining until the Middle Ages, appeared in the North of West Siberian plain. First fortified settlements with complex architecture precisely date back to this period. This phenomenon remained underexplored. Of greatest interest is the settlement of Kayukovo 2 at the turn of the VII – VI millennium BC. The remains of its constructions are still clearly visible on the surface. This monument has been partially studied by the excavations in 2000–02, 2018–19. The data obtained allowed to reconstruct its architecture. Precisely, in the last years, information was obtained on the presence of the wall structure surrounding residential buildings. A series of radiocarbon dates was also obtained, leaving no doubt about the age of the settlement. According to the engineering design, the Kayukovo 2 residential complex is being reconstructed as a wood-earthen construction. The planning structure was formed by a complex of five main buildings placed crosswise and surrounded by a wall structure around its perimeter. An extraordinary complex of objects was discovered during excavations. It is characterized by spherical conical vessels with a flat bottom and a symbolic ornament. Today it is the only monument of the VII – VI millennium BC in the North of Western Siberia with a regular planning structure which was studied through excavations. This phenomenon raises many questions, since initially the region was inhabited by collectives with an appropriating economy. One of them could have arisen exactly among hunters and gatherers of the North settlement with complex architecture.

**Keywords:** North of West Siberian Plain, Ob River, Bolshoy Salym River, Bolshoy Yugan River, Punsy yurts, early Neolithic, Kayukovo archaeological culture.

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# Mesolithic resource use inferred from DNA captured in birch tar pitch

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Ancient DNA investigations have immense potential in providing insights into early human demography and movements, but also into other species present in the proximity of human populations. In an earlier study we demonstrated the presence of human DNA in several pieces of Mesolithic birch bark pitch, most likely deriving from saliva. However, the DNA extracted and sequenced from the pieces is for a large part of non-human origin. Here we present the first results on DNA from animals and plants and discuss how these findings can be interpreted. The studied pieces of pitch derive from Huseby klev, a Mesolithic site excavated in the 1990s on the west coast of Sweden. The earliest context on the site, called the deep pit, is a transgressed layer dated to c. 8000-7500 BC and has a good preservation of organic material. Among the archaeological finds from the pit are more than 100 pieces of birch bark pitch. The forms of the pieces indicate variable ways of use, while c. 10% of them have imprints of teeth implying chewing. Many of them contain ancient DNA. Cooked food is less likely source for genetic material as DNA survives heating poorly, fresh food and other material is more likely. A clear possibility is the processing of materials in the mouth, such as softening skins and fibres by chewing. DNA from Mesolithic "chewing gums" thus yields information on both the environment and variable human activities.

**Keywords:** resource use, DNA, birch tar pitch, West Sweden, Huseby klev

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\*Speaker

# Eurasia's most ancient promontory fort? The 8000 year old hunter-gatherer settlement complex of Amnya in the Western Siberian taiga

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When and why do hunter-gatherers build fortifications? Which social constellations and societal processes can lead to defensive terraforming and enclosed settlements in mobile foraging groups? The emergence of fortified sites among Stone Age hunter-gatherers in the Western Siberian taiga in the 7th-6th millennium BC represents one of the earliest instances of communities enclosing and fortifying their settlements worldwide. These early enclosed sites coincide with a range of other innovations that bear witness to substantial sociocultural and economic changes in the forager lifeways, among them the appearance of pottery vessels, the foundation of sacrificial mounds, and a decrease in residential mobility. Thus, the Stone Age fortified hunter-gatherer settlements of Western Siberia are part of a set of socio-economic and technological innovations demarcating a phase of accelerated cultural change that at the moment is only partially understood. In this talk, we present new research on these questions based on the investigation of Amnya 1, one of the oldest and most prominent of these Early Holocene hunter-gatherer complex sites. The settlement is located on a promontory above the River Anmya and has three lines of defense consisting of palisades, banks and ditches, and ten pit house depressions. Ca. 50m beyond the fort a contemporary unenclosed bailey with further pit house structures bears witness to potential complex social constellations. Previous excavations in the 1990s confirmed the chronological setting within the earliest pottery phase in this region around 6,000 cal BC. New multidisciplinary research at this exceptional complex started in 2019 within the frames of a Russian-German project. The generation of 3D surface models, stratigraphic investigations, sedimentological and archaeobotanical studies, the elaboration of the site chronology by AMS dating, as well as analyses of previous and new finds are conducted in order to generate new topographical, environmental and chrono-typological data. Based on this fresh information, we evaluate the significance of Amnya and further similar sites within a emerging system of Early Holocene hunter-gatherer complexity in the taiga zone. Taking into account archaeological and ethnohistoric information from various parts of the Northern hemisphere, the study of this phenomenon contributes to a new framework of emerging hunter-gatherer social diversity.

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\*Speaker

**Keywords:** Western Siberia, fortified settlement, pit houses, early pottery, 7th/6th mill cal BC



# **”Ain’t no mountain high enough”.**

## **Mesolithic colonisation processes and landscape usage of the inner alpine region Kleinwalsertal (Prov. Vorarlberg, Western Austria)**

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At the end of the last ice age and with the melting of the glaciers the Alps, a landscape of 200.000 km<sup>2</sup>, formerly covered almost entirely by ice became again inhabitable for plants, animals and humans alike. One of those new ice-free regions was the Kleinwalsertal (province of Vorarlberg, Austria), which represents one of the numerous little-known archaeological areas of the Austrian Alps. Here, over 90 mainly Mesolithic sites of various sizes and functions were found over the last thirty years. Within this talk, the results of the project ”The Kleinwalsertal. A Mesolithic landscape with far reaching contacts” will be presented. The project itself aimed to understand the archaeological landscape Kleinwalsertal, as well as its ”colonisation” and the subsequent usage of this habitat during the Mesolithic. To obtain a most complete picture, the sites and their artefacts were studied by an integrated methodological approach. This approach included an examination of the topographic and landscape morphological position of the sites within the landscape via a field survey and subsequent GIS-analysis. Hereby, the sites within the regions were not simply considered as dots on a map, but rather as an integral part of the landscape, intertwined with its possibilities, resources and limitations. Furthermore, the three excavated Mesolithic sites Schneiderküren, Egg-Schwarzwasser and Bärämähder were studied in more detail, including an intra-site analysis and an examination of morpho-technological and typological characteristics as well as raw material provenance of their lithic artefacts. The synthesis of the obtained data will address questions regarding the function of the sites in the landscape and mobility patterns throughout the Mesolithic in the study area and to adjacent regions farther abroad. Furthermore, we provide solid basic data for further investigations regarding the studies of the Stone Ages in the Eastern Austrian Alps. Hereby we come to realize that the alpine regions were not an unsurmountable barrier, but rather areas of transition and maybe also interaction.

**Keywords:** Austrian Alps, Kleinwalsertal, Boreal and early Atlantic, mobility patterns, technology and typology, raw material procurement

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\*Speaker

# The site of Murten/Ober Prehl (Canton of Fribourg, Switzerland) : reflection on the notion of territory in Early Mesolithic

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The present talk is the result of a collective work on the Swiss Mesolithic site of Murten/Ober Prehl. Located near the Lake Murten in the canton of Fribourg, it was excavated between 1990 and 1991 by Michel Mauvilly in a rescue context (Archaeological Service of the State of Fribourg ; Boisauvert *et al.*, 2008). The excavation uncovered on a surface of 520 m<sup>2</sup> several layers of distinct occupations ; the oldest one dated from the Mesolithic. No bone was found, but 2016 lithic artifacts were at least gathered; a majority belongs to the Mesolithic.

As just preliminary papers were published (Mauvilly *et al.*, 2002), it was decided to make a complete study of this material in a master's degree at the University of Burgundy (Rostollan, 2019). Three main objectives were defined: refine the dating of the site, characterize the nature of the site and assess its place in the regional context. To answer, several approaches have been carried out. The typological study of this collection was completed by the study of the spatial distribution of the remains, the search of the reassemblies and use-wear analysis. Then, thanks to the petrographic analysis conducted by Jehanne Affolter, it was also possible to define the management of raw materials. The results of these approaches will be presented in this paper.

The dating of the site is based on the presence of segments associated with retouched and transverse basal points and isosceles triangles. Such armatures are characteristic of the Early Mesolithic in the Jura (Thévenin, 2008).

More than 99% of the pieces were coordinated, so it is possible to create spatial projections. The results show a high density zone, over an area of about 30 m<sup>2</sup>, and a second one, less larger (15 m<sup>2</sup>), a few meters West. Lithic reassemblies shows links between these two locations, so potentially contemporaneous. The number of the burned flints allows to hypothesize the existence of a hearth within the dense area, but none in the second one.

The petrographic analysis identifies the diversity of the raw materials found in Murten/Ober Prehl. The pattern of the geographical origins show clearly a predilection for local resources,

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especialy ölquartzite and radiolarite, which could be collected in a less than 50 km radius. Many elements are also from more than 100 km. The most exotic raw material is a flint from the Ain department, more than 170 km away. Such supply pattern seems to be reminiscent of the one recognized for the Dammartin-Marpain locus 2 in Jura (Séara et Roncin, 2013).

The lithic reassemblies reveal several operating chains, some of conducted entirely on the site – namely local rocks such as fine-grained quartzite -, other ones partialy. These observations complete our knowledge about the circulation of materials.

Furthermore, comparison with other sites allows us to propose a restitution of the cultural landscape in which Murten/Ober Prehl was integrated in the early Mesolithic period. These comparisons are made with sites located in the neighbouring Swiss cantons crossed by the Jura Mountains (Cornaux " Prés du Chêne ", Mollendruz) but also in the French departments also crossed by this mountains (Oberlarg, Ruffey-sur-Seille), and finally with sites in south-western Germany (Siebenlinden).

In addition, a few elements from Murten/Ober Prehl deserve to be mentionned, namely numerous sketched pieces. Used for the traitment of animal hard material during the Neolithic period (Le Brun-Ricalens, 2006), their role still unknowmn for the Mesolithic period, and complementary studies must be led.

This brief summary about Murten/Ober Prehl shows the interest of returning to sites excavated a couple of years ago. The aim of this presentation is not only to make this Fribourg open-air site better known, but also to compare it with the advances in Mesolithic archaeological research and to have a reflection about the notion of territory through the supply territory and the cultural terrtory.

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Coudret (dir.), *Le début du Mésolithique en Europe du Nord-ouest*, Actes de la table ronde d'Amiens (9-10 octobre 2004), Amiens, Société préhistorique française (Mémoire, XLV), p. 31-50.

**Keywords:** Early Mesolithic, spatial analysis, typotechnology, supply territory, cultural component

# Mesolithic Montology: a space for connection

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The use of mountain environments is a recurrent feature of Mesolithic settlement patterns across Europe, with evidence for a wide variety of hunter-gatherer uses of these landscapes. The ways in which humans live in mountain landscapes is an inherently inter disciplinary study, sometimes called Montology (Rhoades 2007). Most of these reviews, however, focus almost exclusively on agricultural adaptations to mountain environments and there is little consideration of hunter-gatherer use of mountains. There is a therefore a significant opportunity for Mesolithic archaeology to contribute to these broader debates and offer important long-term perspectives on how hunter-gatherers used mountain landscapes and how, as these landscapes changed over time people's activities changed. A recent synthesis from Price (Price 2015) outlines three reasons that mountains have been important to people (although all of his examples are agricultural): as sources of food; sources of valuable minerals and precious stones and as places of great cultural importance. This paper will use this framework to begin to sketch out an overall perspective on mountains and the Mesolithic. The intention is to open discussion and provide space for networks and connections with colleagues.

Price M. F. (2015) *Mountains: a very short introductionn*. Oxford, Oxford University Press

Rhoades R. (2007) *Listening to the Mountains*. Dubuque, Kendall/Hunt Publishing

**Keywords:** Montology, mountains, overview

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\*Speaker

# Emerging evidence relating to the late Pleistocene and early Holocene settlement of Scotland

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Increasing evidence is pushing the earliest settlement of Scotland backwards. In the 1980s the suggestion that settlement in the island of Rum, West Highlands, occurred in the seventh millennium cal BC was received with scepticism. Today, though precise radiocarbon determinations are lacking, several sites have yielded assemblages likely to date as far back as the twelfth millennium cal BC. Not surprisingly, this evidence is complex in nature. Recent work reveals increasing numbers of broad blade flaked stone artefacts as well as a variety of tanged and other points, all likely to indicate early activity. Previously, the Scottish Mesolithic has been dominated by narrow blade flaked stone industries of a type that would have been considered later Mesolithic further south, though in Scotland the dates were often surprisingly early. Although the evidence is still very fragmentary, it is worthwhile asking how this enhances understanding of the earliest settlement of Scotland. This paper will focus on information related to the possible access routes into mainland Scotland from the lowlands of Doggerland. It will also consider a wider palaeoenvironmental approach in order to research a more nuanced and comprehensive interpretation of the Late Upper Palaeolithic in Scotland. Finally, it will recognise the processes of change inherent in both the environmental and human records through time in order to suggest possible relationships with the existing data on Mesolithic Scotland.

**Keywords:** Palaeolithic, Mesolithic, Tanged Points, Broad Blades, Narrow Blades, Microliths, Scotland, Pleistocene Holocene Transition

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**Topic: Art, symbols and rituals**

# The place of art in Mesolithic societies: from technical gesture to graphic abstraction

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The characterisation of the cultural links between the latest hunter-gatherer societies on a European scale has been carried out mainly by focusing on the technological and typological study of the lithic industry. In this context, graphic manifestations were often excluded from the debates. In contrast with the figurative expressions that characterized the art of the Upper Paleolithic, the emergence of graphic abstraction, which has often a difficult reading and interpretation, has even raised doubts about its "artistic" nature, or may have led to it being considered as a "minor" expression. Synthesis studies on Mesolithic art are rare, and interregional approaches have sought to establish thematic parallels rather than a true definition of possible links at different temporal and geographical scales.

This session aims to highlight the informative potential of graphic manifestations in the characterization of cultural units and links established at the European level during the Mesolithic period. The aim is to share approaches according to different focal points. The microanalysis of the technical gesture, with the characterization of the nature of the strokes and their temporal sequence of execution in complex compositions, is especially relevant in order to identify common practices and know-how at a site, or even in a larger territory. The study and systematization of the themes depicted can be useful to identify recurring patterns at different scales, and therefore possible graphical convergences. The purpose of sharing these distinct approaches is to encourage collective discussion. It will allow, first, to better understand the "chaîne opératoire" of Mesolithic graphic manifestations, and second, to reach an overview of these manifestations in order to identify possible regional and supraregional characteristics.

Such an approach requires a sophisticated data acquisition and restitution protocol. In this session, communications about different protocols for microanalysis, experimental reproduction of decorated objects, and the use of new digitization and three-dimensional reproduction technologies are particularly welcome.

**Keywords:** Mesolithic, Art, Chaîne opératoire, Technical gesture, Experimental Archaeology, 3D restitution

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# Reconstructing the life histories of people, animals and things in Mesolithic funerary archaeology

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Increasing research interest in the reconstruction of life histories of objects, humans and animals within the Mesolithic funerary sphere is helping to shape new understandings of hunter-gatherer mortuary practices. Across Europe, large burial grounds to single/isolated burials are being investigated with a broad suite of scientific techniques, e.g. aDNA, stable isotopes, ZooMS, osteology, zooarchaeology, provenancing, technological and traceological studies, microscopy analysis of soil samples etc., enabling new, socially-driven narratives relating to the life histories of individuals and their grave assemblages to be told. Here, we invite researchers working on burial archaeology to contribute a paper framed around the concept of "life history", with a view to establishing how different methods and theories (old/new) can be employed to reconstruct past lifeways, including those of objects, within mortuary contexts.

**Keywords:** Individual life histories, mortuary archaeology, scientific methods in archaeology, traceology, social archaeology

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\*Speaker

# Death and the dead: new approaches to Mesolithic mortuary practices

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Deathways in the Mesolithic are varied and present significant variation across time and space. Recent discoveries, but also new approaches to older finds and archives, reveal an ever more complex and varied archaeological record of the treatment of the dead in Mesolithic Europe. This session seeks to problematize central aspects of human engagement with death in the Mesolithic, exploring dimensions such as cognition and symbolic thought, emotion and experience, the body, ritual and social relations - through the lens of human attitudes towards death in the archaeological record. We invite papers that combine empiric evidence with a strong interpretative framework, and push the theoretical and methodological boundaries toward a more nuanced and better insight into the diverse treatment of the dead during the Mesolithic, capturing the state of the field in all its current diversity.

**Keywords:** Death, funerary archaeology, archaeology of death, mortuary practices, burial

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**Session: The place of art in  
Mesolithic societies: from technical  
gesture to graphic abstraction**

# Portable soapstone animal figures in Mesolithic western Norway

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During the last few years, soapstone figures have been found during excavations of Mesolithic sites in western Norway. Four of the figures are of birds, and a fifth figure represents a porpoise or possibly a killer whale. They are 3-5 cm long and naturalistically shaped. The figures have been found in the middens or in floor layers of ordinary residential sites at the outer coast, which are dated to between 5300 and 4000 cal BC. An important aspect of the figures is that they all represent marine animals or birds. This stands in contrast to the contemporary stationary rock art figures in this region, which mainly represent terrestrial animals, mainly red deer. The paper will first present the figures themselves, the sites and the dates. We will also look at contemporary portable artifacts made of soapstone (line sinkers and shafthole hatchets) in western Norway. Thereafter an attempt will be made at contextualizing the figures in terms of their significance to subsistence-settlement patterns and to regional cosmologies, where the relationship between terrestrial and marine domains would have been crucial. Finally, we will apply a comparative perspective, where similar bird and animal figures in adjacent regions (Southern Scandinavia and Russia) are drawn into the discussion.

**Keywords:** Portable art, soapstone figures, marine birds and mammals, symbolic expressions, coastal sites

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\*Speaker

# Is there a mesolithic art? Mesolithic versus modernity at the time of Napoleon 3 and Jules Grévy

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At a time when the programs of groups of researchers are focusing on the study of stereotypes (The Other and Us) and representations of the Other through the history of "Human Zoos", we want to re-examine an important question for our discipline: why were the Mesolithic and its decorated artefacts denied in the modern era of Napoleon 3 and Jules Grévy. To understand why these aesthetics were not considered in the same way as the aesthetics of the Paleolithic and Neolithic periods in which it is embedded?

In the effervescent era of nascent anthropology, Europe claims, everything by discussing the evolutionism of C. Darwin, technical progress as a model of life to adopt. What influence do evolutionist, positivist, ethnocentric ideas have they had on the judgment issued on the Mesolithic and its aesthetic productions?

