TRACING SOCIAL DYNAMICS

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PREFACE

After the great success of the meetings held in Faro, Leiden and Nice, the 2022 AWRANA meeting takes place in Barcelona. Initially scheduled for spring 2021, this conference was postponed to 2022 due to the Covid-19 pandemic. Given the exceptional circumstances in which the conference is held, we opted for a hybrid format, both in person and online, to allow those limited by travelling restrictions to attend the meeting. Additional measures have been taken to assure a healthy and serene atmosphere, as the conference venue is large enough to maintain adequate and safe interpersonal distance, coffee breaks will take place outdoors and using masks will be mandatory indoors.

In this conference, some topics that have become traditional in the AWRANA’s conferences will be dealt with, as the use of the information on tool utilisation for the reconstruction of economic and social behaviours. These include contributions showing how traceological data/functional studies can help reconstruct past economic and social behaviours through the analysis of tools and symbolic/non-utilitarian objects. Some of the approaches that are recently gaining momentum within the field of use-wear studies will also be addressed. Examples include the integration of use-wear and residue analyses and the implementation of quantitative methods in traceology. Furthermore, colleagues working on dental microwear are invited to share their methods and results for the first time. Both lines of research (tools and teeth) have been running in parallel for decades, overcoming similar difficulties and challenges. We hope that the exchange of experiences will be fruitful for everybody.

Unfortunately, the conference will take place in a difficult time marked by the war in Eastern Europe and by the suffering of the people involved in the conflict. The Barcelona conference welcomes all those colleagues who participate within a spirit of constructive scientific exchange, as we are convinced that science is a place where people from different countries and beliefs gather and work together for building new knowledge in benefit of the whole humanity.

The AWRANA Barcelona conference is organized by the Archaeology of Social Dynamics (ASD) research group, from the Milá I Fontanals Institution (IMF) of the Spanish National Research Council (CSIC). Two other CSIC’s research groups also contribute to the organization of the conference, the Laboratory of Pleistocene Archaeology (CCHS, Madrid) and the Escuela Española de Historia y Arqueología (EEHAR, Rome). Other researchers, who thoroughly collaborate with the ASD group, from the Universities of Pisa, Tübingen and Barcelona are also engaged in the organization.

The conference is possible thanks to the support of CosmoCaixa, the Service of Archaeology and Paleontology of Catalonia, ArchaeologyHub.CSIC, the network joining the research groups working in Archaeology in the CSIC, Sensofar and the ASD research group.

We welcome all the participants and hope you will enjoy the conference and our cosy city.
We are happy to announce the 3rd Conference of the Association of Archaeological Wear and Residue Analysts (AWRANA), corresponding to the 14th International meeting focused on traceology, to be held in Barcelona between the 4th and the 7th of April 2022!

Originally scheduled for spring 2021, this conference had to be postponed to 2022 due to the COVID-19 pandemic crisis. This decision was made taking into account the importance of having an in-person meeting, not only to foster scientifically fruitful interactions, but also to provide a spontaneous, warm and friendly atmosphere after two years of restrictions and limited social events. We strongly believe that Barcelona offers the utmost conditions for a completely safe and high-yielding event.

After the great success of the meetings held in Faro, Leiden and Nice, the motto of the Barcelona conference will be *Tracing Social Dynamics*. The challenge of this edition goes beyond proving the importance of traceology within the spectrum of interdisciplinary archaeological approaches for the study of material culture. By tracing the relationships and interactions between artefacts, people and societies, the AWRANA 2022 conference aims to support the critical role of traceology in reconstructing past techno-economic, cultural, and social systems, as well as their entanglements. Therefore, we encouraged the submission of proposals that, through the application of the traceological method, focused on the structures underlying the use of artefacts, animals and of the human body.

We were particularly keen on receiving proposals dealing with non-utilitarian items and objects such as body ornaments and figurines, and rock art as the traceological applications on these categories have not received sufficient consideration yet. Additionally, and for the first time, colleagues working on dental microwear analysis were warmly invited to take part in the conference, as the sharing of experiences between specialists working on artefacts and teeth will surely energize both fields of research.

Papers concerning the analysis of all kinds of archaeological findings, experimental and/or ethnographic artefacts were welcomed as long as they integrate one of the topics listed below:

- **Timing technical and functional processes.** Traceology and residue analyses, more than many other analytical techniques, have the capacity to investigate the history or the biography of tools and the changes in their function in a diachronic perspective.
- **Activities in space.** Traceology and residue analysis as a proxy for reconstructing spatial organization, mobility and social territories.
• **Addressing past tool-kits to reconstruct social dynamics.** Approaching activities and their social interpretation by studying the variability of tools, materials, techniques and know-how.

• **Tracing symbols.** Exploring technology and functionality to grasp the significance and social value of symbolic objects.

• **Teeth in focus.** Microwear and residue analysis to trace diet and technical activities.

• **New issues, big methodological challenges.** A showcase for technical and methodological advances, including the application of new quantitative techniques, and the integration of traces and residues.

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Simone Sani (University of Pisa)
Lucia Spadacini (University of Pisa)
Agnese Terranova (University of Pisa)
Hilda Torres (Texas State University, San Marcos)
TRACING SOCIAL DYNAMICS

PROGRAMME
04 April 2022

08:00 - 09:00  Registration
09:00 - 09:15  Greetings & opening speech

Theme 1: Timing technical and functional processes

Chair: Caroline Hamon & Ignacio de la Torre

09:30 - 09:40  Ollé et al. - New data on the function of Homo antecessor’s stone tool assemblage (Gran Dolina: TD6, Atapuerca, Spain) - [online].
09:40 - 09:50  Asryan et al. - Micro-wear study of the Gran Dolina TD10.2 subunit lithic assemblage (Sierra de Atapuerca, Spain) - [online].
09:50 - 10:00  Martin-Viveros et al. - Early direct evidence of hafted butchering knives, multi-purpose and plant processing tools from a late Middle Paleolithic open-air site on the Levant: the case of Nahal Mahanayeem Outlet (NMO, Israel).

10:00 - 10:10  Discussion
10:10 - 10:20  Sørensen - Filling the gap: Microwear evidence for Aurignacian fire production at Abri Pataud (Dordogne, France).
10:20 - 10:30  Fassb et al. - A qualitative and quantitative approach for the analysis of backing retouch techniques in Upper Paleolithic armatures.
10:30 - 10:40  Tomasso et al. - Gone with the wind? Evaluating the functional potential of a Federmessergruppen assemblage from the eroded dune landscape of Lommel-Maathede - [online].

10:40 - 10:50  Discussion
10:50 - 11:20  Coffee break
11:20 - 11:30  Girya - On the concept of “morphonomy” as a keystone of the evidence-based interpretation of artefacts - [online].
11:30 - 11:40  Aleo et al. - An experimental approach to identify hafting methods of Mesolithic barbed points.
11:50 - 12:00  Petrović et al. - Quotidian life of prehistoric groups in the Iron Gates region during the Late Mesolithic and Early Neolithic period.

12:00 - 12:15  Discussion

Chair: Veerle Rots & Juan José Ibáñez

12:15 - 12:25  Osipowicz & Zagorska - Did the Neolithisation matter? A technological and functional aspect of the artefacts discovered in the Late Mesolithic grave no 57 and Neolithic graves no 164 and 277 at the Zvejnieki cemetery, Latvia - [online].
12:25 - 12:35  Halbrucker et al. - Understanding the Neolithisation process from functional analysis of lithics in Northern Belgium
12:35 - 12:45  Holst - Hearth activities at the dawn of the Neolithic - Use wear and residue analyses on stone plates from the site Neustadt I.A 156 - [online].
13:05 - 13:20  Discussion
13:20 - 14:50  Lunch break