**Keywords:** Mesolithic era, Evolutionism, Esthetics, Modernity, Primitive, Art, Colonization.

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\*Speaker

# Experimental approach of prehistoric rock art in the sandstone chaos of Fontainebleau massif : analysis of the engraved material, technical choices and engraving durations in a ritual practice dating from the 8th millennium BCE

Alexandre Cantin \* <sup>1</sup>, Alain Bénard <sup>1</sup>, Colas Guéret <sup>1</sup>, Emilie Lesvignes <sup>1</sup>, Michel Rey <sup>2</sup>, Eric Robert <sup>3</sup>, Médard Thiry <sup>4</sup>, Boris Valentin <sup>1</sup>, Laurent Valois <sup>2</sup>

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This talk develops the experimental and archaeometrical approach of Fontainebleau’s engravings undertaken over the last three years in the framework of a collective research program on Fontainebleau’s rock art featured in this session (B. Valentin et al.). Based on a detailed knowledge of the engraved material, the present contribution evaluates the technical involvement of mesolithic hunter-gatherers into these symbolic practices by examining two dimensions. The first one is technical and concerns the scarcity of curved grooves : is that scarcity resulting from a cultural choice or a material constraint linked to the engraved sandstone or the lithic tools ? The second one is temporal with the time span to complete the main patterns (grooves and grids) which is an essential data needed to understand this vast rupestrian phenomenon. Concurrently with this research, unexpected results from experimental practice contributed to parietal analysis of the archaeological engravings : chronological significance of grooves intersections based solely on relative depth was questioned during a collective blind test on the internal construction order of experimental grids. The results of this test warns us about relative chronology attempts in similar engraved rock arts and plead for systematic experimental tests of the criteria used.

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\*Speaker

**Keywords:** engraving, sandstone, experimentation, hardness, duration, rock art

# On the question when the Shigir Idol was made

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The 5m high idol from Shigir peatbog in the Trans-Urals is the oldest and largest anthropomorphic wooden sculpture in the world; it is a unique work of art, and it is a valuable source for the reconstruction of material culture and worldviews of the Stone Age population of Northern Eurasia. The history of its study goes back more than 100 years, but a number of issues such as the place and conditions of its discovery, the time of its creation, periods of exposure etc. remain controversial. The paper will analyse and evaluate various sources of information including archival materials with information on the place and time of discovery and on the nature of the accompanying materials, and the results of a recent comprehensive study conducted by Russian and German archaeologists and scientists in 2014.

Attention will focus in particular on the analysis of the new AMS radiocarbon dates of the 2014 study, which are ranging from the end of the Pleistocene at ca. 10,500 to the Late Mesolithic period at ca. 6,000 cal BC. These dates clearly differ significantly among themselves and also compared to dates obtained in by conventional radiocarbon dating.

Palaeogeographical and archaeological data from the Trans-Urals do not support an early, 10,500 to 10,000 cal BC age of the Shigir Idol, but rather correspond to later ages also covered by some AMS <sup>14</sup>C age ranges from the set obtained in 2014. Therefore, it is necessary to continue research of Mesolithic monuments of the Urals region, to study the paleoclimate, and to determine the age and character of the primary processes of peat formation in the Ural peatlands, as one option to gain information on the age of the idol is to date microremains of peat that are preserved in apparently early cracks of the wooden sculpture.

**Keywords:** Trans, Urals, Early Mesolithic, Shigir idol, anthropomorphic image, wooden sculpture, <sup>14</sup>C dating

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# The engraved plaquettes collection of Cueva de la Cocina: Redefining the Mesolithic archaeological context from 3D stratigraphic reconstruction and new radiocarbon framework

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The engraved plaquettes collection of Cueva de la Cocina offers a unique example of one of the richest Holocene Prehistoric artistic sequences recorded in southern Europe. In fact, it can be considered the clearest Mesolithic graphic symbolism to date in the context of the last hunter-gatherers in Mediterranean Iberia. In this work we aim to show the current record considering the spatial data and temporal distribution of the plaquettes in the context of Cueva de la Cocina (Dos Aguas, Valencia, Eastern Iberia). Performing this new research at the site is also giving the possibility of testing **new methodologies** in order to better understand older archaeological works, taphonomic processes and, ultimately, the archaeological sequence. For evaluating spatial distribution of the engraved plaquettes we have created 3D models including the different research works conducted at the site. The high-resolution chronology programme conducted confirms the attribution of the engraved plaquettes to the last episodes of the Mesolithic sequence at the beginning of the 8th millennium cal BP.

**Keywords:** Engraved plaquettes, Mesolithic, 14C, Spatial distribution, Cueva de la Cocina

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# The engraved portable art from the Iberian Mesolithic: first insights to the technical and compositional patterns of the plaquettes from Cueva de la Cocina (Valencia, Spain)

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The Cueva de la Cocina, an emblematic site for understanding the last Mesolithic sequence in the Mediterranean basin, has yielded a unique collection of portable art in Iberian Mesolithic. The archaeological excavations carried out by L. Pericot in the 1940s, later by F.J. Fortea in the 1970s, and in recent years by O. García-Puchol, S. McClure and J. Juan-Cabanilles have made it possible to record a collection of thirty decorated limestone plaquettes. The decoration is made up of fine engraved strokes that give rise to complex geometric-type compositions, similar to those documented in southern France. Although this collection of plaquettes was partially published by Fortea (1973), Barandiarán (1987) and Pascual Benito (2006), it has never been thoroughly studied at a technical and compositional level, and many questions have been raised regarding the decorative patterns and the possible meaning of these representations.

In this communication we will advance the first results obtained in the macro- and microscopic study of these engravings, focusing especially on aspects linked to the sequence of technical gestures that give rise to a redundant compositional pattern. Throughout the technical study of the strokes, their temporal sequence and their organization in the graphic space, we will try to go beyond the technical order to the eventual meaning of these engraved plaquettes. This in-depth study will allow us at the same time to integrate these plaquettes into the framework of the European Mesolithic portable art.

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**Keywords:** Mesolithic, Iberian Peninsula, engraved plaquettes, geometric decoration, microanalyses, technical gesture, spatial composition

# An engraved pebble from the Roquemissou site (Aveyron, France): technique, composition and context

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The Roquemissou site, a natural shelter located in the Aveyron region, presents a long sequence of occupation that span from the Azilian (~11 500 cal. BC) to the Late Neolithic (~2300 cal. BC). This long sequence gives it enormous potential when it comes to understanding the modes of occupation and the environment of the last groups of hunter-gatherers, as well as the development of farming. The site was first excavated by G.B. Arnal between 1982 and 1991, and then since 2012 by Th. Perrin.

In 1989, the excavations made it possible to document a small pebble with engraved decorations. These engravings are of the utmost interest since they reproduce the same decorative patterns documented in Azilian engraved pebbles in southern France, as it was shown in a previous paper (Bobœuf 1996). The stratigraphic context of the discovery remains complex since the stratigraphic revision of the site shows that some Laborian occupations succeed to the Azilien ones in a level taken initially as a whole. Comparisons with other engraved pebbles from the south of France, and particularly from the Pyrenees, suggest that this engraved pebble should be related to the first occupations of the site, around 11 ky cal BC.

In this communication we present a new macro-microscopic study carried out on this engraved pebble, with special emphasis on technical and compositional aspects, which in turn allow us to integrate it into the framework of European Azilian portable art.

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**Keywords:** Azilien, Roquemissou, Aveyron, engraved pebble, microanalyses, technical gesture, composition

# Techniques and ideas. Context of use of the zigzag motif in Zamostje 2 (Upper Volga region)

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Decorated bone tools and stone pebbles, sculptured whole forms or parts of objects, sometimes resembling zoomorphic creatures, are, from our point of view, manifestations of the Mesolithic art. They took their place in the ideological (cult) and everyday life of the ancient population, the line between them is not always possible to draw. Meaning of the symbols used almost always eludes us. Therefore, we will try to correlate one of the ornamental motifs with the context of its use and a set of technical skills and tools necessary for its implementation. For the Late Mesolithic settlement Zamostje 2 (Upper Volga, 7th mil. BC), the zigzag motif is the most common. It is associated with different categories of bone implements, to a lesser extent with engraved stone pebbles, as well as with some wooden figurines. The manufacturing of zigzag lines in some cases (types) was characterized by a clear sequence of operations (*chaînes opératoires*). Some types of zigzag images (in particular, double) are repeated in a strictly defined position. It seems that the meaning of the zigzag on objects with a piercing and penetrating function may be related to the concept of a snake.

For clarification of these statements and hypotheses we consider the types of zigzag, the methods of its manufacturing, the possible working tools basing on the data of experimental, use-wear and technological analysis as well as a three-dimensional visualization experience.

Despite the advanced technology of artefact decoration from the Mesolithic population of the Upper Volga region and favorable conditions for preservation of organic materials in many Mesolithic and Early Neolithic settlements, the motif of zigzag seems to be a characteristic feature of Zamostje 2 site only, which may reflect its cultural or ethnic identity. In turn, some other motives find parallels in the materials of Northern and Central Europe.

**Keywords:** Late Mesolithic, Upper Volga region, bone tools, Mesolithic art, ornamental motives, techniques, thematic and cultural context

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\*Speaker

# An engraved shale pendant from Star Carr, UK: An indicator of cultural connection?

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The paper focuses on an engraved shale pendant recovered from the Early Mesolithic (9300-8500 cal BC) site of Star Carr, UK. The pendant, initially published in 2016, has been analysed using a raft of techniques, including SEM, microwear analysis, residue analysis, light microscopy, RTI, 3D scanning, and experimental replication (Milner et al. 2016). This paper summarizes the findings of analysis before considering the object in the wider context of artistic expression in the Mesolithic of the UK. The pendant is found to be unique, with no other art objects showing engraving of a similar type in the UK. This includes at Star Carr itself, where other engraved objects, notably barbed points, are stylistically distinct. However, the shale pendant may, in some respects, represent an interesting point of potential connectivity with other regions of Europe, in particular Denmark where engraved amber pendants have been recovered. Yet, amber pendants recovered from Star Carr demonstrate no evidence of engraving and no shale beads or pendants have been recovered from Denmark or other Scandinavian countries. The specific engraving is similar, whilst the materials used as a support for these engravings are dissimilar. A picture emerges of points of continuity and discontinuity between regions in terms of personal adornment and artistic expression. The study highlights that in trying to analyze artistic expression across regions, the study of engravings benefits from the incorporation of a wider raft of factors, including variations in material, production strategies and tools used, contexts of use and extent of use, and deposition in exploring the question of cultural connectivity.

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**Keywords:** Mesolithic, personal ornaments, UK, cultural connection

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\*Speaker

# Action and dynamics in the manufacture of Late Palaeolithic and Mesolithic art objects

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Finds of Late Palaeolithic and Mesolithic ornamented artefacts are still very rare in Central Europe. In our paper we examine four objects: three from northern Poland (Pomerania), and one from southern Poland (Malopolska). The artefacts from Pomerania dated to the Mesolithic include a baton from Szczecin-Podjuchy, a mattock-head from Trudna and a chisel-like artefact from Niezabyszewo. The Late Palaeolithic artefact is a fragment of reindeer antler found at Podzamcze, Cave IV at the Birów Mountain. The cave is located in the Kraków-Częstochowa Upland.

The artefacts from our study are made of bone or antler. The three Mesolithic objects are stray finds. The artefact from Podzamcze although deriving from a regular archaeological excavation surfaced in a disturbed layer. With no context to rely on, the only source of information about these decorated objects was the study of their form and ornamentation. The approach used was that of artefact biography – from the time of their shaping until discarding. One of the aims of our research was analysing the dynamics and the technique of ornament manufacture. This was done through the study of all traces of manufacture, use and the technology of ornamentation and its phases. Advanced methods of analysis of the ornaments, shaping traces and usewear involved the use of a stereomicroscope, metallographic microscope, 3-D microscope, SEM and other methods of surface analysis (tomography, RTI), completed with making resin casts of the decorated objects. The latter method enabled a non-invasive study of surfaces and ornaments.

Our study showed that the engravings covering the surfaces of the Mesolithic artefacts had not been made all at once. Sometimes new decorations were added while some earlier ornaments were deliberately worn off. In such cases, the ornament was not the result of a one-off action – it would be expanded upon as the need arose, when the older forms became worn and/or lost their symbolic function. The distribution of the engravings is directly related to the type of object. The form of the ornamented artefact was dictated by the desired optimal technological properties but also by an appearance suited to its symbolic use. It seems that some parts of surfaces, such as perforations of the batons, played both a functional and a symbolic role. We can conclude that the functionality of objects was the effect not only of technological properties, but was dictated to an equal extent by appropriate symbolic actions in the form of the ornament. The research, the results of which are presented in this paper was supported by the funds of the research project no. UMO-2018/29/B/HS3/01162, granted by the National Science Centre in Poland, titled "The Mesolithic art in Poland: social and ritual meaning of artefacts in the light of their biographies".

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\*Speaker



**Keywords:** Mesolithic, Late Palaeolithic, art, symbol, ornamentation

# Rediscovered Mesolithic rock art collection from Kamyana Mohyla complex in Eastern Ukraine

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Among all the variety of Ukrainian pre-Historic art types and styles, ancient rock art is probably the least studied and presented for the community worldwide. However, the biggest rock art complex in Ukraine - Kamyana Mohyla - attracts the attention of both scholars and wide audience by its unique parameters. It is located in the South-Eastern Ukraine, close to the Eurasian Steppe Belt borderline on the bank of picturesque Molochnaya River. The rock art instances from there were known since the end of XIX century. Some of them were studied and interpreted during Soviet period; however, most of this interpretation remains obsolete, barely proven and misrepresented to the archaeological community worldwide. Meanwhile the site still contains the unique collection of different traces created by numerous cultural groups. The oldest petroglyphs and rock art instances here are possibly Pleistocene and the newest one belongs to XIX century.

The parietal rock art collection from Kamyana Mohyla, located in the numerous sandstone grottoes, as well as portable rock art one from the site and its surroundings contain some artifacts that reflect the beliefs and habitation style of Late Mesolithic population of the region. They were found and published years ago; however, the finds, methods and archaeological data require recontextualization in the frame of our current understanding of Mesolithic societies of the region. One of the most intriguing archaeological contexts for the Mesolithic art of Kamyana Mohyla is provided by a multilayered settlement nearby that consists of numerous Mesolithic and Neolithic cultural levels, containing also some later ones. The radiocarbon analysis provides the earliest date of at least IX millennia BC. This data is also connected to the portable rock art instances that were found here during the field works in 2016. These figures reveal both the Mesolithic beliefs of the settlement habitants and their direct connection to the rock art complex due to their geological nature.

The sufficient contextualization and understanding of these instances became possible because of the advantages of Structure-for-Motion photogrammetry, microscopic examination and precise interpretation of engravings through the means of 3D models surface analysis. Using the advantages of digital tools it is possible to literally rediscover some artifacts and provide a new, qualified and comprehensive look on the Mesolithic art of Kamyana Mohyla complex.

Besides the contextualized and stratigraphically attributed artifacts, Kamyana Mohyla also contains a portable rock art collection that was found out of any cultural context inside the

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\*Speaker

grottoes of the complex. It was first discovered and briefly described by V. Danilenko in 1973-1986. His brief explanation and schematic drawings do not allow providing a comprehensive interpretation or contextualization of these finds, although some of his assumptions seem to be quite reasonable. Large part of this collection was found in so-called "Churingas grotto". More than 40 instances from there were interpreted as different fish sculptures. Considering fishing has been proven to be more important than hunting or gathering for the Mesolithic of Ukrainian Steppe, one should consider the rediscovery of portable rock art instances collection. The context for such rediscovery is really promising, since it includes numerous fishing tools, decorated fish bones and Late Mesolithic settlements close to the river bank. However, the collection of portable art of this age is quite important and unusual for Ukraine as well as for European prehistory in general. The closest analogy to such collection belongs to the Mesolithic of Danube River banks, namely Lipenskiy Vir settlement in the region of Iron Gates. The complex of Mesolithic rock art at Kamyana Mohyla consists not only from portable instances. While a few scenes that were considered to be Mesolithic require reconsidering their obviously wrong interpretation, some of sculptures and panels appeared to be older than it was thought before. So called "Vishap" (Bronze Age Dragon), for instance, turned out to be a multileveled panel of a Stone Age origin. All these rock art instances form the unique complex of Late Mesolithic art that reveals the beliefs of fishing societies in their recognizable artistic tradition. However, such enormous collection in Ukrainian Steppe raises the question of ancient society's development and enhances the discussion with new important facts. Perhaps, these societies were much more complex and capable of artistic actions? Perhaps, we should have a closer look at the cultural processes that influenced the Ukrainian Steppe during Late Mesolithic Age?

**Keywords:** Mesolithic, Ukraine, Kamyana Mohyla, fishing societies, portable art

# Prehistoric Rock Art in the sandstone chaos of Fontainebleau massif. Strategies for research, archiving and outreach

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In the sandstone chaos south of Paris, between Nemours and Rambouillet, more than 2,000 engraved shelters, usually cramped, were discovered. Some were reported as early as the 19th century and most of the discoveries took place in the late 20th century thanks to the tireless surveys of the "Groupe d'Étude de Recherches et de Sauvegarde de l'Art Rupestre" (GERSAR). There is at least one Paleolithic engraving, whose formal characteristics are similar to those of Lascaux, and there are above all, in addition to explicitly protohistoric or historical age designs, thousands of geometric engravings, mostly dominated by grid patterns and deep grooves arranged in parallel series. Various arguments suggest that a substantial portion of these abstract engravings go back to the VIIIe millennium BCE, i.e. the end of the first Mesolithic. In 2017, new research began with the support of the French Ministry of Culture: the main objectives consist in archiving several shelters by documentation including 3D modelling while new means of relative dating are investigated. At the same time, an ambitious outreach program is underway to ensure that everyone - especially inhabitants living in the vicinity - becomes a protector of this very fragile prehistoric heritage, sometimes in the midst of highly touristic areas.

**Keywords:** Rock art, 3D modelling

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**Session: Death and the dead: new  
approaches to Mesolithic mortuary  
practices**

# Back to Hoedic: Recording the Breton Mesolithic cemeteries from a 21st century perspective

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The Breton cemeteries are among the key sites for the study of the late Mesolithic of Atlantic Europe. The excavations carried out by Saint-Just and Marthe Péquart at Tévéc (1928-1930) and Hoedic (1931-1934) provided one of the richest funerary assemblages of Europe's last hunter-gatherers. Both the human remains and the associated Archaeological items have been one of the main sources of information on the late Mesolithic of Western Europe, and they have been the object of numerous re-analysis, including relatively recent techniques such as stable isotopes or Palaeogenetics. However, in spite of the high standards of the Péquarts' field work and the good preservation of the materials, dealing with old Museum collections is a challenge that presents serious limits. Issues such as the precise chronology of the funerary structures, the formation processes of the sites, or the relationship between the graves and other coeval features are very hard to study without direct contact with the field.