Chair: Benjamin Chan & Fiona Pichon

14:50 - 15:00  Vinet & Lemorini - The obsidian toolkit from Çatalhöyük – a diachronic perspective from the Early Neolithic to the Early Chalcolithic (7100-5550 cal. BC).
15:00 - 15:10  Hilbert et al. - Replication and functional analysis of stone tools from the Camel Site (Saudi Arabia).
15:10 - 15:20  Vučković & Rosenberg - Tel Tsaf and the mystery of the Middle Chalcolithic society of the southern Levant: technology of painted pottery with a Tel Tsaf decorative style.
15:20 - 15:30  Li - Diversity of the use and typology of grinding tools at the Neolithic site of Jiahu, China - [online].
15:30 - 15:45  Discussion
15:45 - 15:55  Portillo et al. - Plant processing and ground stone equipment in Early Neolithic: phytolith and use-wear evidence from La Marmotta (Italy).
15:55 - 16:05  Pérez Martínez et al. - Implications of the form-function analysis in two lithic assemblages of the Mexican southeast in the Pleistocene-Holocene transition - [online].
16:05 - 16:15  Winiarska-Kabacińska et al. - Triangles of El-Ghorab Unit: what did they serve for?
16:15 - 16:25  Caricola et al. - Organic Residue Analysis Reveals the Function of Bronze Age Metal Daggers - [online].
16:25 - 16:40  Discussion
16:40 - 17:10  Coffee break
17:10 - 17:20  Verbaas & van Gijn - Microwear analysis of ceramic vessels from the Early Iron Age sites of Vix-Mont Lassois and Heuneburg.
17:20 - 17:30  Zagorodnia & Milokhod - Bone and amber items from the antique necropolis Volna 1.
17:30 - 17:40  Acosta Ochoa et al. - Use-wear and micro-residue analysis in bone needles associated with textile work during the Postclassic period (1100-1521 CE) in southern Basin of Mexico.
17:40 - 17:50  Debels et al. - Interdisciplinary approach to past and present foodways in south Casamance (Senegal). A use-wear study on ceramic pots.
17:50 - 18:10  Online posters - Theme 1
Bronowicki - The mystery of stone battle axes of the Corded Ware Culture: the complex biography of the axes from Budziszów Wielki 2/3, southwestern Poland.
Takakura - Microscopic manufacturing traces and identification of the knapping techniques of blades and microblades in the LGM lithic assemblages of Northern Japan.
Mutri & Sigl - Fish processing along the Nile. A shell tool from the Middle Kingdom of Elephantine Island.
Sharada & Sandhra - Traceological and taphonomic analysis of Dholavira bone points.
18:10 - 18:30  Discussion
05 April 2022

08:30 - 09:00  Registration

Theme 2: Activities in space

Chair: Colas Guéret & Yamandu Hilbert

09:00 - 09:10  Schunk et al. - Understanding Middle Palaeolithic asymmetric stone tool design and use: functional analysis and controlled experiments to assess Neanderthal technology.

09:10 - 09:20  Torres et al. - Identification of Kharaneh IV Bone Tool Use through Tip Breakage.

09:20 - 09:30  Sawada - Use-wear on burins and burin spalls: looking at human mobility in the Upper Paleolithic Japan - [online].

09:30 - 09:40  Visentin et al. - Palaeo-backpacks. Transporting lithic tools and raw materials in the Dolomitic uplands at the end of the Palaeolithic and in the Mesolithic.

09:40 - 09:55  Discussion

09:55 - 10:05  Bates et al. - Interpreting structures: the social dimensions of tool using areas at the Early Mesolithic site of Star Carr, UK.

10:05 - 10:15  Needham et al. - Understanding the use of flint awls at the Mesolithic site of Star Carr.

10:15 - 10:25  Gassin et al. - Five millimetres of cutting edge. What function for the chamfered pieces from the Chassey culture site of Daurelle (Montélimar, Drôme, France): tools associated with the functioning of burials?

10:25 - 10:35  Hamon et al. - Working at home. Reconstructing activities within Lbk household through the systemic use-wear analysis of flint industries, bone and antler tools and ground stone tools.