That is why we have decided to return to the sites. Since 2018, a Spanish-French team has started a new programme of field work at Hoedic, intending to re-analyse the cemetery and its context using 21st Century techniques, thus providing resources for a better understanding of the Archaeological information gathered nearly ninety years ago. Our project will follow

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a strict and updated fieldwork protocol which will allow us to apply a wide series of analytical techniques. It will include georeferencing all the archaeological materials and samples and processing the sediments with floatation and water-sieving procedures. The excavated surfaces will be recorded using photogrammetric techniques, and non-visible features will be explored through high-resolution surface mapping of the magnetic field and molecular analysis of the floors. The analytical programme will include Radiocarbon dating (including pairs of marine and atmospheric samples to establish the  $\Delta R$  parameter for this sector of the Atlantic coast), Chemostratigraphic and Micromorphological analysis of the sediments, lithic analysis (including raw materials, technological and micro-wear analysis), Archeobotanics (Palynology, Carpology and Anthroecology) and Archaeozoology (mammals, birds, fish, and marine and terrestrial invertebrates, including geochemical and biochemical analysis such as stable isotopes and ZooMS). The excavation in the necropolis area opens the possibility that new human remains are recovered. If so, a strict protocol will be followed to get samples for Palaeogenetic and Biochemical analysis ( $\delta^{13}C$ ,  $\delta^{15}N$ ,  $^{87}Sr/^{86}Sr$ ,  $\delta^{34}S$ ,  $\delta^{18}O$ ) and proteomic and metagenomic analysis of dental calculi in the best possible conditions.

The first field seasons, developed in 2018 and 2019, have focused on a detailed exploration of the site. More than 5,000 square meters have been recorded using several surveying techniques: Ground-penetrating radar (GPR), Electrical resistivity tomography (ERT), Magnetogradiometry, and mapping of the magnetic field intensity. Moreover, sedimentological cores, 2 m deep, were taken with a percussion window sampler using a Van Walt/Eijkelpkamp mechanical corer, and limited test pits were opened in the margins of the site, allowing us to get a precise pre-view of the stratigraphic sequence of the site. This has permitted us to establish with a reasonable precision the extension of the Mesolithic site, and to select some areas where anomalies suggesting the existence of Prehistoric features have been found. That will allow us to plan the new excavations on a realistic basis.

**Keywords:** Cemeteries, Brittany, shell middens, Archaeology of Death, Field Archaeology

# One by one. A case study of the multiple grave VI-2 at Dudka cemetery, Masuria, NE-Poland.

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The cemetery at Dudka site was used in the Mesolithic and in the Para-Neolithic (Zedmar Culture). It yielded over 29 graves and at least 114 individuals. Graves were mostly collective and contained different burial types – primary, secondary and cremation ones. In most cases all remains were deposited in given grave at once. The only unquestionable exception is grave VI-2 with at least seven individuals. There were three sitting primary burials, at least three secondary inhumations and a concentration of burned human bones. The poster will present taphonomical analyses of the grave in order to determine how many times grave was used and to reconstruct the sequence of the burials.

**Keywords:** burial rite, collective grave, Mesolithic, Para, Neolithic, NE, Poland

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\*Speaker



# Left behind or venerated ancestors ? New data on the mortuary practices of the last hunter-gatherers in Belgium

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Until recently, the mortuary practices of the last hunter-gatherers in Belgium have been mostly described as successive deposits of fresh human cadavers in sepulchral caves. These bodies, dated to the Early Mesolithic, were then only disturbed by taphonomic processes. The scattered human remains discovered in the Autours rock-shelter (Province of Namur, Belgium) allow questioning this apparent homogeneity.

The site, excavated in 1992-1993, delivered two deposits of human remains dating from the Early Mesolithic: on the one hand, an assemblage of several hundreds of disconnected-dispersed bones of several adults and children (AA2; 9090 +/- 140 BP, OxA-5838) and on the other hand, an individual burial (AA3; 9500 +/- 75 BP, OxA-4917). Early anthropological studies demonstrated that AA2 was a collective burial recovering the remains of at least six juveniles and six adults (one of whom was cremated), while AA3 was an individual primary burial of an elderly female. However, the constant renewal of knowledge of Mesolithic mortuary practices through an increasing number of discoveries now makes it possible to question some of these interpretations. A recent revival of the Autours rock-shelter collection has been realized. In addition to the "classical" archaeo-anthropological analyses (calculation of MNI, estimation of age at death and sex determination), less common protocols such as the study of the fragmentation of long bones, the analysis of the osseous surface modifications and an examination of the spatial distribution of the remains in order to determine the form of the initial deposit have been made. The results demonstrated that the human remains of AA2 would rather be the residual bones left after a selection which occurred after the decomposition of fresh human cadavers successively or simultaneously deposited in the cave, and combined with a particular deposit of cremated human remains. These manipulations happened several hundreds years after the deposit in the primary burial (AA3) of the elderly female suffering from hyperparathyroidism and partially covered by ochre.

The mortuary practices implemented at the Autours rock-shelter thus correspond to a complex mortuary "chaîne opératoire" still unheard in Belgium and place the site in the continuity of the huge diversity of Mesolithic mortuary practices in Europe.

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**Keywords:** mortuary practices, Mesolithic, Autours rock, shelter, burial, scattered human remains, mortuary "chaîne opératoire"

# Applying GIS spatial density analysis to infer human burial practices at the Mesolithic shellmidden of Cabeço da Amoreira (Muge, Portugal)

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The Muge shellmiddens have provided, in more than 150 years of research, one of the most numerous and well-preserved collections of Mesolithic human remains in Europe. Unfortunately, despite the high number of burials found during the initial campaigns, very little information is currently available about their provenance and association with archaeological materials. Starting in 2008, a series of new excavation campaigns have been carried out at Cabeço da Amoreira, allowing to recover, so far, a total of five human burials, from different stratigraphic contexts within the mound. This work presents new data regarding the spatio-temporal variability of these burials. The application of modern techniques allowed to recover unprecedented information on each context and to establish a more complete reconstruction of the burial practices at the site. Specifically, our approach combines accurate three-dimensional location of different classes of artifacts recovered from the recent excavation of a human burial at Cabeço da Amoreira shellmound (Muge, Portugal) with two spatial analysis procedures - the Average Nearest Neighbor and the Kernel Density Estimation. The application of these techniques intended to test the presence of anthropogenic actions of matrix and artifact mobilization occurring before and after body deposition, as well as, if possible, to define more clearly the limits of the inhumation context.

**Keywords:** Mesolithic, Muge, GIS spatial analysis, Human burial

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# "Fat or other tissues of corpses": Sensory engagements with the dead in Mesolithic Europe

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As the session abstract states, evidence for the treatment of the dead reveals an ever more complex and varied set of mortuary practices taking place across Mesolithic Europe. These include inhumation, cremation, secondary burial, manual disarticulation and dismemberment and, potentially, cannibalism. Many of these practices involved the living engaging with the dead body in various states of decomposition or skeletonisation, such as preparing and posing the recently dead for burial or cremation, collecting fragments of burned bone from the ashes of a pyre, retrieving specific bones from a skeletonised burial, or cleaning tissue from the bones of an exposed body. Such practices clearly involved sensory and affective engagements with death and the dead body. What is more, ethnographic studies show that bones and other bodily substances could hold significance beyond the funerary context, being utilised for their affective, magical or powerful qualities. Examples include the potential agency of the dead to enhance hunting success through the use of amulets or charms made from human remains, or spiritual assistance obtained through the consultation of curated dead bodies or the application of their bodily substances to the bodies of hunters and their weapons. Through a series of case studies, this paper will explore the ways in which human remains and other bodily substances were engaged with in Mesolithic Europe to discuss Mesolithic sensory experiences of death and attitudes to the dead body.

**Keywords:** death, senses, experience, mortuary practices, funerary archaeology

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\*Speaker

# Sex determination of the late Mesolithic individuals from the Strøby Egede burial, Køge Bugt, Denmark

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In the summer of 1986 a mass grave was discovered in the course of expanding a carp pond along the bank of the river Tryggevælde where it empties into the Køge Bugt, the bay south of what is today Copenhagen, Denmark. The human remains, dating to the late Mesolithic Ertebølle culture, consisted of eight individuals of all ages, ranging from a 45+ year old individual to newborn children. Four individuals were arranged on one side of the grave, with four on the other, placed head to foot. Bioarchaeological analyses assigned one individual as female, one as probably female and one individual as male. Together with this assessment, and on the basis of grave goods, the burial was interpreted as consisting of four females arranged on one side, and four males on the other. The grave however has poor organic preservation, which has to date precluded successful A) direct radiocarbon dating, B) light isotope analyses of bone and dentine collagen, and C) aDNA analyses. Conclusions regarding the biological sex of the adolescents and sub-adults therefore remain presumptive. We applied an acid etch-based analysis of dimorphic sex chromosome-linked tooth enamel peptides to determine the sex of the individuals in the grave. Our results permit a direct discussion of engendered grave treatment and biological sex in non-adult individuals of the Ertebølle culture as young as ca. four years of age.

**Keywords:** Ertebølle, peptides, sex determination

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# Tradition and Transition - The Mesolithic Cemetery of Groß Fredenwalde, Northeastern Germany

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The Mesolithic burial site of Groß Fredenwalde in the Uckermark region is considered the earliest cemetery in Germany. A Stone Age multiple burial was first discovered in 1962 on top of a morainic hill, but only the detection of the Mesolithic burial of Strøby Egede, Denmark, raised more attention to the site. In the 1990s, radiocarbon dating confirmed the Mesolithic age of the Groß Fredenwalde burials. New research since 2012 has yielded evidence not only for several further graves at the site, but also for a unique set of burial traditions. Most of the graves date into an early Atlantic context between 6,500 and 5,900 calBC, but an extraordinary burial of a young man probably buried in upright position is about a thousand years younger (c. 4,900 calBC), indicating that this individual had been living side by side with the earliest farming communities of the LBK in this region. New fieldwork started in 2019 financially supported by German Research Foundation and has already yielded evidence of more burials. To date, at least eleven individuals from the site are known, originating from at least six graves in an area covering only a few square meters. The well preserved human skeletons make the Groß Fredenwalde assemblage one of the most important series of Mesolithic individuals of Central Europe. Isotope studies and aDNA-studies contribute to better characterize the Mesolithic economy and population before and after the advent of the first farmers in the region. Palynological and geochemical sediment analyses from adjacent Lake Behrendsee provide insight into landscape development and environmental changes connected with the arrival of the first farmers in the Uckermark region. The interplay between hunter-gatherers and early farmers is a crucial aspect within local and regional socio-economic processes. On a supraregional scale, grave goods and ritual characteristics find similarities in Mesolithic burial sites in Northern and Eastern Europe. The paper will present new research on Groß Fredenwalde and evaluate its significance in

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regional and supraregional context.

**Keywords:** Cemetery, Burial Ritual, Neolithisation

# Past Responses to Plague reflected by the Northern Tradition Rock art

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The presentation will tentatively argue that the Northern Tradition Rock art came as a response to rather dramatic demographic changes at the end of the Late Mesolithic, and that the iconography still stores most relevant information under need for further decoding. Recent analyses of the Northern Tradition rock art have pointed at the frequent presence of both human skeleton images – variedly disarticulated – and the numerous motifs of skeletonised cervids, most explicitly addressing a past death perspective for the iconography. The rock art tradition has also been associated with growing sedentism, but several dating approaches have shown that the relatively short production period for the rock art can also be associated with a drop in the population at the term of the Late Mesolithic. Dead and disarticulated anthropomorphs, skeletonized animal images, the end of a rock art tradition or practice, and a documented severe decline in the population, after their clustering into larger groups, makes it tempting to suggest that some type of plague or epidemic spread of diseases could have been the inevitable natural cause for a decline in the population and the ultimate end for the rock art tradition. Growing sedentism might have formed preconditions for the spread of diseases not only because of the clustering of people, that might have attracted rodents, fleas, or insects that transmitted diseases but also because of domestication or semi-domestication of animal species that are yet not known to us. It will therefore be suggested that major loss of people, even affecting animals, triggered religious rituals and the making of images onto solid rock. The paper also addresses a future goal of a more thorough decoding and deciphering of the numerous panels with Northern Tradition rock art. Such investigations of the rock art in the light of relevant archaeological and scientific data, will most positively extract more meaning from the imagery, helping us to acquire an even deeper understanding of Late Mesolithic demography, epidemics, diseases, and potential narrative responses to past plagues.

**Keywords:** Rock art, Death prespectives, Mortuary Processes, Skeleton images, Epidemic diseases, Late Mesolithic

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\*Speaker



# Fell and lost into the Abyss? Mesolithic human skull remains from a sinkhole in southern tip of Iberian Peninsula (Sima Hedionda, Casares, Málaga)

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The presence of isolated human bones in cavities and sinkholes throughout Late Prehistory is a common phenomenon in a large part of the Iberian territory. These are usually interpreted as erratic elements from burial contexts, which are very frequent in karst areas of the Iberian Peninsula since the Early Neolithic and especially frequent in the Late Neolithic and Copper Age. However, the discovery of Mesolithic human remains in cavities is becoming more and more frequent, both as complete sets associated with sepulchral deposits (La Braña, León) (Vidal et al. 2008), or as disarticulated elements of a markedly different nature, including postmortem manipulations and consumption events (Santa Maira, Alicante) (Morales, et al. 2017). In this work, we present the partial remains of a human skull belonging to an adult male dating from the middle of the 7th millennium Cal BC, found at the bottom of a 30 m deep sinkhole, located in the geographical area of the Strait of Gibraltar. This discovery is very significant not only for its nature and interpretation (that may be an accidental fall, intentional thrown or to be part of a dismantled funerary deposit) but also because it is one of the few pieces of human evidence in the VII and the first half of the VI millennium Cal BC in the south of Iberia. In this territory, as can be seen in other parts of the western Mediterranean, the appearance of the Early Neolithic farmers seems to follow a perceived archaeological gap or hiatus, whose cause and nature we are is difficult to evaluate in the current state (Aura et al. 2009). In the absence of new evidence, the appearance of partial human bone remains in caves could constitute one of the few testimonies of the last hunter-gatherer populations in the southern tip of Iberia.

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**Keywords:** Human remains, Mesolithic, Southern Iberia, Sinkholes

# The places for the dead in the Mesolithic

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Human attitudes towards death are never random. Regardless of beliefs and symbolic associations to death, dead bodies require a physical action from the living, which is defined within a worldview in the way we see the world and express our emotions.

Archaeological remains of past mortuary practices become more common in postglacial sites in Europe and in the Near East. Archaeologists are well-aware of the fragmentary nature of the archaeological record, but despite preservation and research biases, it is accepted that the absence of human remains in earlier chronologies also relates to ways of handling the dead that do not leave traces in the archaeological record.

It has been argued that the burial of the dead becomes a more common practice in the Mesolithic, however, other ways of handling the dead have been documented, indicating that the adoption of one or another practice varies regionally and according to specific social dynamics. It is important emphasize that the presence of human remains in a site is not necessarily correlated with funerary practices, and there are a variety of contexts where human remains can be found. Human remains can be involved in an array of ancestral and religious rituals, as well as in demonstrations of power; can be found in scenarios of violence and conflict, as well as in contexts of accidental death; can be worn as ornaments, as well as amulets and relics. The funerary context is just one of the many contexts where human remains can be present.

In this study I examine the places for the dead in Mesolithic Europe by reviewing the archaeological evidence for sites with radiocarbon dated human bones. This review focus on the locations where Mesolithic human bone has been found, aiming at identifying regional patterns and local choices, and I argue that like the attitudes towards death, the places for the dead are never random.

**Keywords:** Mortuary practices, Place, Hunter, gatherers, Mesolithic, Europe

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# A Wasteful Death? Rethinking the Treatment of the Dead in the Late Ertebølle Period

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The Late Ertebølle period (ca. 4800-4000 BC) is characterized by a general lack of burials. Only seven supposed burials are known from the South Scandinavian area, and six of these are skeletons found embedded in middens with a lack of grave goods. Their contexts and the lack of apparent care suggests that the midden skeletons cannot be classified as certain burials. Instead, they probably emphasize the absence of burials even more.

Focusing on the present skeletal remains and the absence of burials in the period, this paper seeks to challenge the traditional way of interpreting the treatment of the dead in the Late Ertebølle period, as well as to address the importance of the treatment of the dead for our understanding of this decisive period.

It is argued that a marked change in the treatment of the dead occurred around 4800 BC, shifting from the rich and diverse burial customs of the Late Kongemose period/Early Ertebølle period to practically the opposite in the Late Ertebølle period. The reasoning behind the shift is discussed in light of the societal changes that occurred at this time as a result of increasing contact with Neolithic groups. Furthermore, it is argued that the funerary customs continued for at least 200 years into the Neolithic, along with other societal elements, suggesting that the Early Neolithic 1A should be considered the ultimate stage of the Mesolithic in South Scandinavia.

**Keywords:** Kitchen midden skeletons, Late Ertebølle Culture, Burial customs, Funerary customs, Early Neolithic 1A, Absence, Neolithisation, South Scandinavia

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\*Speaker

# Documenting the diversity of the treatment of the dead: the case of Cuzoul de Gramat (Lot, France, 2nd Mesolithic)

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The treatment of the dead during Mesolithic in the north-western Mediterranean area and its margins is still very poorly known. An overview of practices reveals that the corpus of data appears to be under-exploited due to non-systematic analyses. It also reinforces the hypothesis put forward by various studies of a significant variability in the funerary gesture; variability whose interpretation has so far remained unsuccessful, due to the lack of precise decoding. Deposition in individual, isolated or grouped primary burials seems to be the most widespread, or, at least, the most documented. Rare cases of cremation also have been reported. While it seems highly likely that body manipulations were carried out, the presence of scattered human remains is preferentially interpreted as resulting from the disruption of poorly buried burials. After a quick presentation of this diversity, we propose to illustrate it with the case of Cuzoul de Gramat (Lot, second Mesolithic). Two very different deposits of human remains had been discovered during the excavations conducted by R. Lacam in the first half of the 20th century. These are an individual burial and cranial remains on which we have recently identified artificial modifications. A frontal bone, also bearing incisions, has been discovered in place in 2017 by N. Valdeyron. This confirms the existence of manipulations of corpses during the second Mesolithic in the south of France, of which we will present some details.

**Keywords:** north, western Mediterranean, Mesolithic, primary burial, scattered bones, artificial modifications, manipulations of corpses, Cuzoul de Gramat.

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**Session: Reconstructing the life  
histories of people, animals and  
things in Mesolithic funerary  
archaeology**

# Mortuary programmes and bioarchaeology of the Danube Gorges Mesolithic foragers in the central Balkans

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The paper reviews mortuary programmes and bioarchaeological aspects of the Mesolithic forager populations in the Danube Gorges of the central Balkans. A large number of skeletal remains in the excess of 500 individuals were found at a dozen of sites located along the Danube in this region on the Romanian and Serbian banks of the river. A large suite of now available aDNA genome-wide data, multi-isotope data, including carbon, nitrogen, sulphur, and strontium, along with data on sex and age profiles, dental calculus, tooth wear and microstructure, paleopathology, and musculoskeletal stress markers allow for fine-tuned reconstructions of human physical plasticity in this key European Mesolithic hotspot.

**Keywords:** stable isotopes, aDNA, bioarchaeology, mortuary programmes

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\*Speaker

# Reassessing Mesolithic human diet, mobility and funerary practices in the Cantabrian Region (northern Spain) throughout dental calculus, stable isotopes and funerary taphonomy analyses.

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The Cantabrian Region (northern Spain) contains one of the most important record of burial practices during Mesolithic in Iberia. Three types of burial contexts have been documented: 1) human bodies buried in well-defined graves found within shell middens and in caves; 2) isolated human remains into shell middens; and 3) surface findings on the cave floors, where the evidence of inhumation is unclear due to the available evidence. This rich archaeological record provides an opportunity to understand the symbolic behaviour, subsistence strategies and mobility patterns of Mesolithic groups. Previous isotopic analysis of some regional Mesolithic human remains showed two different diets, depending on the geographical site location. While in coastal sites,  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values reflected a mixed diet of marine and terrestrial proteins, in inland areas the results showed a mainly terrestrial diet. This fact was interpreted as evidence for the different use of the territory by the regional hunter-gatherer groups. Here we report the results of new human remains found during recent excavations at El Mazo, El Toral III or ou Amieva sites, as well as the assessment of funerary contexts as Mazaculos II and La Paré de Nogales, excavated in the past. Firstly, a taphonomical analysis has allowed to define and reevaluate the funerary practices distinguishing disturbed primary burials from isolated human remains and ascertain how taphonomical processes, common in karstic systems, modified those deposits. Later,  $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$  and  $\delta^{34}\text{S}$  stable isotope analyses, on bone collagen, have verified the previous hypothesis and have confirmed the importance of marine resources in the Mesolithic diet. In addition, and for the first time,  $\delta^{34}\text{S}$  analyses permitted to corroborate the mobility of the Mesolithic human groups along the region, much more restricted than in Paleolithic

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times and mainly local. Finally, an analysis of microfossils entrapped in the dental calculus has supported the relevance of plant consumption, complementing in this way the stable isotopes results, which mask this type of resources.

**Keywords:** Mesolithic, Cantabrian Region, stable isotopes analysis, dental calculus, funerary taphonomy

# Late Mesolithic individuals of the Middle Danube origin on the Dnipro Rapids (Ukraine): archaeological and bioarchaeological records.

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The region of rapids on the Dnipro River was a natural niche rich in resources for the subsistence of hunter-fisher-gatherer groups. This caused the rise of numerous large burial grounds dated to the 10th-5th millennium BC there. The remains of many buried were investigated with a broad suite of bioarchaeological methods during the last 70 years. The stable isotope analysis carried out by Kenneth Jacobs and Malcolm C. Lillie has shown that several individuals from the Late Mesolithic burial ground of Vasylivka II (Vasilyevka II in transliteration from Russian) are characterised by  $\delta^{13}$  ratios more positive than those obtained for any of the other cemeteries. According to Jacobs, this points to the significant role of plant food (including cereals) in nutrition of these individuals in contrast to the rest of the Mesolithic inhabitants of the region who exploited freshwater resources and herbivores. Both scholars explained this as a possible presence of migrants from some unnamed territory there. In the current report I present an attempt to verify this hypothesis comparing published information about archaeological finds, funerary rites, craniometry, stable isotope, osseous pathology and DNA of individuals from the cemetery and other sites of the region and from the distant territories.

The Vasilyevka II cemetery dated to the late 8th-7th millennium cal BC was excavated by Abram Stoliar in 1953. In total, 27 burials containing the remains of 32 individuals interred in the extended position were excavated. But our knowledge about the funerary rite and grave goods from there is extremely scant due to the lack of full-fledged field report and publication, as well as the loss of all finds except human bones.

Generalization of all available information and searching for analogues has enabled to suggest that several bearers of the Middle Danube Lepenski Vir culture were buried in the cemetery. In the first place, this is indicated by "dozens and hundreds" perforated cyprinid pharyngeal teeth and "necklaces of peculiar spiral nacreous shells of possibly Mediterranean origin", mentioned by some participants of the excavation. In the North Pontic area, 2 such perforated fish teeth were found by Dmitrii Krainov in the Mesolithic burial of a single human skull within the Crimean rock-shelter site of Zamil-Koba 1 in 1936; and 18 ones by Oleksandr Bodianskyi in the cemetery with no radiocarbon date of Skelia-Kamenolomna on the Dnipro Rapids in 1954. In the distant territories, hundreds such beads are known among finds from the Late Mesolithic burials on the sites of Vlasac, Schela Cladovei, Kula, and Lepenski Vir in the Iron Gates area on

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the Middle Danube, and one from the Mesolithic cultural level in the Vrbička cave in Montenegro.

Scatterplot of the  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  stable isotope values for burials of the Mesolithic and Neolithic cemeteries from the Dnipro River and the Iron Gates regions shows the grouping of two remote clusters. Among all the Dnipro cemeteries indexes, only 2 females and 1 male from Vasylivka II are included in the Iron Gates cluster, and another 10 individuals are located between the clusters. On the contrary, only one buried mature male from Vasylivka II falls into the Dnipro burial grounds cluster.

Currently, the mtDNA of only one female among the individuals from Vasylivka II with the "Danube"  $\delta^{13}\text{C}$  ratios has been analysed. It attributed to subclade U5b2. In the Iron Gates area, carriers of this subclade were found in synchronous burials on the sites of Schela Cladovei, Vlasac and Hajdučka Vodenica, including burials with finds of perforated cyprinid teeth.

According to Ilya Gokhman monograph of 1966, the buried in Vasylivka II are different from the rest of the Meso-Neolithic population of the Dnipro region by the frequent presence of *torus mandibularis*. This osseous pathology is recorded on 18% of all examined jaws from there, compared to less than 1% of all examined jaws from the rest of the burial grounds. Based on the data published by Mirjana Roksandić, *torus mandibularis* is on 63.6% of the examined lower jaws from Padina, 45.4% from Vlasac, 40.0% from Hajdučka Vodenica, 19.6% from Lepenski Vir. It is noteworthy that perforated fish teeth were found in the burials of some individuals with *torus mandibularis* in Vlasac.

Finally, analyses done by Jacobs found significantly higher barium content in the bones of people from Vasylivka II compared to people from one of the earlier neighboring cemeteries. Now, barium content is not used to research an ancient diet, but along with the strontium content it is considered as a possible marker indicating a specific geographical area. In this regard, it draws attention that barites are not mined industrially in the Dnipro region, but their deposits are exploited near the Negotin city in the Iron Gates area.

Thus, the archaeological and archaeobiological peculiarity of Vasylivka II can be plausibly explained by some of the individuals buried there were born on banks of the Middle Danube, and the group that used the cemetery persistently contacted with inhabitants of that distant territory. This conclusion should be verified by a further deliberate comparative multidisciplinary research of the Late Mesolithic materials from the Dnipro Rapids and the Iron Gates areas.

**Keywords:** Late Mesolithic, North Pontic area, Iron Gates area, cemetery, perforated cyprinid pharyngeal teeth, funerary rites, stable isotopes, craniometry, osseous pathology, DNA, migration

# Animal tooth pendants and burial customs at the Kreiči cemetery, south-eastern Latvia

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The well-known Zvejnieki cemetery with 330 burials is one of the largest hunter-gatherer cemeteries in northern Europe and has overshadowed the more than 100 other Stone Age burials known from the territory of Latvia. At the Kreiči cemetery, situated in south-eastern Latvia, twenty-three hunter-gatherer burials were excavated in the 1950s, making it one of the major Stone Age cemeteries in the country. This paper presents the little-known Kreiči burials and the "life history" of this hunter-gatherer burial ground. We approach the topic through the analysis of grave properties and burial practices, and especially through the osteological analysis of animal remains from the burials. Funerary practices and grave inventories (including the choice of used animal species) partly differ from the ones recorded at the Zvejnieki site. All in all, Kreiči is characterized by variable and specific features in burial customs (such as numerous double burials and interments in sitting or prone position), and provides spatial depth and nuances to the image of hunter-gatherer burial archaeology and the previous knowledge on the Stone Age mortuary practices in the Eastern Baltic area.

**Keywords:** Stone Age, hunter, gatherer archaeology, mortuary practices, Latvia, animal tooth pendants

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# Animal tooth pendants and burial customs at the Kreiči cemetery, south-eastern Latvia

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**Keywords:** Stone Age, hunter, gatherer archaeology, mortuary practices, Latvia, animal tooth pendants

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\*Speaker

# Biographies of recycled artefacts in burial context. Case study from Yuzhniy Oleniy Ostrov, Northwest Russia

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Pendants made of animal teeth or splitted tubular bones are common finds in inhumation graves at Yuzhniy Oleniy Ostrov in Northwest Russia. Among the bone pendants, we identified items made of barbed points. The points were cut, and grooves for attaching were made on the narrower end. In this paper we present the biographies of these items. We studied the raw material, technology and tool type of the barbed points, and investigated how these broken artefacts were later turned into pendants, and used in an ornament. We studied the grave context of these artefacts, and describe various phases in their life histories. Finally, symbolic meanings of these artefacts is discussed and compared with data of the other types of ornaments in this burial site and other Late Mesolithic sites in Northeast Europe.

**Keywords:** Artefact biography, burials, material circulation

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# Stone axes in ritualized contexts – the production and deposition of pecked adzes at Strandvägen, Motala, 5500–5000 BC

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*This poster aims to present the production and utilization of pecked and polished round-sectioned adzes of diabase at Strandvägen in Motala, eastern Sweden (c. 5500–5000 cal BC), and the contexts of their final depositions. Much speaks in favour of a ritualized concept where axes produced on site were deliberately used as ritual props among human bones along the River-shore of Motala Ström.*

Finds and intra-site studies of the settlement at Strandvägen have previously revealed a delimited area of greenstone axe production (Carlsson 2007). Axes from the site are mainly pecked round-sectioned adzes (*Swe*: trindyxa), but there is also fully polished smaller adzes or chisels with accentuated narrow sides, as well as ground stone adzes of Lihult/Nøstvet type. The raw materials used are local greenstone and diabase and the find material includes both axe blanks and flakes. Characteristic hammer stones of red porphyry are also found together with raw material, grinding stones, and fragmented axes.

Motala is one of few places in the region demonstrating a manufacture of greenstone axes, although production appears to have been limited and not intended for further distribution. It, rather, illustrates the specialized craft and the spatial disposition of the settlement also seen in, for example, the production of bone tools, as slotted points or leisters (Gummesson and Molin 2019). Moreover, several of the axes at the site were deliberately deposited in and along the waterside of the River Motala Ström, along with richly decorated bone artefacts and human bones (Molin et al 2014; Gummesson and Molin 2016; Larsson and Molin 2017).

At Strandvägen inhumation burials, as well as disarticulated human bones formed important parts of the local mortuary practice (Molin et al in press). The shoreline of the river was of importance where human bones were immersed in the water and deposited on stone packings built along the riverbed. These depositions have clear parallels to the finds at the nearby site Kanaljorden where several human skulls (calvaria) were recovered in a similar depositional context (Hallgren and Fornander 2016).

Previously, Mesolithic research has tended to view grave goods as possessions of the deceased, however, evidence is now emerging showing that deliberately deposited tools played an active part in hunter-gatherer mortuary rites. The practice of creating material culture, not the least stone axes, specifically for placement within burials or ritual depositions have recently been

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illustrated by the early stone adze from Hermitage, Ireland (Little et al 2017). This implies a pattern of material culture appointed specifically for use in ritual contexts, and the associated levels of care and social interaction within mortuary practices (*cf.* Nilsson Stutz 2006).

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**Keywords:** strandvågen, adzes, ritual depositions, human bones

**Topic: Methodology and theories**

# A Little Give & Take: Studying Mesolithic Archaeology and Studying Hunter-Gatherers in 2020

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Whilst the striking diversity and eclecticism of Mesolithic research in 2020 is characterised by a huge range of analytical approaches, datasets and interpretive frameworks, a small handful of core themes still unite us as a body of study. One of these is a primary interest in hunter-gatherers. The relationship between our understanding of the hunter-gatherer groups with whom we currently share the planet, and that of those who inhabited Europe during the Mesolithic period, has been an ever-present theme in Mesolithic research. Contemporary or near-contemporary hunter-gatherers have provided a variety of analogies for our reconstructions of Mesolithic lives. These have ranged as the discipline has developed: from (neo)evolutionary assumptions, through the application of foraging and mobility models, developing social complexity, ontological frameworks and many more.

There is great variety in the relationship between Mesolithic archaeology and the broader anthropology of hunter-gatherers, including important regional and research tradition variation. However, it is clear that this dialogue has tended to be dominated by the archaeological application of anthropological concepts. The extent to which Mesolithic research has contributed to wider anthropological debates over what hunter-gatherer societies are and can be has seldom been assessed or addressed.

This session aims to reflect on the history of the relationship between hunter gatherer anthropology and Mesolithic archaeology, and take stock of the range of ways in which these two disciplines currently engage with one another. However, it seeks to go beyond a retrospective historiographical study, and poses a critical question of its own: In 2020, how does Mesolithic Archaeology contribute towards the wider field of hunter-gatherer research?

We welcome contributions which:

- Critically reflect on the relationship between Mesolithic archaeology and Hunter-gatherer anthropology over the past two centuries
- Explores the ways in which Mesolithic research undertaken in the past 5 years has engaged with hunter-gatherer anthropology

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\*Speaker

- Outlines novel approaches to the Mesolithic, informed by emerging anthropological concepts
- Offer appraisals of the ways in which Mesolithic archaeology can contribute towards current debates within Hunter-gatherer anthropology

We are delighted that Professor Charlotte Damm (Univ Tromsø) has agreed to act as discussant. We feel that Professor Damm's perspectives on long-term hunter-gatherer dynamics and the interaction between different analytical perspectives will provide a very important contribution to our debate.

**Keywords:** Hunter, gatherer, Anthropology, Mesolithic, Analogy

# Experimental Archaeology in Mesolithic Research

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Experimental archaeology is becoming increasingly important in archaeological practice: both as a scientific tool and as a way to include the public in research. Experiments range from constructing dwellings to burial experiments exploring organic residue survival, involving state-of-the-art bioarchaeological techniques. But how are these approaches transforming our understanding of the Mesolithic, whether that be our own research agendas or the way the Mesolithic is visualised by the public? In this session we would like to bring together researchers who are using experimental archaeology to address key theoretical questions regarding the different aspects of Mesolithic lifeways: pushing beyond functional typological studies to explore more socially grounded questions relating to past processes, activities and materials. We aim to show how a close and intensive dialectic between Mesolithic archaeological remains and experimental archaeological research can enable us to move beyond cliché assumptions about Mesolithic life. We invite speakers to present research which utilises scientific, well documented experiments to address a specific research question relating to archaeological objects, structures, activities and processes, for example, pyrotechnology, adhesive production, foraging, fishing, or burial practices.

**Keywords:** Experimental archaeology, visualisation, public archaeology

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# Modelling the Mesolithic

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The use of modelling techniques provides an increasingly common way to approach the study of the Mesolithic, from site location to analyses of mobility. It has even become a tool for public interpretation. Various types of modelling are involved, including Site Location Analysis and Agent Based Modelling, though all draw on GIS techniques in order to manipulate and interrogate data. Nevertheless, for many archaeologists, modelling remains somewhat of a ‘dark art’, a bastion for the few and the processualists. This session seeks to draw on examples from a diverse range of applications in order to explore the current potentials of different modelling techniques and likely future developments. The aim is both to generate discussion between practitioners and to illustrate the prospective value of computational modelling as a recent addition to the archaeological toolbox. Submissions relating to both case studies and methodologies are welcome.

**Keywords:** Modelling, site prediction, Geographic Information Systems, Agent Based Modelling, landscape analysis

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## **Session: Modelling the Mesolithic**

# Beyond structures: A microscale multi-proxy approach to understanding the social dimensions of tool using areas at the Early Mesolithic site of Star Carr, UK

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During recent excavations at the Early Mesolithic site of Star Carr, North Yorkshire (UK), nearly 24,000 flints were found and at least three structures were identified; the oldest ever found in the UK. Microwear results from a study of 126 flints (Conneller et al. 2018) have shown that a range of activities were undertaken across the site, such as plant working, axe manufacturing, bead making, hide and antler processing. From initial analysis, there appears to be variability in tool-based activities undertaken in and around the structures. However, the full extent and nature of these activities remains unknown, and it is unclear to what extent tool-using activities within the structures can provide insights into the functions of these structures, and how they relate to other tool-using areas at Star Carr. Due to large scale excavation, the site offers a unique context in which the results from the microwear analysis can be integrated with high-resolution spatial analysis and Bayesian statistical modelling, with potential to reveal discrete episodes of activity.

This paper presents a multi-proxy approach of using microwear analysis alongside spatial and Bayesian modelling to explore the use of flint tools found in and around the three structures, showing unique glimpses of spatial and temporal patterns in tool-using behaviours. GIS was implemented throughout all stages of analysis as a spatial model which was used to: 1) establish which flints to sub-sample, 2) plot the results of microwear analysis, 3) explore spatial patterns in tool use within and between the different structures. A Bayesian statistical model detailing the chronology of human occupation has previously been established for the site (Bayliss et al. 2018), which was incorporated into this research to enable insights into possible changes in behaviour and the use of these structures during the site's use. Through a spatial and temporal understanding of the microwear data found in and around the structures, the results of this research will contribute to more nuanced narratives into the social spaces created within and around the structures. It is hoped that the future potential of applying a microscale approach, alongside a range of complimentary modelling methods, to understand elusive spaces in the Mesolithic will be seen.

**Keywords:** Settlement, structures, GIS, flint, tools, microwear

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<sup>\*</sup>Speaker



# Ornaments as proxy for reconstructing social networks from Iberia Mesolithic hunter-gatherers

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Archaeologists and ethnographers have long suggested that certain artifacts classes may be especially useful to investigate shared identities or shared social practices due to their symbolic meaning or style (Peeples, 2019). Among these artifacts, personal ornaments are perceived by members of hunter-gatherers (HG) societies as an indicator of their ethnic identity, enhancing within-group cohesion and contributing to drawing the boundaries with neighboring groups (Newell et al., 1990; Wobst, 1977). Although ornaments provide great inference on HG's social connectivity, the refined assessment of the social structure through means of Social Network Analysis (SNA) has been overlooked in archaeology (Romano et al., 2020). We use this innovative approach to formally reconstruct HG networks in the Iberian Peninsula throughout early Holocene. Developed within the scope of the ERC project PALEODEM (ERC-GoG-2015 Ref.683018), which aims at studying Late Glacial and Postglacial population history and cultural transmission in Iberia, this communication presents the preliminary results from a case study that formally applies SNA methods on the Mesolithic archaeological record. First, we assume that the greater the similarity between ornament assemblages, the greater the likelihood of shared social relations (Mills, 2017). Second, matrices of similarity based on ornaments assemblage are used to create two weighted and undirected networks: one corresponding to the Early Mesolithic and the other to the Late Mesolithic. Next, networks are characterized according to their microscopic (i.e. relevance of regional groups within the network) and macroscopic (e.g. how densely connected is the network) features. Last, we compare their structural properties and track potential changes throughout time. With this study case, we hope to contribute to a deeper understanding of the patterns of socio-spatial structure of HG during the Mesolithic, which ultimately may provide insights into the mechanisms behind the significant cultural changes documented in the Iberian Peninsula during the same period.

**Key words:** Mesolithic; Social Network Analysis; Iberian Peninsula

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**Keywords:** Mesolithic, Social Network Analysis, Iberian Peninsula

# Modelling radiocarbon dates and site counts: paleo-demographical dynamics in the western Scheldt Basin in Belgium and Northern France

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The Mesolithic in the western Scheldt drainage basin has been extensively studied during the last few decades. The total number of sites in western Belgium and Northern France already exceeds one hundred, in considerable part having been extensively dated.