10:35 - 10:50  Discussion

10:50 - 11:20  Coffee break

11:20 - 11:30  Chan - Settling the argument: the contribution of use-wear studies to understanding settlement in Neolithic Britain.

11:30 - 11:40  van Gijn - Visualizing domestic crafts and mobility: Neolithic life in the wetlands of the Rhine/Meuse delta.


11:50 - 12:00  De Angelis & Lemorini - The monumental wall in level VI B2 of Arslantepe (Malatya, Turkey): union or division element of the village? The contribution of use-wear analysis of macro-lithic tools and chipped stone tools.

12:00 - 12:15  Discussion

Chair: David Cuenca & Hermine Xhausflair

12:15 - 12:25  Skakun & Terekhina - Comprehensive research of production equipment and interpretation of economic features of archaeological sites - [online].

12:25 - 12:35  Huidobre et al. - Use wear analysis and activities organization at Bahia Colorada site, Englefield Island, Southernmost Patagonia.

12:35 - 12:45  Tetrushvili - Reconstruction of agricultural activities on the Grakliani Hill (Based on the interdisciplinary study of grinding stones) - [online].
12:45 - 12:55  Robitaille et al. - *Grinding cereals: household socioeconomic and subsistence variations.*

12:55 - 13:10  **Online posters - Theme 2**
- Orlowska - *Upper Palaeolithic osseous artifacts from the Mamutowa Cave in Poland. First results of the traceological studies.*
- Chłoń et al. - *Should we stay in touch? New insights into contacts between first farmer communities in Central Europe, based on macro lithic stone tools analysis.*
- Kufel-Diakowska et al. - *The Neolithic polished stone tool as a Bronze Age funerary gift.*
- Previti et al. - *People and artefacts: social interactions and dynamics in a medieval town.*

13:10 - 13:30  **Discussion**

13:30 - 15:00  **Lunch break**

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**Theme 3: Addressing past tool-kits to reconstruct social dynamics**

**Chair:** Consuelo Huidobro & Davide Visentin

15:00 - 15:10  Djellal et al. - *Early Homo sapiens behavior in North Africa: Function of the MSA stone tools in Morocco - [online].*

15:10 - 15:20  Cagnato et al. - *A tailored procedure disentangles the elaborate activities of the Early Upper Paleolithic occupants of Dzudzuana Cave (Caucasus, Georgia): A macro-lithic tool perspective - [online].*

15:20 - 15:30  Coppe & Rots - *Towards a referential framework for the identification of projectile points and propulsion modes.*

15:30 - 15:40  Taipale - *Can stone tool hafting reflect Upper Palaeolithic social dynamics? New data from Abri Pataud, Hohle Fels, and Maisières-Canal - [online].*

15:40 - 15:55  **Discussion**

15:55 - 16:05  Alexandrovsky & Groman-Yaroslavski - *The Wadi Hammeh 27 ’Double Sickle’ – An Experimental Archaeology Approach.*

16:05 - 16:15  Calvo Gómez et al. - *Together we go further: use-wear analysis of lithic and shell tools from the Mesolithic coastal sites of El Mazo and El Toral III - [online].*

16:15 - 16:25  Gueret - *Hide-working with stone tools in the Mesolithic of Western Europe: historical processes and geographical diversity.*

16:25 - 16:35  Macâne et al. - *Moving beyond status - new research exploring the meanings of hunter-gatherer grave goods from North Eastern Europe.*

16:35 - 16:50  **Discussion**

16:50 - 17:20  **Coffee break**

17:20 - 19:00  **In person poster session (all themes)**
In person poster session

Theme 1: Timing technical and functional processes

Bello-Alonso et al. - New experimental insights for the traceological study of Ambrona and Torralba archaeological sites.
Leventi et al. - Exploring the function and the impact of post-depositional surface modifications (PDSM) on Châtelheronian end scrapers from Quinçay Cave, France.
Taranto et al. - The role of the husking trays: food practices and social behaviors in the late Neolithic Near East.
Hamon et al. - Identifying the stone toolkit of copper and bronze age metallurgists: new contribution of use-wear and XRF analysis on experimental tests.
Reniere - Whetstones on the cutting edge. Understanding the cultural biography of Roman and medieval macroolithic tools through use-wear analysis. From domestic and agricultural activities to specialized craft productions.
Havlíková - Sword fighting in Bronze Age Europe: assessing the use of bronze swords from Bohemia and Moravia.
Capra et al. - Preliminary techno-typological study of stone and ostrich eggshell beads at Mahal Teglinos, Eastern Sudan. Local manufacturing or imported personal ornaments?