Owing to the ever growing number of radiocarbon dates within this area, the opportunity presents itself to attempt to reconstruct paleo-demographic dynamics through the use of summed radiocarbon probability distributions. This has proven to be a popular, if flawed, proxy in modelling demographic processes; particularly during the preceding decade.

The distributions, after careful selection and correction of the data, form a preliminary model of demographic evolutions. The resulting major troughs in the probability distributions possibly coincide with short-lived climatic events such as the well-known 8,2 ka event. Due to its inherent flaws and uncertainties we have supplemented the summed probability distributions with site count analyses in order to compare results and test the validity of the method.

By utilizing the modelling of radiocarbon dates and site count analyses we present preliminary paleo-demographic reconstructions coupled with a critical approach of the use and evaluation of radiocarbon modeling of demographic processes.

**Keywords:** Scheldt drainage basin, Paleo, demography, summed probability distributions, site count analyses, Belgium, Northern, France

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# Predictive modeling for Mesolithic site locations in southeastern Europe

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The sparsity of Mesolithic sites preceding the earliest Neolithic in southeastern Europe has been variously attributed to lack of habitation, low population density, and biased research coverage. The question of whether some parts of the landscape were vacant, or whether the sites are there waiting to be found, has not been answered. This paper provides a land-use model for southeastern Europe that serves as an entry point for discussions about the presence and potential distribution of Mesolithic sites on the landscape. We use elevation and lithic raw material hotspots in key areas of southeastern Europe to build a set of expectations of where more sites might be found in countries where they are already known, and also build expectations for where new sites might be found across national borders where similar environmental conditions prevail. We also discuss potential strategies for prospective field survey in areas with no confirmed Mesolithic sites.

**Keywords:** southeastern Europe, predictive modelling, buried landscapes, research bias

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# Modelling a submerged and preserved Mesolithic landscape under the Harbour of Køge, Denmark, with sites from the Maglemose- and Kongemose Cultures

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A partially preserved submerged prehistoric landscape, with several sites and a vast amount of stray finds from the early Mesolithic has been investigated by the Viking Ship Museum, prior to a development project in the Harbour of Køge, Denmark. Test pits excavated by mechanical excavator made it possible to document and sample the thick stratigraphy of the area. A reconstruction of the sedimentation of the prehistoric landscape was created by modelling and radiocarbon dating the local stratigraphy. The model shows the development of the area from an inland freshwater river system to a coastal lagoon, to transgression of the area by the sea, providing a landscape context to the archaeological sites in the area. After the pre-investigations with mechanical excavator, two sites were further excavated with divers. These sites consist of a partially dispositioned settlement material from the phase 1 of the Maglemose Culture (8000-7500 BC), as well as a fish weir, dated to the transition between the Maglemose- and the Kongemose Culture (c. 6800 BC).

**Keywords:** submerged landscapes, landscape modelling, maritime archaeology

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# Modelling hunter-gatherer cultures after nature? – Reality or fake research? An old and unfortunately forgotten anthropological discussion

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In a world of smart desktop approaches, it can be healthy to go back to the roots of the discussion of whether it is possible to model the behaviour of small-scale human cultures on the basis of their environment – or not. Our days modellers appear to have forgotten this at times quite heated debate, which played an important role in the late 19th and early 20th centuries' anthropology. Apparently, this disagreement was never settled. Around the 60s archaeological theoretical modellers decided that it was possible to model hunter-gatherer's culture and behaviour on the basis of their environment and thus to ignore social anthropological data, supporting the opposite point of view. This was the start of a tradition of archaeological modelling that ignored cultural differences and with time also, as the developing landscape ecology provided this information, environmental complexity and small-scale dynamics. It is difficult to see any scientific rationale behind such an archaeological isolation from other disciplines' relevant data. A more likely driver could be the demand for cheap and fast management methods that do not create a demand for too expensive management. The presentation outlines the history of the debate in focus here and suggests the development of alternative approaches.

**Keywords:** modelling, hunter, gatherer, environmental determinism, landscape ecology

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\*Speaker

# The diffusion of pottery technology among Eastern European hunter-gatherer-fishers: using spatial-temporal modelling to understand the knowledge transfer process

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Northeast of a line between the Baltic and Black Seas, pottery technology first appeared in mid-Holocene hunter-gatherer-fisher contexts, long before the local start of food production. A general east-west gradient in legacy 14C dates associated with the earliest pottery types supports the traditional view that pottery-making knowledge spread westwards from Siberia, but large dating uncertainties hinder observation of more detailed spatial-temporal patterns, and do not exclude multiple independent sources of pottery making, or allow us to compare potential mechanisms for the diffusion of this technology. We report preliminary results of a new initiative to date the spread of hunter-gatherer pottery between the Urals and the Baltic, combining 14C dating, technological and typological analysis, and spatial-temporal modelling.

Modelling the process of cultural transmission involves assumptions about how knowledge of the craft of pottery was passed from person to person, consuming resources of energy and time as part of this process. Knowledge of the tradition was spread as each cohort of pottery-using people influenced those around them. The rate of spread was moderated by the strength and range of the pre-existing social network or the ‘sphere of influence’ that each community had over others nearby. Other parameters that may be modelled include demographic variables of population density and diffusion rate, and the physical terrain itself.

Therefore, by reconstructing how the hunter-gatherer landscape was interconnected along natural routeways, and using Bayesian chronological models of 14C results from selected sites to apply a spatiotemporal gradient to this network, we can predict the arrival time of pottery at any given location in the study region. Using typological data to validate this model, we can also identify cases where the data expose limitations of this framework with regard to rapid transmission that occurred alongside certain patterns of resource adaptations. The rapid spread of hunter-gatherer pottery across north-east Europe, in the early 6th millennium BC, strongly suggests that demographic factors are unlikely to have contributed significantly to the process, at least during its initial spread.

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**Keywords:** spatial, temporal model, chronology, radiocarbon, pottery technology, pottery typology, knowledge transfer



# Modelling the Mesolithic without people

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Europe's Lost Frontiers is a 5-year ERC-funded project which uses a variety of techniques, both traditional and innovative, to examine the submerged Holocene landscape of the southern North Sea. These techniques include sedimentary DNA analysis, geochemistry, seismic geophysics and pollen, foram, ostracod and diatom analysis. Computer simulation was intended to act as a hub within which the data from these techniques could be brought together in digital models. These models would serve as hypotheses to be tested in digital sandboxes within which, data from outside the project could be incorporated. The first phase of this programme involved a simulation of the inundation of the landscape that was being mapped by the seismic geophysics specialists. This took data regarding short and long term processes of sea-level change and combined them into a simulation which allowed a simple model of the intertidal zone to be run at a variety of spatial and temporal resolutions. This paper presents the initial results of this simulation with a focus on how this model, without any explicitly modelled human activity, can help understand how humans may have used this landscape. It will highlight some of the questions raised by the simulation and explain how the project will attempt to answer those questions. The submerged landscape under the North Sea was a dynamic environment and, via the project's models, we aim to demonstrate the benefits of using dynamic computer simulations to investigate this type of landscape compared with more traditional technologies.

**Keywords:** Computer simulation, Doggerland, North Sea, intertidal, sea, level

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\*Speaker

# A modelling approach to explore the origin(s) of the Blade-Trapeze Complex

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The distribution throughout Europe of the Blade-Trapeze Complex (BTC) that covers less than one millennium, based on available radiometric information, suggests there may have been demic and/or cultural diffusion processes before the Neolithic. In this context, the BTC industries have generally been studied from a regional perspective with the exception of G. Clark's work, who analysed the spread of this complex in terms of demic diffusion. However, if there was a population movement, where did the last hunter-gatherers living in Southwestern Europe come from? In recent years, the debate about the origin of the BTC phenomenon has pivoted between Crimea and North-western Africa following the excellent syntheses by Clark. In this talk, we will present a preliminary conceptualisation of an agent-based model to explore both origins based on radiocarbon dates and bioarchaeological data.

**Keywords:** Blade, Trapeze Complex, Agent, Based model, Biomass, Radiocarbon dates, demic diffusion.

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# Agent-based modelling of the Mediterranean Neolithization and Mesolithic-Neolithic interactions: a first draft

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The spread of the Neolithic from the original Near Eastern heartland is a process that combines demic movements (of settlers) with possible acculturations of Mesolithic hunter-gatherers. This westward diffusion did not take place in empty territories but which were, on the contrary, more or less densely populated by native groups. If the first models of the seventies insisted on the regularity of the diffusion, the ‘wave of advance’, those recently developed insist on the arrhythmia of the process. It can be very rapid or, on the contrary, can stop for several centuries. These slowdowns are sometimes interpreted as regional resistance by groups of aboriginal hunter-gatherer groups that are more dense. In the Mediterranean area, it is also known that the sea is a possible vector of acceleration, like with the model of ‘leapfrogs’ diffusion. On the contrary, the more mountainous or less fertile areas may have acted as a brake on this expansion. On the basis of some of the simplest environmental and anthropological constraints, this communication proposes an initial approach to this process on the scale of the Mediterranean basin as a whole through agent-based modelling. This is only a first draft, the purpose of which is above all to show the potential of the tool for modelling the possible interactions between Mesolithic and Neolithic in a constrained environmental framework. The (desired!) refinement of such a model would require the implementation of a vast collective program.

**Keywords:** Neolithization, Mediterranean area, Agent, based model, interactions

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\*Speaker

# Using residential data as proxy for population dynamics: Aoristic modelling of shoreline dated sites in coastal SE-Norway

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The Mesolithic in Norway is represented by a vast archaeological material, where South-Eastern Norway alone holds sites numbering in the thousands. The concentration of settlement in coastal areas and a continuous land-rise in the Holocene means that Mesolithic sites in South-Eastern Norway can be dated with reference to their elevation above present day sea level. This offers a great possibility for elucidating general, long-term tendencies in societal variation.

Modelling relative fluctuations in radiocarbon dates has proven a valuable proxy for prehistoric population dynamics. Shoreline dated sites can offer a large, independent source of temporal data that is not contingent on the preservation of organic material. While this data can be leveraged to model long-term societal fluctuations, it is, however, associated with its own set of underlying assumptions and uncertainties.

Here we draw on works that have attempted to combine several, disparate sources of data for studying long-term population patterns. By applying a probabilistic approach, using aoristic modelling, we offer preliminary results and methodological considerations pertinent for the handling of both a material on this scale and the uncertainty associated with dating and summing site counts by means of shoreline displacement.

**Keywords:** demographics, aoristic modelling, shoreline displacement, Norway

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# Building a model for material flow patterns in North Swedish river systems – Part 1

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Lithics are an important element of inferences into mobility among hunter-gatherers. Establishing the provenance of the material from which the lithic artefacts are produced is an important aspect of prehistoric resource strategies, linked to the concept of the *chaîne opératoire*, as well as providing an insight into possible exchange networks. One critical component, however, is the identification and comparison of the materials with possible geological sources, something which is not always so straightforward to undertake.

While the bedrock in Northern Sweden has been well studied, and as a consequence is well understood, the effects of the Last Glacial has displaced a lot of materials from their sources, making quartz and quartzite widely available as surface finds with vague provenance. Perhaps due to this situation, provenance studies of these materials have been lacking, but in recent years The Environmental Archaeology Lab at Umeå University, Sweden, has been experimenting with Near Infrared (NIR) spectroscopy and Hyperspectral Imaging techniques on lithic artifacts. They have proven useful in chemical characterization of quartz and quartzite materials, allowing us to separate them into different classes based on provenance.

This presentation will be discussing an ongoing PhD project with the goal of expanding upon the above approach. Using NIR, pXRF and Raman spectroscopy the project aims to build a more robust classification of quartz and quartzite points found in the County of Västerbotten. A combination of multivariate statistics and GIS-modelling will be used to test models for material flow patterns and to link these to settlement and mobility in Northern Sweden. A significant advantage of the methodology is that it is both non-destructive, and relatively cheap, allowing us to process and work with larger datasets of artefacts. While the geological sources are still somewhat vague, the underlying dataset should still provide a robust insight into possible source areas and material flow in the North Swedish river systems.

**Keywords:** Spectroscopy, Lithics, Provenance, Mobility, Material flow, Chemometrics, Raman, NIR, XRF, Quartz, Quartzite, Sweden, Points

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\*Speaker

# Combining agent-based modelling and geographical information systems to create a new tool for modelling movement dynamics: A case-study of Mesolithic Orkney

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*The earliest Holocene occupation of Orkney is still poorly understood. A lack of obvious sites means that it has, to date, undergone inadequate representation in the wider research agenda. This proof-of-concept study explored the development of a ground-up environment-based site-prediction model; a realistic mobility-resistive prehistoric landscape; and a dynamic human exploratory approach, using advanced computational techniques to place Mesolithic activity within a realistic landscape setting. Constrained variables pertaining to the base physical character produce initial insights into site placement and exploratory movement. This lifts topography and terrain from a passive backdrop to play an active role within Mesolithic studies, moving away from the static frameworks of previous analyses. The promotion of a complex physical environment can be used to test hypotheses and allows the development and layering of more complex input factors, and progresses research by addressing further questions. The approach promotes understanding of post-glacial Orkney and is widely applicable to other situations around the globe. This research is the first step of a scalar investigation into the utility of regression-based predictive modelling for the early Holocene.*

**Keywords:** Modelling the Mesolithic, Agent, Based Model, Geographic Information Systems, Landscape Reconstruction

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\*Speaker

## **Session: Experimental Archaeology in Mesolithic Research**

# Fishing during the Late Mesolithic Ertebølle Culture – an Experimental Approach to the Use of Fishhooks

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The great conditions of preservation for organic material on Ertebølle coastal settlements (5400-3950 cal BC) have enabled the conservation of wooden artefacts such as log boats, leisters and fish traps, showing the complexity and diversity of fishing practices during the south Scandinavian Late Mesolithic. Bone fishhooks also form an integral part of the fishing activities, but they have sometimes been considered less important in the economy than the rest of the fishing tackle. However, besides a preserved piece of line on one fishhook, little is known about the implements, techniques and gestures involved in the use of the different Ertebølle fishhook types. Being an implement that often necessitates an actor and therefore an array of individual skills and techniques, the tangible and intangible aspects that surround the use of fishhooks in the Ertebølle culture are worth investigating.

This communication presents the results of preliminary archaeological experiments carried out during the summer of 2019. Replicas of fishhooks from selected Ertebølle sites were produced and tested in different fishing contexts. The techniques tested were adapted from universal modern and ethnographic techniques, in order to try to understand how the fishhooks may have functioned, which techniques worked best and whether they were adapted for active or passive fishing. Therefore, cooperation with modern fishermen was decisive for the success of the experiments.

Modern and ethnographic examples of angling show how fishhooks can be embedded in social believes, skills and transmission of knowledge through generations. More than only being a test of fishhook efficiency, the experiments provided new thoughts towards a social understanding of techniques and artefacts within Mesolithic communities, as well as creating a bridge between ancient times and modern populations through technical skills, showing that archaeology is also relevant for the public outside of museums.

**Keywords:** Late Mesolithic, Ertebølle culture, bone fishhooks, fishing techniques, experimental archaeology

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\*Speaker



# Burning questions about Mesolithic sites

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Fire has played an important role in human history. It has been part of occupation sites since at least the Middle Palaeolithic. However, little is currently known about the exact impact of fire on lithic artefacts, which are frequently found within prehistoric hearths. Even less is understood about the effect of burning on microscopic wear traces. To address this gap, we conducted several experiments in the framework of an interdisciplinary project at Ghent University combining geologists and archaeologists focusing on replicating conditions known from Mesolithic sites in NW Belgium. Experimentally used replicas of these Mesolithic flint artefacts were burnt both in field and laboratory conditions. Microwear traces were analysed before and after the alteration, and also validated by blind-tests. Possible microstructural and geochemical changes in the flints are investigated using macroscopic observations, colour measurements, micro-CT and thin-section analysis. This is combined with traditional microwear analysis. The first results show that some microwear traces are preserved even when the replicas show heavy burning features. The preservation characteristics are connected to heating temperatures, raw material characteristics, and contact materials. Therefore, to have a more unbiased view on the activities conducted with stone tools, burnt artefacts should be included in functional analysis of lithic assemblages. This way we can have a more inclusive view on the way of life during prehistoric times. This certainly holds for Mesolithic sites, as these generally include large proportions of artefacts affected by heating (30-75%). Our observations are also interpreted on a broader theoretical level. We reflect on the spatial and social organisation of camp sites and on the possible causes for the concentrated larger quantities of burnt artefacts on the sites. Were stones deliberately thrown into the fire after use? Could this have been done as a clean-up strategy? Or were they discarded at the same refuse area where heat-dumps were deposited? We will present the insights gained from our experiments to these questions.

**Keywords:** Mesolithic, burning, experimentation, microwear, flint

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\*Speaker

# Functional analyses of Mesolithic ground stone tools

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Ground stone tools play a key role for reconstructions of subsistence, craft technologies, land use and settlement behaviour. This is especially true for the Mesolithic, when ground stone tools appear in large numbers and varieties. According to their find contexts and morphologies these commonly and multifunctionally used stones were needed for a wide range of activities, including food preparation, manufacturing of tools, as building material or heat conductor. Furthermore, ground stones have for the first time been deliberately modified into mace-heads or axes. Still, they receive little attention in Mesolithic research.

The project works on reconstructions of the use history of ground stone tools, starting with case studies based on the the find materials from selected Mesolithic sites in Northern Germany (Duvensee, Rothenklempenow 17, Friesack 4, Neustadt LA 156). These sites are distinguished by an excellent organic preservation and careful documentation. The analyses focus on quantitative reconstructions of the functions and the economy of ground stone tool use in the respective settlements and subsistence contexts.

Analyses include the identification of the raw materials selected, measuring of their properties, stone morphology, surface topography, use wear and possible residues, investigations of heating temperatures (Ftir-spectroscopy) as well as experiments on tool use and heating. Intra-site spatial investigations will contextualize the results.

The presentation will focus on the methodologies employed and present some first results of the recently started project.

**Keywords:** ground stone tools, Northern Germany, functional analysis, use wear, experiments, 3D scanning

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\*Speaker

# Axes and chisels made of elk antler from the Mesolithic - Early Neolithic sites of Russia and Belarus: technologies and functions.

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Our report will present the results of experimental and traceological analysis of the chisels and axes made of antler (*Alces alces* L.) from the site near the village of Michnievičy (North-Western Belarus) and settlement Zamostje 2 (Russia). The largest part of the collection refers to the period of Mesolithic – Neolithic. At the first stage of work, the most expressive and numerous group of artifacts made of antler were selected for a techno-morphological analysis. Analysis of the technological traces recorded on the items allowed us to highlight the differences in the manufacturing processes of the tools. According to technological and morphological features, the whole of the analyzed material was divided into conditional categories of instruments. In addition, on the basis of the macro signs of utilitarian wear observations on the functional using of objects were obtained. A series of experiments were conducted to reliably verify the traces of use recorded on artifacts. It was found that the choice of raw materials, a specific part of the elk antler, was deliberate for the manufacture of tools of different type. Established standards for the manufacture of tools with a set of certain functional characteristics indicate a strict specialization of this category of tools. It can be assumed that the functional specialization of the antler chisels and axes of special types were preserved in other territories where these items were found (for example, in the Baltic States and Western Russia), which may indicate a wide spread of elk antler processing skills in communities of the Late Mesolithic - Early Neolithic period.

**Keywords:** Mesolithic, Early Neolithic, Belarus, Russia, Zamostje 2, elk, antler, traceological analysis, functional analysis, experiment

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# Fashioning fishhooks in Mesolithic Scandinavia: regional traditions and chronological trends

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This paper discusses the use of experimental approaches to gain novel understandings of the social organization of everyday craft in different Mesolithic communities in Scandinavia, using the fashioning of bone fishhooks as a point of departure. We present results from experiments and archaeological assemblages in three regions; Southern Norway, Western Sweden and Southern Scandinavia. Experiments with different osseous materials (elk, red deer and roe deer metapodials and red deer ribs) combined with analysis of artefacts and bone debris, reveals regional and chronological variations in raw-material use, CO and the time and skills required to make fishhooks. This indicate that fishhook manufacture and use is embedded in different and persisting traditions that are chronologically, culturally and geographically defined. The collective and communal aspects of tool production are often disregarded in experimental archaeology and popular dissemination of the Mesolithic (Finlay 2006) at the expense of the singular expert flint-knapper. The vital role played by social transmission in traditional crafts and the large number of interrelated tasks involved in fishhook manufacture and use, such as assessing osseous and lithic raw material, disarticulating bones and making blanks, extract sinews or gather plant materials for making lines etc., enable us to portray Mesolithic life as a community of individuals *crafting together*. Finlay. N. 2006. Manifesting microliths: insights and strategies from experimental replication. In: Apel, J. & Knutsson, K. (eds). *Skilled production and social reproduction. Aspects of traditional stone-tool technologies*. Sau Stone Studies 2. Uppsala.

**Keywords:** Bone fishhoooks, experimental archaeology, regionality, craft tradition, community

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# Personal ornaments at Star Carr: Integrating experimental archaeology, microwear analysis, and GIS to identify crafting spaces

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We report on the discovery of a personal ornament crafting area at the Early Mesolithic (9300-8500 cal BC) site of Star Carr, UK. Microwear analysis, experimental archaeology, and GIS were used to understand the spatial patterning and use of awls, beads and pendants. During excavations from 2004-2015, three shale beads, a shale pendant, and 69 flint awls were excavated, recovered from a spatially discrete area. These finds expand the assemblage recovered by Clark in 1949-51: three amber pendants, 26 shale beads, one shale pendant, two cervid teeth pendants, and a probable bird bone bead. This assemblage constitutes the second largest but most diverse recovered from the UK. Good preservation and open area excavation provides the opportunity to integrate techniques and critically analyse tool function alongside spatial patterning.

New analysis using these techniques expands on previous findings, identifying further mineral working traces on some awls (including *mèche de foret*). Awls were used in a rotational motion on soft mineral, consistent with drilling shale, confirmed through experimental archaeology. GIS evidences spatial patterning of beads/pendants and awls to the west of the site. Taken together, this evidence suggests a craft working area focusing on personal ornament production. The high resolution nature of the site and open area excavation further facilitates a consideration of the social implications of this crafting activity at Star Carr.

The study highlights experimental archaeology as an important tool when used in tandem with microwear analysis to provide technical insight into the use of Mesolithic stone tools. The use of experimental archaeology to create a comparative assemblage suitable for use in microwear analysis, in this case related to bead and pendant manufacture with awls, is essential in facilitating the interpretation of archaeological tool function. Microwear analysis, used in combination with spatial analysis using GIS, offers the potential to identify craft activity zones and may have wider applicability in prehistoric other prehistoric contexts.

**Keywords:** Mesolithic, UK, personal ornaments, experimental archaeology, GIS, microwear analysis, craft

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# To fish or not to fish? Fish processing at Iron Gates: an experimental approach

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It is well known that many Mesolithic and Early Neolithic sites have been recovered during the past century in the Iron Gates region (Eastern Serbia). The application of diverse analysis on human remains and artefacts raised many questions, but also offered new ideas about the transitional period in the middle and lower course of Danube. New methods and studies of the artefacts enabled the researchers to have a look at the everyday life of the hunter-gatherer fishermen groups who inhabited the area during Late Glacial and Early Holocene.

Communities in Iron Gates consumed fish and exploited the bank in the prehistory. This is visible in the results of isotope analysis done on the human individuals implying that they fed on aquatic resources, in some periods more than in others. Fish remains were also found in the settlements and based on the iconography present on the sculpted boulders and other artefacts, the bond between the people, river, and eco-system was compelling.

The idea of this communication is to present the possible fish working using chipped stone tools in the Iron Gates region during the Mesolithic-Neolithic transition. The traces are observed by various methods, having in mind how hard is to detect activity specific as fish processing. The analyses consisted of both low- and high-power approach combined with FTIR analysis.

The experimental approach has also been applied as a usual procedure in the use-wear analysis. A couple of experimental sets were done on the larger fish, like common carp (*Cyprinus carpio*) with an idea to reproduce use-wear traces on chipped stone replicas. Diverse activities as scale removal, hide working, organ removal and filleting were done. In the case of experimental tools, FTIR analysis was of additional help to test the tracing of chemical elements that could be connected to activities on diverse fish parts and organs.

Finally, the experimental results represented by macro traces and polish are being compared to the use-wear traces found on the archaeological sample. Traces of filleting, butchering and decapitation found on the bones were also compared to the ones found on Lepenski Vir, Vlasac and Padina site. This combined and specific study helped us understand the processing of fish in the prehistoric period in detail, from the tool selection to the hide tanning.

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**Keywords:** use, wear analysis, FTIR analysis, experimental archaeology, chipped stone tools, fish processing, Mesolithic, Neolithic, Iron Gates

# Something new in the quivers: experimental approach to functioning of the Late Mesolithic and Early Neolithic geometric bitruncations

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During the 7th and 6th millennium BC, a major cultural change took place in Mesolithic societies. Particularly perceptible in the lithic industries, this technological and stylistic rupture spread in the western basin of the Mediterranean and then affected most of Western Europe. The changeovers occur at different levels, including the introduction of the pressure knapping technic and the indirect percussion and the adoption of trapezoidal shaped microliths, manufactured on the regular blades using the *microburin* technique. Probably echoing changes in the different registers - technical, economic, social or symbolic - of the hunting system, these new arrowheads shapes reflect functional roles which are still underexplored.

In this poster, we present the results of a projectile experimental program performing in order to characterize and interpret this new conception of the wounding tip of the arrow. Centered on the Late Mesolithic (Castelnovian) but with extensions in the Early Neolithic (Impressa/Cardial), it has enabled the creation of a large-scale reference collection by the implementation of experimental shooting sessions following different protocols, archery session on animal target and parametric shooting session on a ballistic gel with automated bench. On the one side, we got a model of macro and micro-impact damages as well as on symmetrical and asymmetrical bitruncations according to their shape and their mode of hafting (transverse and piercing tip hafting) but also on bones. Through systematic research of the link between the wear on the arrowhead and on bone, one of the objectives was to assess how the nature of the impacted skeletal element and the angle of penetration of the arrow into the carcass, affect the type and the intensity of damage to lithic projectiles. On the other side, we have obtained some initial data on the behavior of the projectile (trajectory, damage, detachment....) and evaluate the performance and the wounding efficiency of different arrows, in term of penetration depths and damage to gelatin (laceration, tearing, etc.).

At last, this experimental program and traceological approach, provide an analytical tool for a

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better understanding of the mechanisms of projectile changeovers and their typological diversity, through a detailed analysis of their use and a reading beyond their shape.

**Keywords:** Late Mesolithic, Early Neolithic, trapezoids, shooting experiments, projectile, use, wear analysis, impact damage

# Qualitative and quantitative experimental data for understanding functional biographies of quartzite macro tools from Mesolithic Danube Gorges

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The Danube Gorges region in the Central Balkans represents one of the key areas for studying late Pleistocene and early Holocene human adaptations. Numerous archaeological sites discovered along the banks of the Danube River yielded crucial evidence for understanding local forager lifeways and mortuary practices during the Mesolithic as well as changes occurring with the arrival of farmers in the region at the end of the 7th millennium cal BC. Taking into account material culture, grinding and pounding tools could represent an important source of information for exploring modalities of food processing and daily life activities as well as technological changes throughout time, due to the long-life histories of macro-tools. Such artefacts are particularly abundant at all the Mesolithic sites of the Danube Gorges region. Also, their functional analysis confirmed the extraordinary preservation of organic residues and functional modifications on their surfaces and the use of groundstone technology in key daily life activities related to animal and plant food processing. Experimental archaeology along with the analyses of use wear and residue represent a fundamental means for testing functional hypothesis and understanding tools' role in the life of ancient human groups. In this presentation we discuss the results of a specific experimental framework designed upon the functional data available for the assemblage of quartzite macro tools from the site of Vlasac. We propose a novel methodology combining quantitative and qualitative approaches. Specifically, surface modification and residue distribution, associated with the utilisation of quartzite macro tools in processing plant, animal and mineral matters have been analysed applying a range of quantitative surface measurement techniques performed at macro and micro scales, coupled with the qualitative analysis of use wear and residue observed at low and high magnifications. Through our experimental framework we were able to evaluate the efficiency of quartzite macro tools in performing a variety of activities and in the processing of organic and inorganic matters. Moreover, the use of experimental macro tool replicas allowed to build a solid use-wear and residue comparison col-

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lection including both qualitative and quantitative data. Our results highlight the multipurpose role of groundstone tools at Vlasac and suggest their relevance within the daily life activities carried out at the site.

**Keywords:** Macro Tools, Use Wear Analysis, Residues Analysis, Danube Gorges, Vlasac

**Session: A Little Give & Take:  
Studying Mesolithic Archaeology  
and Studying Hunter-Gatherers in  
202**

# Consumers, not contributors? The study of the Mesolithic and the study of Hunter-Gatherers

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This paper explores the relationship between the archaeology of the European Mesolithic and the broader field of hunter-gatherer research, encompassing archaeological and anthropological approaches as well as a range of advocacy and activist positions. We begin with the contention that Mesolithic archaeology has generally been a ‘consumer’ of information from hunter-gatherer anthropology and has, to date, contributed little back; a disconnection that has left several major themes within broader hunter-gatherer research overlooked within the context of the Mesolithic. This will be demonstrated through an analysis of the engagement of archaeological and anthropological perspectives at recent CHAGS conferences, and a reflection on the impact that a general lack of indigenous hunter-gatherer groups in Europe has had upon the way Mesolithic archaeology is practiced.

We argue that this one-way dynamic represents both a missed opportunity and neglected obligation. The European Mesolithic boasts a combination of significant quantities of very high-quality archaeological and palaeoenvironmental data, alongside a suite of ever-improving analytical techniques. As such, Mesolithic research is uniquely placed to provide us with compelling behavioural information regarding temperate-dwelling hunter-gatherer societies over the *longue durée*. Equally, Mesolithic research is founded on the insights gained from the study of hunter-gatherer groups. Yet we contribute little towards the advocacy of the rights of our hunter-gatherer contemporaries who are rapidly disappearing in the face of a myriad of social, economic and environmental threats.

Within the context of the extreme marginalisation of hunter-gatherer groups, Mesolithic archaeology presents one of the very few opportunities to address a range of key questions for hunter-gatherer studies. These include (but are not restricted to); hunter-gatherer behaviour in pre-colonial contexts, resilience and vulnerability to changing environments, and interactions between hunter-gatherers and different types of societies (of varied economic models). In all of these areas, Mesolithic archaeology has the potential to make a significant contribution to broader debates within hunter-gatherer studies, through the analysis of relatively high-quality datasets. And yet this potential remains to be fulfilled. We will conclude our paper by reflecting critically on why this is, and in doing so set out a series of new challenges for Mesolithic research.

**Keywords:** Hunter, gatherers, advocacy, indigenous peoples, ethnography, social interaction, envi-

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\*Speaker

ronmental resilience

# Using Ethnography to focus our minds on the specifics of Mesolithic Archaeology, not to mask them

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Research into Mesolithic human-environment interactions have become increasingly relational in recent times; however, archaeologists are approaching this relationality in different ways. New theoretical paradigms, in particular Assemblage Theory/ New Materialism, de-centres the human, considering them within relational flat ontologies, where their relationship with nonhuman elements of the world are key to their understanding of the world. Ethnography presents an alternative route, offering rich narratives of the lives of contemporary hunter-gatherer groups within non-western relational ontologies. However, these alternative approaches are not interchangeable, and whilst scholars continue to be cautious about the applicability of ethnographic parallels within archaeological interpretations, we argue here that Ethnography offers a unique and vital route into understanding the material assemblages and lives of Mesolithic Hunter-Gatherers. Whilst new theoretical paradigms argue for recognising the inter-connected nature of elements of the world, it is not always clear how this concept may manifest, or be materially acknowledged by past human groups. Ethnographic accounts focus our minds on the ways in which ontological understandings and relationships are developed and maintained through practice, and how they are manifest in the material remains that are left behind. There are, of course, problems with applying direct ethnographic analogies, however, we argue that it is possible, and more useful, to consider broader patterns drawn from a wider review of ethnographic literature. In particular we will focus on ‘rules of practice’ as a concept, which the ethnographic record shows plays a significant role in shaping a wide range of practices and resultant material assemblages. This concept will be used to consider Mesolithic data in detail, to consider the sorts of assemblages specific tasks might be producing, and to identify the specifics of practice in the British and European Mesolithic across time and space. This approach uses ethnography as an inspiration to examine our Mesolithic assemblages in new ways, and not to layer over specific and unique Mesolithic practices with explanations taken directly from the ethnographic literature.

**Keywords:** Mesolithic, Ethnographic Analogy, Human, Environment Relationships

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# Learning about Mesolithic societies through disasters

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This paper takes a project in its initial phase: LAST – Life after the Storegga tsunami, as its point of departure. LAST explores the life worlds of hunter-gatherer-fishers after the Storegga tsunami hit the coast of western Norway and northeastern Scotland 8200 years ago.

Whereas earlier research on this tsunami has pivoted around the identification of the tsunami's date, geographical range and physical impact, our project will emphasise its potential social impacts. Where this has been studied, the tsunami has been considered a disaster for the coastal communities, or as augmenting the effects of the 8.2 ka cold event causing a population decline. In these views are certain presumptions about the existing Mesolithic coastal societies as vulnerable or lacking strategies enabling people to reorganize and rebound when facing dramatic events. This contrasts another presumption of hunter-gatherer fisher societies, one where these are considered as well equipped for adaptation and change. To some, the tsunami would certainly have been deadly and disastrous, yet for others perhaps it was only a reminder of the hazards of living by the sea. Hence, we should expect a multitude of responses. These responses inform on the organisation and capacities of Mesolithic societies. Persistent knowledge transmission in for example lithic technology, landscape use or settlement patterns before and after the event are indications of the capabilities of the existing societies. Alternatively, if the Storegga tsunami led to a noticeable disruption of the historical contingency, it may have opened the societies up for change, introducing new practices or intensifying old ones.

In anthropological studies, one perceives current hazards and disasters as challenges to social structures and organization, potentially bringing about systemic adaptation to sustain stability and viable lifeways (Oliver-Smith 1996). By applying a similar holistic, developmental and comparative perspective, the Storegga tsunami can function as a reflector of fundamental features of Mesolithic societies. In this way, the project will aim to combine anthropology and archaeology to invoke new knowledge of the hunter-gatherer-fisher societies.

**Keywords:** Disaster, hazard, capacities, hunter, gatherer, fisher societies, anthropology

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\*Speaker



# Towards expert dialogues on the hunter-gatherer past: Perspectives of ethnoarchaeology in Mesolithic studies

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Ever since its first heyday in the 1960s, ethnoarchaeology has been a prominent player in the scientific quest to understand and explain hunter-gatherer pasts. Processual archaeologists established the approach within their positivist deductive frameworks in order to bridge the patchy archaeological record and the past reality of hunter-gatherer life worlds. Later, post-processual critique began to question the legitimacy of employing ethnographic analogy in this way, and the focus shifted more on the self-reflection of the researcher's position and frame of experience and its impact on scientific interpretations. Today, ethnoarchaeological approaches are controversially evaluated in their very legitimacy, and fundamental questions regarding the methodological applicability of ethnographic information to explain past conditions as well as more general ethical aspects of research with and within indigenous communities remain open. Much of ethnoarchaeological work in contemporary communities across the globe derived from research questions in Palaeolithic archaeology. In Mesolithic research, too, ethnoarchaeological approaches and analogies have been employed in various fields, ranging from the study of settlement and mobility systems in boreal forest, of temporary dwellings, their construction and cosmological organization, of shell middens and burial practices, to wider anthropological reflections of human-nature relations, self and identity, etc. Currently new impulses broaden the view through postcolonialist debates, the rise of indigenous archaeologies, multivocal interpretation, the growing interest in multi-species systems, and the growing prominence of ethnoexpertise. Against this background, the talk will explore how ethnoarchaeological approaches on Mesolithic hunter-gatherer pasts can go beyond the long-prevailing ethnocentric modes of thought and research practice based on an "outsider" explorative view on communities "investigated". Drawing on some examples from Siberia and North America, it will discuss options how to rather engage in a dialogue "with modern foreign societies about the [past] societies with whom we can no longer communicate", as the German archaeologist U. Veit formulated.

**Keywords:** Ethnoarchaeology, Mesolithic archaeology, interpretation, postcolonial debates, symmetrical archaeology

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\*Speaker

# Marking a Landscape – thoughts on how early Danish Maglemosian hunters marked their routes and sites in the boreal forests

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In 2011-14 two large hunting stations were excavated on the southern part of the Danish island of Fyn. These excavations showed that each site stretches across an area of 1 hectare, and not the expected 5-8 sqm! Burnt hazelnuts date the sites to the period around 8200 – 8000 BC CAL. The finds indicate several stays at the two sites and thus a repeated use. This led to thoughts on how the early Maglemosian hunters found their way back to these specific locations – places they intended to return to with prepared cores for the manufacture of microliths. Explanations were sought using ethnographic parallels and theories, focusing on the concept of wayfinding. This proved difficult, as most existing parallels are drawn from areas of either dense jungles or arid steppes, and therefore with very different kinds of visual environments. Also, the parallels in existing literature often dealt with rocky terrain, where rock art and petroglyphs could readily be inscribed everywhere. The questions for the excavated sites on Fyn are: How did the users of these sites find their way back to specific hunting sites? Did they produce markings in this landscape without rocks and how? But what about trees? Ethnographic parallels from North America and Fennoscandia show that trees could be altered into shapes or embellished with markings, so-called arbo- or dendroglyphs, which helped with the marking of trails and sites in the boreal landscape. Could there have been a whole world parallel to rock art where the basis were trees not rocks? What would the implications be?