Theme 2: Activities in space

Gassin et al. - First glimpses on the technological and functional study of the early Neolithic lithic industry of La Marmotta (Latium, Italy).
Petrogiannaki - Reflections on hide-working. Dehairing experiments and use-wear analysis on Vlaardingen Culture (3400-2500 BC) scrapers from Den Haag Steynhof.
Hilbert et al. - Preliminary results from the traceological analysis of the Late Neolithic and Bronze Age stone tool assemblages from Ra’s al-Jinz 3 (Oman).
Rega & Mutri - First attempts at sampling and analysing residues from macro-lithic tools in Eastern Sudan.

Theme 3: Addressing past tool-kits to reconstruct social dynamics

Visentin et al. - Fish processing in the Mesolithic. First data from Romagnano Loc III rock shelter (South-Eastern Alps, Italy).
Pichon et al. - Traceological analyses of the JKSH Pš2 site lithic assemblages from occupational layers, Jibal al-Khashabiye, Jordan: implications on our understanding of the desert kites users during the Late PPNB.
Zupančič et al. - Deciphering the role of wild plant foods at the dawn of agriculture in the Levant.
Vučković & Risch - The economy of the Neolithic communities of the Central Balkans according to the macro-lithic artefacts.
Dolezaková - Bronze Age grinding stones revealed: a comprehensive study of the finds from central-western Turkey.
Terekhina et al. - Ethnotraceological analysis of stone knives of the Ekven cemetery.

Theme 4: Tracing symbols

Berruti et al. - The legend of Porosphaera globularis beads and their relationship with the emergence symbolic thinking in human prehistory. A myth debunked.
Beyries & Gauvrit-Roux - Middle Magdalenian flint toolkits to engrave and sculpt the stone.
Little et al. - Stone Tools and their Roles in Mesolithic Funerary Rites: The Stone Dead Project.
Alarashi et al. - Drilling down the details: furthering the investigation on the perforations of the Neolithic stone beads and drilling tools.
Vinet - The obsidian mirrors a reflection of the past.
Nováčková - Prestigious but strongly worn. Antler combs in Roman period.
Robitaille - Crushing Ochre in Ethiopia.

Theme 5: Teeth in focus

Ramírez-Pedraza et al. - Palaeoecological reconstruction from the Plio-Pleistocene site Guefaït 4.2 (Jerada, Eastern Morocco) based on dental wear analysis of fossil ungulates.
Francès Abellán et al. - Microwear texture metrics on buccal enamel surfaces of hominin teeth show significant associations with dental crown cusp topography and feature density and length.
Martínez et al. - On sample size and buccal enamel preservation in dental microwear.

Theme 6: New issues, big methodological challenges

Vassanelli et al. - Copper Age Marble Beads: an interdisciplinary approach.
Schunk et al. - Comparative Study of Silicone Moulding Materials in Archaeology and the Forensic Sciences.
Cifuentes-Alcobendas & Little - Make it clean: critical assessment of the impact of cleaning methods in osseous archaeological remains.
Despotopoulou et al. - Creating a protocol for non-destructive analysis of ancient adhesives.
Petrović et al. - Introduction to TRACEBOOK: an IT solution for collection and study of the experimental traces on different materials.
Thaler et al. - Robo(?)chop - a purpose-built rig for controlled use-wear experiments with bronze axe replicas.
06 April 2022

08:30 - 09:00  Registration

Chair: Annelou van Gijn & Andrea Zupancich

09:00 - 09:10  Cnunts et al. - Towards a detailed reconstruction of Mesolithic plant-related wetland activities at the Lower Scheldt basin (Belgium) through systemic experimentation, residue and use-wear analysis - [online].