**Keywords:** Landscape, trails, wayfinding, ethnographic parallels, hunting camps

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\*Speaker

**Topic: Current research**

# Fading Ageröd – Human encroachment, climate change and the deterioration on a Scandinavian Mesolithic key-site in despair

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Ancient organic remains are essential for the reconstruction of past human lifeways and environments but are only preserved under particular conditions. Recent findings indicate that such conditions are becoming rarer and that old archaeological sites, with previous good preservation, are losing their preservative qualities. To investigate this, we returned to the well-known Swedish Mesolithic site Ageröd I In May 2019. Here we will present the result of the re-excavation and the osteological analyses of the bone remains from the 1940s, 1970s and 2019 excavation campaigns of the site and show how we documented and quantified the changes in bone preservation and related them to variations in soil conditions and on-site topography. The results indicate that the bone material has suffered from accelerated deterioration during the last 75 years. In some areas, this has led to a destruction of the remains while other areas, while suffering badly, are still able to preserve archaeological bones. We conclude that while Ageröd can still be considered an important site, it has lost much of the properties that made it unique and if no actions are taken to secure its well-being it will soon lose the organic remains that before modern human encroachment and climate change had been pristinely preserved at the site for 9000 years. Finally, because nothing special, compared to most other archaeological sites, has happened to Ageröd during these last 75 years, our results also raise questions of the state of organic preservation in other areas and call for a broad examination of our most vulnerable hidden archaeological remains, i.e. the organic remains from Stone Age contexts.

**Keywords:** Organic degradation, Sweden

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\*Speaker

# The "Reguisheimer Feld/ZAID Tranche 3 and 4" site in Ensisheim (Haut-Rhin, Alsace, France). First results

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In 2018, an archaeological survey in Ensisheim-Reguisheim, Alsace (France) uncovered several Mesolithic concentrations. Over an area of 2.5 hectares, 18 locus and 13 combustion structures were discovered. Concentrations were located on both side of a paleochannel that was still active for part of the year during the Mesolithic. Floods of the Ill River, to which this paleochannel was probably connected, contributed to the rapid burial of the remains by the addition of fine alluvials.

Concentrations delivered small sets, lithic industries and burnt fauna remains spread over restricted areas. The combustion structures are located within or outside the concentrations and come in the form of heated pebbles more or less arranged.

Lithic industries are homogeneous. The composition of the microlithic corpus allows the attribution of 5 concentrations to the Early Mesolithic and 13 to the Late Mesolithic. A single locus delivers stratified diachronic occupations. Analysis of the lithic industries of the Early and Late Mesolithic industries are currently under way. The technological study of the lithic industries of the Late Mesolithic is part of a doctoral thesis at the University of Paris 1 Pantheon-Sorbonne. This work highlights two phases of site occupation, characterized on typological, technological and petrographic bases. This will be the heart of our presentation of the discoveries made during a preventive excavation carried out between September 2019 and February 2020 on an adjacent plot.

**Keywords:** Lithic Industry, Late Mesolithic, Survey Archaeology, Alsace

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# Hidden in the Hills? Preliminary fieldwork results from Pimple Hill, Herefordshire

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Inland and upland locations have historically been a neglected aspect of Mesolithic Studies in southern Britain. This has particularly been the case for the West Midlands and the Anglo-Welsh border region, where limited archaeological investigation more generally has created a gap in research. Consequently, although this is changing, limited information has been gained towards understanding the relationships between sites in this region and those in more intensively studied landscapes such as the Severn Estuary to the south-west. This paper presents the preliminary results of fieldwork investigations into an extensive series of Mesolithic lithic scatters on the Herefordshire/ Worcestershire border. It details initial analysis of the artefacts discovered, the results of doctoral research towards geochemical sourcing of artefacts from these sites and the implications for mobility at the national scale, and directions for future research in this region.

**Keywords:** Fieldwork, Early Mesolithic, Lithics, Lithic Scatter, Geophysical survey, Landscape Archaeology

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\*Speaker

# Preliminary results and research perspectives on the submerged Stone Age in Storstrømmen, Denmark

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Storstrømmen is a narrow sound, separating the islands of Zealand and Falster in Southern Denmark. The area has been subject to archaeological surveys and investigations since the 1980's. In 2015, prior to the construction of a new bridge, sub-bottom data from the bridge corridor and other affected areas, were used to give a representation of the moraine till as a proxy for the submerged prehistoric topography. During the investigations, a new Paleolithic and several Mesolithic sites were found. The sites are preserved at different depths in the channel. The oldest site dates to the Federmesser Culture (12,000-11,500 BC) and is located at *c.* 13 m below present sea level along a prehistoric lake shore, on the former valley floor. The youngest site is located at a former coastal lagoon, only *c.* 1 m below present sea level and dates to the Ertebølle Culture (5400-3900 BC). Different environmental analyses are planned to investigate the changing environment of the area. The elevation and temporal distribution of sites in the area have the potential of contributing to the understanding of the environmental change of the area as a whole. Of special interest is the Holocene sea-level rise, as the rate and timing of the transgression in the area is still not well dated.

**Keywords:** current research, submerged landscapes, maritime archaeology

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# Stable oxygen isotopes and Mg/Ca ratios from the limpet *Patella depressa* Pennant, 1777: climatic and archaeological implications of the novel application of LIBS to mollusc shells

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Isotopic and elemental composition studies are increasingly emerging as avenues for obtaining unparalleled, high-resolution insights into palaeoclimate and past seasonality. In coastal areas, such as the Atlantic façade of Europe, which is characterised by an increase in human littoral resource exploitation during the Early Holocene, accurately establishing the impact of abrupt climate changes and determining coastal exploitation patterns is crucial to properly understanding human resilience and foraging strategies. Traditionally, researchers have attempted to meet these goals through stable oxygen isotope analysis of carbonate from mollusc shells, though this methodology is expensive and time consuming. Increasing the number of shells analysed is critical for improving palaeoclimatological and archaeological insights available from sub-fossil samples. Previous investigations have highlighted the significant advantages of elemental analyses by Laser Induced Breakdown Spectroscopy (LIBS), which significantly decreases the time required for sample preparation and increases the number of shells that can be analysed. In this study, the LIBS technique is applied for the first time to limpet *Patella depressa* Pennant, 1777 samples live collected in northern Spain. In order to determine if Mg/Ca profiles obtained by

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\*Speaker



LIBS are a usable proxy to reconstruct palaeoclimate conditions and seasonality in this species, a comparison between stable oxygen isotopic profiles previously derived from the same shells and LIBS Mg/Ca series were conducted. Results showed a significant correlation between elemental and isotopic sequences obtained, highlighting the archaeological and palaeoenvironmental potential of the novel application of LIBS on *P. depressa* species.

**Keywords:** Stable oxygen isotopes, Mollusc shells, LIBS, Trace element analyses, Climate proxy

# Mesolithic and Chalcolithic mandibular morphology: using Geometric Morphometrics to reconstruct incomplete specimens and analyse morphology

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Human skeletal remains provide direct palaeobiological data about past populations. However, post depositional factors often cause bone fragmentation and so reduce the sample size of morphological studies. Geometric Morphometrics (GM) may be used to analyse morphology, but also to estimate the original form of incomplete mandibles that would otherwise be excluded from analysis. In this study we use a GM based reconstruction method to estimate the original morphology of incomplete Mesolithic and Chalcolithic mandibles from the present Portuguese territory. Moreover, we compare mandibular morphology between those samples to examine hypothetical morphological differences between those populations and how those differences may relate to other underlying variables.

To reconstruct the incomplete specimens, complete mandibles from each period were used as reference to estimate the location of the missing landmarks of the target incomplete specimens from the same chronology. The Thin Plate Spline (TPS) method of the Geomorph R package was used to that end. GM was then used to compare the morphology of the full sample of 34 Mesolithic (n=22) and Chalcolithic (n=12) mandibles. Dental wear was also recorded to test if hypothetical morphological differences between the two groups relate to disparities in masticatory function.

Morphological analysis of the full sample of mandibles shows little overlap between specimens of the two chronologies. Because mandibular morphology relates to biological affinities and to masticatory mechanics, such differences may relate to any of the two factors. However, consistently with previous studies, the Mesolithic sample shows heavier dental wear on average than the Chalcolithic sample. This may suggest differences in diet and masticatory mechanics relate to the morphological differences, but future studies will explore this hypothesis.

**Keywords:** Mesolithic, Chalcolithic, Portugal, Biological anthropology, Form, function

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# Muge Portal: A new digital platform for the last hunter-gatherers of the Tagus Valley, Portugal

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This work presents "The Muge Shellmiddens Project: a new portal for the last hunter-gatherers of the Tagus Valley, Portugal" that focuses on the requalification and valorization of the archaeological and paleoanthropological heritage of the Mesolithic complex of Muge (Tagus Valley, Portugal), classified as Portuguese National Monument since 2011. It is a new multidisciplinary and innovative approach that involves the development of cybernetic infrastructures and e-science initiatives, that in turn will allow: (1) a systematization of the archaeological data collected over the last 150 years in Muge, implementing an online database that offers the possibility of storing, consulting and performing analytical-interpretative and spatial queries of archaeological, paleoanthropological, paleoenvironmental and historiographic data; (2) the creation of interactive didactic and dissemination contents based on augmented and virtual reality technologies. With these approaches, the project intends to promote a new path of scientific and cultural access to the Muge shellmiddens, transporting the Mesolithic to the present in a vibrant, as well as informative way.

**Keywords:** Mesolithic, Muge, Heritage, Archaeological Database, Augmented and Virtual Reality

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# Into the wide! Extensive surveys in rescue archaeology and the question of Mesolithic site function in Northern France.

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For nearly 30 years, Mesolithic period in northern France has been characterised by the dynamism of his rescue archaeology. Indeed, in recent years, several excavations have notably renewed our knowledge about the organisation and function of Mesolithic open-air sites, both for Early and Late Mesolithic. This is due in particular to the extensive character of excavations (over several thousand square metres), the methods used (planimetric and manual digging, geo-referencing of remains, etc.) as well as the technological and use-wear studies of lithic material undertaken in this framework. Detailed analysis of the lithic material and dates show that most sites are the result several episodes of occupations sometimes spread over several hectares. But refits also shows the existence of real camps, connecting together several occupation units. At the same time, lithic use-wear analysis enable us to better identify the spatial organisation of Mesolithic occupations by identifying differentiated functional spaces within the concentrations and on their periphery. These concentrations are characterised by areas related to knapping activities, arrowheads manufacture and sometimes by fire practices. Other activities are regularly identified in these zones in association with more discrete and peripheric spaces that also provide lithic remains with use traces (skin working, butchery, plant working, etc.), scattered faunal remains, combustion structures (fireplaces or garbage dumps), pits... Burials are also quite frequently discovered but rarely associated with contemporaneous occupations in the surroundings. All these areas, generally located at a distance from the main concentrations, can only be identified by an extensive and careful exploration around the concentrations. These

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excavation strategies are not always in line with economic interests and sometimes questioned. But it is at this price that we can understand the complex spatial and functional configuration of Mesolithic occupations and thus better define the last hunters-gatherers mobility and lifestyles.

**Keywords:** Preventive archaeology, extensive excavation, use, wear, fonctionnal space

# The open-air Mesolithic site of Arenal de la Virgen (Villena, SE Iberia). Occupation features and Bayesian chronological modelling

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The interdisciplinary fieldwork on open-air sites still remains an elusive issue in the Mesolithic research of Iberian Mediterranean region where most of the current record comes from rescue operations. In this paper we present a synthesis of the new research conducted at the Mesolithic open-air site of Arenal de la Virgen in the context of the research project PALEODEM (ERC-CoG-2015 Ref.683018). This site lies on a sand sheet in the southwestern margin of the Villena paleolake, in the Upper Vinalopó Valley (SE Iberian Peninsula). New fieldwork was undertaken in 2017 following an intensive spatial and stratigraphic recording strategy expanding the excavation area up to 84 m<sup>2</sup>. The new excavations allowed to document a wide range of archaeological features in the unit IV associated to lithic scatters forming a single archaeo-stratigraphic horizon. A bespoke protocol involving micromorphology and palaeobotanical analyses was conducted to produce stratigraphically reliable and featured-constrained radiocarbon chronologies to disentangle different occupation phases. In parallel, a multi-proxy research program focused on the investigation of combustion structures and other domestic features is in progress using geoarchaeology and experimentation to study the impact of fire on archaeological materials. The radiocarbon results have been constrained using a Bayesian phase model that shows two different Mesolithic occupation phases at c.9.3-9.0 kya cal BP, and 8.6-8.4 kya cal BP taxonomically associated to Notches and Denticulate industries. These results together with the ongoing research on lithic refits and intra-site spatial analysis have allowed to distinguish different domestic activity areas within each phase.

**Keywords:** Mesolithic, open, air, excavation, features, Bayesian chronological modeling

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# From Early to Late Mesolithic in Sicily. New data from Grotta D'Oriente (Favignana Island)

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Grotta d'Oriente, a coastal cave located in Favignana Island (Sicily), is one of the key-site for the study of Palaeolithic and Mesolithic of Sicily and, more generally, of the Central Mediterranean. Archaeological excavations, performed by University of Florence, have provided evidence of several short-term human occupations of the cave in a period spanning from latest Upper Palaeolithic to the Late Mesolithic/Early Neolithic (~14.2 to ~7.8 cal. ky BP) (Martini et al. 2012; Lo Vetro et al. 2016; Colonese et al. 2018). The archaeological sequence consists of 3 main unit: Layer 7, Upper Palaeolithic - Late Epigravettian, Layer 6, Early Mesolithic, with Sauveterrian-like stone assemblage and Layer 5, Late Mesolithic or Early Neolithic, which presents a small stone assemblage marked by the occurrence of blades and trapezes and by the appearance of the pressure blade technique.

A multidisciplinary research project carried out in the last fifteen years, has resulted in a large amount of data which has significantly improved the knowledge on both the cultural-economic framework known for the Paleo-Mesolithic of Sicily and the local environmental evolution at the Pleistocene-Holocene transition.

This communication focuses on the post-Palaeolithic occupations of the cave by the last Hunter-gatherer groups presenting new data on chronology, material productions and resources exploitation (chert, terrestrial and marine fauna). Particular attention will be paid to the evidence from Layer 5 and to its chrono-cultural attribution also in relation to the current debate on the diffusion of the Blade and Trapeze assemblages in the Mediterranean. New achievements from the anthracological study provide also new insights on the evolution of the regional landscape during the Early Holocene in North-Western Sicily.

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**Keywords:** Early and Late Mesolithic, stone tools assemblages, subsistence strategies, palaeoenvironmental evolution, Sicily



# More than stones? A survey for Mesolithic sites in Northwestern Germany

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The Mesolithic in Northwestern Germany so far has been characterised by silex finds from surface scatters and some excavated sites containing fire pits. Only few sites have given insight into the wider range of organic material as they were situated on the rim of lakes and peat bogs. A current project is dedicated to the search for well-preserved Mesolithic sites. Surveys are conducted on selected sites along the edges of bigger peat bogs, the border between sandy upland and the marshes as well as along little kettle bogs.

This paper is giving an overview about survey methods from field walking, coring and the use of mega-drills to small test trenches in water-logged surroundings. First results of the current project are being presented. A tight cooperation between archaeologists, soil scientists and botanists provide new insights into small-scale landscape development reconstructions in the surrounding of the sites, which are essential for the further direction, and success of the project.

**Keywords:** Survey, water, logged sites, Northwestern Germany, bog sites, landscape reconstruction

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# Current research

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The purpose of this session is to enable everyone to quickly present the main advances and discoveries of the last five years in the field of European Mesolithic: field work, material analyses, study and/or analysis methods, theoretical reflections, etc. This session, which is complementary to the posters, will focus on proposals that cannot be included in the topics proposed by the other sessions, while maintaining a certain geographical, thematic or chronological scope.

**Keywords:** Actuality, Current

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# Motorways of Prehistory? Boats, Rivers, and Mobility in Mesolithic Ireland

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The proposed poster presents a critical review of the way inland navigation is constructed in the archaeological literature as an essential component in the mobility of the Mesolithic hunter-gatherer communities of Ireland, with a particular focus on boats and rivers. Against a scarce background of direct archaeological and environmental evidence, a content analysis of the academic discourse highlights a dominant processual approach structured around three themes: seafaring and pioneering "events"; boat technology and performance; broad generalisations about the land- and waterscape. It is argued that such a narrative could be usefully revisited by adopting a small-scale, high-resolution approach that would explore human and material agency and integrate analogy as a method.

**Keywords:** mobility, landscape, agency, analogy, methodology, ireland

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# A newly discovered South Swedish Mesolithic settlement with more than 50 huts or houses, Ljungaviken

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Did large aggregation sites exist in Southern Scandinavia already around 6400 BC, during the Kongemose period? The preliminary results of a major excavation conducted during May–August 2020 suggest this. In Ljungaviken at Sölvesborg in Southern Sweden, over 50 well-preserved Mesolithic huts have been found within a limited area, under thick layers of sand and gyttja from the Littorina transgression. The huts lie at close distances to each other but do not overlap visibly. In a few huts, bone material is preserved, which together with the constructions indicate settlement during the winter season. Construction details of the huts also indicate that they have been used for several seasons.

**Keywords:** Mobility, huts, aggregation sites, Kongemose culture, Littorina transgression, Southern Scandinavia

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# Palimpsest dissection in Early Holocene open-air sites through lithic refits and intra-site spatial analysis. The Arenal de la Virgen (Villena, Spain) study case.

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Open-air postglacial sites very often present complex, time-averaged archaeological deposits, affected by different kinds of post-depositional processes forming occupational palimpsests. In this context, the identification of occupational episodes requires the reconstruction of the formation history through the application of extensive multidisciplinary research programs.

In this paper we present an integrated research program aimed at reconstructing the site formation process and disentangle the occupational palimpsest at the Mesolithic site of Arenal de la Virgen (Villena, Alicante, SE Iberian Peninsula). This open-air site was subject to new fieldwork in 2017, in the context of the ERC project PALEODEM (ERC-CoG-2015 ref. 683018). An area of 84 m<sup>2</sup> was intensively excavated using a high-resolution spatial and archaeological data recording strategy, allowing the identification of lithic scatters and several occupational features (hearth-pits, surface hearths, and possible dwelling structures).

Here, we will focus on the results of the lithic refits and the spatial analysis of lithic remains from the Unit IV, in order to identify occupational phases and events. At first sight, the archaeostratigraphic analysis of the occupational horizon did not allow the identification vertically differentiated occupation events, showing a uniform layer with variable thickness and density of remains. The spatial point pattern analysis of the horizontal distribution of lithic remains was performed through multi-scale methods, the calculation of aggregation indexes, the production of Kernel Density Maps, and the analysis of spatial autocorrelation of different artifact classes. High-density concentrations of lithics, spatially correlated to the occupational features, allowed to distinguish different activity areas. The analysis of lithic refits has corroborated both the integrity of the assemblage, with the predominance of short-distance connections, and the spatial structuring of the space on discrete and sometimes connected activity areas. The results in combination with a Bayesian Chronological Model based on a comprehensive radiocarbon dating program on the occupational features, revealed the presence of two different Mesolithic phases.

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**Keywords:** Open air site, formation processes, palimpsest dissection, lithic refits, intrasite spatial analysis

# The InterCity project – New insights into the Middle Mesolithic in the Oslo fjord basin

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During the last 10–15 years a number of excavations have significantly increased our knowledge about the Middle Mesolithic (c. 8300–5600 cal. BC) in Southeast Norway. Recent research has e.g. disclosed prominent and abrupt changes in settlement patterns and lithic technology at the transition from the Early Mesolithic, as well as great variability in Middle Mesolithic settlement sites regarding both types and sizes. Still, there has been a shortage of solid documentation from the very beginning of this development, especially C14-dated sites, and the changes in settlement systems and landscape exploitation in Middle Mesolithic are poorly understood. This paper will present results from recent excavations conducted within the InterCity project in Vestfold. Having excavated five Middle Mesolithic sites, the investigation sheds new light on the settlement in the northwestern parts of the Oslo fjord area. By means of radiocarbon dates and a new shoreline displacement curve, the sites are dated to the period c. 8200–6600 cal. BC. The sites are situated close to the ancient shore in a rich marine environment with an abundance of small islands, inlets, sounds and sheltered bays. The sites vary from 55 to 13,000 square metres in size, and have yielded between c. 100 and 16,000 lithic artefacts. Some sites include rare finds such as charcoal-filled structures, culture layers including hazelnut shells, fragments of burnt bone, and lumps of birch bark pitch. Demonstrating great variability in size and character, the sites are interpreted as representing a diversity in activities and landscape use.

**Keywords:** Middle Mesolithic, economy, landscape use, new excavations, radiocarbon dates, marine environment, variability

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# The Mesolithic of La Baume de Monthiver (Vallée du Jabron, Var): context and nature in a mid-mountain holocene occupation

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In the northern Mediterranean basin, the dominant model favours the idea of continuous and polymorphic cultural processes from the Pleistocene to the Holocene, and the Early Mesolithic of the Liguro-Provençal region is usually considered arising from the Epigravettian traditions. The reality and significance of this process is nonetheless still under debate. A clear reading of this historical process appears hindered by the reduced number of sites and the scarcity of archaeological data in the region, in contrast to the major neighbouring areas (e.g. south-western France or north-eastern Italy). Moreover, archaeological assemblages from the Liguro-Provençal zone reveal a remarkable heterogeneity, but multiple explanatory factors - environmental, functional and/or cultural - remain to be explored.

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\*Speaker



The recent excavations at La Baume de Monthiver (Vallée du Jabron, Var), brings new data on the Early Mesolithic technical and subsistence practices, as well as on the mobility of the human groups, and the evolution of the local environmental conditions of a mid-mountain settlements in the pre-alpine territories. The human occupations of La Baume de Monthiver (1) show the absence of geometrical armatures, a recurrent feature in regional mesolithic assemblages; (2) offer information on the presence of marine shell ornaments (*Columbella rustica*) pointing to links between the coastline and this mid-mountain valley; (3) highlight subsistence strategies (fauna and carp remains) indicating a diversified collecting in the environment close to the site and (4) are related to an environmental evolution marked by the climatic event 8.2. Here we will draw up a general assessment of the multidisciplinary study of the level M-B' of La Baume de Monthiver and proposes interpretative avenues within the wider context of the Mediterranean Mesolithic.

**Keywords:** Liguro, Provençal region, Early Mesolithic, mesolithic assemblages without geometrical armatures, climatic event 8.2

# Go the whole hog in microwear analysis! A new reference dataset of dental microwear textures in extant wild boars (*Sus scrofa*) and implications of intra-facet and intra-dentition variability for applications to the Mesolithic record

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Zooarchaeological data available for Mesolithic sites from Quercy (France) fuel discussions on occupation periods and functional status of the sites within a logistical mobility system of those populations of hunter-gatherers. Dental microwear analysis of fauna has recently been proposed as an additional source of data on occupation time and seasonality of archaeological sites.

Three-dimensional Dental Microwear Texture Analysis (3D-DMTA) aims at quantifying microscopic wear features observed on enamel facets of occlusal surfaces of teeth. Microwear features result from attrition (tooth-to-tooth contacts), abrasion (tooth-to-food contacts, including exogenous particles sticking to food items), and erosion (from acidic foods). Microwear surfaces therefore reflect mechanical properties of ingested food items as well as mastication dynamics and dental morphology. Due to a rapid turnover, microwear surfaces observed on the teeth of a dead animal reflect a diet that is representative of the few days to few weeks before the death. As many animals display strong seasonal variations in diet, dental microwear analysis shows a high potential to reconstruct season of death, and therefore seasonality of human occupations at archaeological sites. A high microwear variation within a zooarchaeological sample would be expected for a long occupation or a repeated occupation at different times of the year whereas a low variation would be expected for samples resulting from short or seasonal occupations.

Wild boars (*Sus scrofa*) are ideal targets for those microwear analyses as: 1) they are the

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dominant species in faunal spectra at most sites occupied by Mesolithic hunter-gatherers; and 2) their extant representants are characterized by opportunistic omnivorous diets with strong seasonal variations that reflect seasonal changes in vegetation. However, application of dental microwear analysis to Mesolithic wild boars is hindered by: 1) the lack of appropriate reference datasets on extant animals with precise temporal and geographic information; 2) the lack of knowledge on the various components (intra-facet, intra-tooth, intra-dentition) of variability of microwear signals; and 3) the fragmentary nature of the archaeological samples of Mesolithic sites, where most specimens are represented by isolated teeth representing different positions of the dentition. The objectives of our study are therefore: 1) to present a new reference dataset that could be applied to Mesolithic wild boars; 2) to better comprehend the impact of intra-facet and intra-dentition microwear variability on comparisons among specimens; and 3) to propose an optimal sampling strategy for future applications to archaeological contexts, especially to fragmented/isolated teeth that represent different positions along the dentition.

We took surface impressions of the occlusal surfaces of teeth using silicone elastomers. We measured surfaces of  $333 \times 351 \mu\text{m}$  on enamel shearing facets with the 100x objective of an optical profilometer and subjected the measured surfaces to several surface pretreatments. A  $200 \times 200 \mu\text{m}$  surface was then extracted, levelled, and subjected to Scale-Sensitive Fractal Analysis. To quantify differences in microwear textures, we compiled fractal parameters known to differ among mammals with different diets: complexity (Asfc), anisotropy (epLsar), heterogeneity of complexity (HAsfc-9 and HAsfc-81, respectively compiled using 9 and 81 subsquares), and textural fill volumes (Ctfv and Ftfv, respectively at coarse and fine scales). In nearly all previous studies, dental microwear parameters were compiled from a single surface (or a small number of surfaces, 2 to 4) per facet (hereafter called the "classic strategy"). This spatial localization of the surface within the facet is chosen almost randomly by the operator, with some consideration for possible preservation biases. This single surface is considered to be representative of the whole facet even though a facet is big enough to sample several dozens of surfaces and the degree of microwear variation within the facet is poorly known. We therefore explored for the first time intra-facet variability by conducting 3D-DMTA on 30 contiguous surfaces (six rows by five columns) that document around one third of the facet of a lower p4 of a Mesolithic wild boar from the Cuzoul de Gramat (Lot, France) Mesolithic site.

First, we quantified intra-facet variability by compiling coefficients of variation (CV) of the 30 surfaces for each microwear parameter. CV range from 28 % to 58 % (average = 47 %), indicating a strong intra-facet variation. Geary's C, an index of spatial autocorrelation, was compiled for each microwear parameter. Its values range from 0.87 to 1.12, suggesting that there is no spatial correlation of microwear parameters for that particular facet. If confirmed by additional specimens, it would indicate that operator-dependent randomly chosen spatial localization of the targeted surface within a facet will not significantly influence the comparisons among facets and specimens.

Secondly, we developed an original statistical approach to explore the impact of the observed intra-facet variation on comparisons among specimens when using a classic sampling strategy. How many  $200 \times 200 \mu\text{m}$  surfaces per facet would be sufficient to correctly estimate the facet mean of microwear parameters? For each sample size (ranging from 2 to 29), we randomly drew 5000 subsamples among the 30 surfaces. Mean value of each randomly chosen subsample was compared to the mean value compiled on the 30 surfaces of the facet by compiling the relative difference to the facet mean (RDFM), expressed as a percentage. As subsample size increases, the distributions of the 5000 values of RDFM get more symmetric and less dispersed. For each microwear parameter, we selected the RDFM thresholds that define the central 80 % of the RDFM values around the mode. Those interval widths decrease as the subsample size increases. For all microwear parameters, the amplitude is around 55 % for a subsample size of 5 surfaces

(meaning that 80 % of the subsample means are at maximum 27.5 % higher or lower than the facet mean) and then quickly decreases to around 30 %, 25 %, and 20 % for subsample sizes of 10, 15, and 20, respectively. Depending on the expected differences between targeted specimens, the number of surfaces per facet required to obtain a precise estimate of the facet mean value will differ. A classic sampling strategy is likely confounding the detection of subtle microwear differences among samples. In future studies, it will be necessary to measure a larger number of surfaces per facet ( $> 10$ -15).

Thirdly, we explored the implications of that improved understanding of intra-facet variability when comparing two enamel facets using the classic sampling strategy. How much differences in microwear parameters would purely result from random sampling of a pair of surfaces within facets with strongly variable microwear textures? We considered two hypothetical facets whose microwear textures are strictly identical (by simply doubling the parameter values of the Cuzoul de Gramat lower p4 facet and considering it as two specimens). Among the 30 surfaces, we randomly sampled 500 pairs comprising one surface for each facet and compiled for each pair the absolute difference between the two values. For each microwear parameter, using the distribution of the 500 absolute differences, we identified the parameter threshold under which 80 % of the absolute differences are comprised and expressed it as a percentage of the whole range of intra-facet variation for that particular parameter. That percentage ranges from 33 % to 66 % (average = 48 %). Those high percentages indicate that, even when discarding the 10 % of highest and lowest absolute differences, numerous random pairs of surfaces would still detect relatively large differences between the two facets with identical microwear textures.

Finally, we explored intra-dentition variability by comparing microwear textures among different tooth positions in the lower dentition (p4, m1, m2) of a new reference dataset of wild boars, using the classic sampling strategy. We investigated a geographically and temporally well-constrained population of extant wild boars (*Sus scrofa*). Twenty-four individuals (including males and females, juveniles and adults) were collected by hunters in Tautavel (Pyrénées-Orientales, France), from August to November 2017. Based on the absolute differences between microwear parameters of m1 versus p4 and m1 versus m2, we explored their variation and compiled mean values of the absolute differences in tooth positions for the Tautavel sample. CV of intra-dentition differences range from 64 % to 117 % for m1-p4 and from 55 % to 113 % for m1-m2. Such high values of CV indicate a strong variability among individuals whereas mean absolute differences between tooth positions are relatively small. The percentages of the means of absolute differences relative to the whole range of values for each microwear parameter range from 11 % to 29 % for m1-p4 and from 6 % to 19 % for m1-m2. This suggests a relatively small difference among tooth positions and a slightly bigger difference between the premolar and molars than between the two molars. However, those intra-dentition differences appear relatively small compared to the differences that could be due to the random sampling of intra-facet variability, and therefore, based on the classic strategy, we cannot conclude on the reality of those intra-dentition differences. Implications for future studies of Mesolithic samples will be discussed.

**Keywords:** 3D Dental Microwear Texture Analysis (3D DMTA), Intrafacet variation, Intradentition variation, Mesolithic, Wild boars (*Sus scrofa*)

# A new Mesolithic site in the Eastern Pyrenees: the Bauma dels Fadrins (Queralbs, Girona)

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In 2019 a new site, Bauma dels Fadrins, dated ca. IX millennium cal BP was discovered in the Catalan Pyrenees. The last archaeological findings dated to this period in the Girona province were unearthed 20 years ago. The site is a rock-shelter located in the village of Queralbs, at 1236 m.a.s.l. This is the highest position never attested for human occupation to this period in the Eastern Pyrenees. So far, the fieldwork seasons revealed a sequence of occupation dated from the Late Pleistocene to the Mid Holocene. The rock-shelter is located in a strategic position on the Ribes Valley, one of the main routes to cross the Pyrenees. The occupation layer dated to 8900-8700 cal BP is characterized by a dense distribution of remains and anthropic structures, including several hearths providing an important number of artifacts, faunal and charred plant remains. Although taphonomic and geomorphological studies in course suggest repeated seasonal freezing-melting phenomena affecting these deposits, they appear to be well preserved. The lithic assemblage recovered so far suggests a predominant use of small local quartz fragments for toolmaking, with a testimonial presence of chert and other rocks. Flake production is mainly attested by bipolar flaking producing a large quantity of debris and angular fragments. Up to now, chert appears exclusively in form of isolated flakes, putatively suggesting that they were introduced in the site already detached. Faunal remains show evidence of hunting and targeting and the constitution of product reserves. Regarding plant remains, the available data suggests exploitation of local resources and seasonal-reliance on represented taxa as well as slightly colder conditions during the Early Holocene. This research is carried out under the frame of the ARRELS project granted by the Government of Catalonia (ES) (code CLT009/18/00048).

**Keywords:** Eastern Pyrenees, new archaeological site, ca. VIII millennium BP, last hunter, gatherers

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\*Speaker

# A new open-air Early Mesolithic site in central Italy: Contrada Pace

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Preliminary survey activities carried out during construction works at the site of Contrada Pace in the Municipality of Tolentino (Macerata, Central Italy), led to the discovery of one of the most complete Early Mesolithic open-air sites in Italy. On a terrace of the Chienti river, an Early Holocene paleosoil with significant traces of human activity was discovered under a 1.5 meter thick fine sedimentary cover. The extensive micro-stratigraphic excavation that took place since September 2019, allowed exploring an area of more than 500 square meters and recovering several thousand lithic artefacts and organic remains. These findings appear to be clustered in different functional areas that yielded multiple structured features. Such results have been attained thanks to the fruitful collaboration between the Italian Cultural Heritage Office (Soprintendenza Archeologia, Belle Arti e Paesaggio Marche) that is in charge of the discovery and the University of Ferrara that led the excavation on practical grounds. Given the extraordinary preservation of organic remains at the site, an extensive activity of manual flotation has started, in collaboration with HIDDEN FOODS – StG-ERC project based at Sapienza University of Rome. In this paper, excavation data concerning the recovered evidence and a preliminary assessment on the lithic and organic assemblages are presented.

**Keywords:** Early Mesolithic, Central Italy, open air site, settlement patterns, functional areas, structured features

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\*Speaker

# Living in the mountains. Late Mesolithic/Early Neolithic settlement in NW Portugal: Rock shelter 1 of Vale de Cerdeira (Vieira do Minho).

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Research into the Mesolithic period in Portugal has been dominated by the famous shell middens, particularly those located in the estuaries of the rivers Tejo and Sado (central/south of Portugal), known since the second half of the 19th century. In conjunction with other archaeological sites discovered in 20th century along the southwest coast (Estremadura, Alentejo and Algarve regions), the panorama of the Portuguese Mesolithic was defined by a littoral settlement model, leading some authors to suggest the depopulation of some parts of the territory, especially upon the north and the inland, after the advent of the Holocene.

However, more recently, new findings in some regions previously considered, according to that model, as uninhabited, provide a more diverse and enriched picture of postglacial Portugal. One of these regions is the north west of Portugal, where in the 1990's one of the authors (J. Meireles) implemented a research project oriented to the recognition of a settlement model associated with the last hunter-gatherer prehistoric communities of the region, in the medium altitude mountain areas. This project had as its reference the surveys and work developed in the neighbouring Spanish region of Galicia, where a continuous Epipaleolithic/Mesolithic settlement pattern was observed in its central and southern mountain ranges.

Therefore, a set of consistent and detailed field surveys took place in the mountains of NW Portugal, leading to the discovery of the archaeological site named 'Rock Shelter 1 of Cerdeira Valley', a granite rock shelter situated in Cabreira Mountain (Vieira do Minho, Braga, NW Portugal, max. alt. 1,262 m).

The campaigns of excavations undertaken permitted the identification of two combustion structures, from which charcoal samples provided two C-14 dates, as well as a significant stone tool

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\*Speaker

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assemblage (around 30,000 pieces), that established the prehistoric occupation of ‘Rock Shelter 1 of Cerdeira Valley’ between the Late Mesolithic and the Early Neolithic.

This archaeological site and its body of evidences are being analysed within the context of an ongoing Phd project developed by one of the authors (P. Xavier), through two mutually related lines of research. The first one relates to the complete technological and typological study of the lithic assembly, identifying the objectives of the stone tool production, i.e., lithic production systems and related *chaines operatoires*; and the second concerns itself with the classification and characterisation of different raw-materials (of a local and exogenous nature) exploited by the prehistoric communities and, wherever possible, to make some additional considerations about the economy of abiotic resources and raw material procurement - exploited areas, potential sources, processes of exchange and lithic mobility.

This text aims to present and discuss some preliminary results of our work in progress.

**Keywords:** Late Mesolithic, Early Neolithic, Settlement Model, Raw Materials, Lithic Artefacts.



# Revealing the hidden” Central Balkan and Pannonian Mesolithic: new radiocarbon evidence from Serbia

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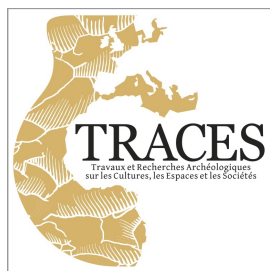
With the exception of well known Mesolithic sites in the Danube Gorges, which provide ample evidence of (more or less) continuous human occupation between 9500 and 5500 cal BC, the wider areas of the Central Balkans and southern fringes of the Great Pannonian Plain still represent a *terra incognita* when it comes to the presence and settlement patterns of Mesolithic communities. In the archaeological literature, the absence of Mesolithic sites in the region was associated with environmental changes in the Early Holocene, presumed low human population densities, the visibility and state of preservation of organic material (often the only indicator of human activity), or the lack of adequate research. However, valuable insights into the obscure regional Mesolithic can be gained not only by new archaeological excavations, but also by revisiting and reanalysis of existing archaeological collections. Particularly informative in this respect are the Early Neolithic sites, which are indicative of the extensive spread of farming communities starting from 6200 cal BC, and/or their greater visibility in the archaeological record. Within the ongoing ERC BIRTH project (*Births, mothers and babies: prehistoric fertility in the Balkans between 10000 and 5000 cal BC*), a large sample of human, animal and plant remains from these sites was AMS dated. Unsurprisingly, the majority of obtained dates corresponded to the expected (Early Neolithic) range between 6200-5500 cal BC. However, several animal bone samples and one human bone sample from the sites of Magareći mlin, Grabovac-urića vinogradi and Gospoinci-Nove zemlje produced Mesolithic dates, i.e. were dated to the 8th millennium cal BC. In this paper, we present new AMS radiocarbon dates, discuss the contextual provenance of dated bones, and explore the implications of these results for a better understanding of the problem of the ”missing” and ”invisible” Mesolithic in the Central Balkans and Southern Pannonia.

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**Keywords:** Central Balkans, Southern Pannonian Plain, new AMS radiocarbon dates, Serbia, Mesolithic



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