09:10 - 09:20  Mazzucco et al. - Early Appearance of Threshing Sledges in Greek Neolithic: A Combined Technological, Traceological, and Quantitative Assessment.

09:20 - 09:30  Milić et al. - Beyond hunting? The use of arrowheads at the Pre-Pottery Neolithic Kharaysin (Jordan) in the context of tool recycling in the Levant.

09:30 - 09:40  Lastra-Alonso et al. - Manufacturing and decorating cardial pottery? shell tools in the neolithic site of Cabecicos Negros (Vera, Almería, Spain) - [online].

09:40 - 09:55  Discussion

09:55 - 10:05  Marigáirt - Different tools for the same functionality. Chalcolithic case studies from the Lower Danube - [online].

10:05 - 10:15  Tsonaki et al. - Assembling traces and processes: understanding Early Bronze Age metalworking through the microwear analysis of stone tools.

10:15 - 10:25  Kluge - Same but different – A Comparison of soft-stone vessel production at the area of Al-Mudhaibi and Shokur, Sultanate of Oman - [online].

10:25 - 10:35  Xhaufail & Ibañe - Identifying the use of plants in prehistoric Southeast Asia through use-wear analyses. Where do we stand?

10:35 - 10:50  Discussion

10:50 - 11:20  Coffee break

11:20 - 11:30  Alonso et al. - Identities, social interactions and knowledge transmission in the uttermost tip of South America: a use-wear approach.

11:30 - 11:40  Czadalen et al. - Domestic, artisanal, and ritual activities in a classical Maya city: functional analysis of flint drills and obsidian blades from the Cancuén site (AD 650-800, Guatemala).


11:50 - 12:05  Online posters - Theme 3

Meluso & Luglie - Harvesting tools during the full Middle Neolithic in Sardinia: a case study from Su Mulino Mannu open-air site.

Forte et al. - Traces analysis on mud figurines: makers, techniques and social dynamics from Middle Bronze Age Egypt (1800-1700 BC).

Vidal-Matutano et al. - Exploring Prehispanic woodworking technologies in the isolated context of the Canary Islands.

Pérez-Martínez et al. - Determining the function of archaeological artifacts associated with a lacustrine way of life during the Archaic in the Basin of Mexico.

Ulanov - Sea mammal butchering in Jomon ritual contexts: use-wear analysis of lithics from Hamanaka 2 site, Japan, Rebun Island.

12:05 - 12:25  Discussion
Theme 4: Tracing symbols

Chair: Emanuela Cristiani & Bogdana Milić


12:35 - 12:45 Martisius et al. - Top-notch bone implements: exploring the technology and symbolism of incised bones at the Epipalaeolithic site, Kharaneh IV (Jordan).

12:45 - 12:55 Gravel-Miguel et al. - The ornaments of the Early Mesolithic infant burial of Arma Veirana (Liguria, Italy): A use-wear and archaeoanthropology approach to reconstructing an infant’s life and death, and the role ornaments played in it.

12:55 - 13:05 Dubreuil & Grosman - Ground stone assemblage from a grave at Hilazon Tachtit (Levant): a use-wear perspective on making memories - [online].

13:05 - 13:15 Alarashi & Ibáñez - Catching the light: studying the polishing techniques of the Neolithic chalcedony beads from the Levant and Upper Nubia.

13:15 - 13:30 Discussion

13:30 - 15:00 Lunch break

Chair: Sylvie Beyries & Hala Alarashi

15:00 - 15:10 Rowland - Bead Biographies: understanding the use and role of beads and ornaments in Middle Neolithic Britain.

15:10 - 15:20 Malyutina & Charniauski - Small but significant: the results of the traceological analysis of bone prongs from the peat bog sites of Northern Belarus (second half of the 3rd – first half of the 2nd mill. BC) - [online].


15:30 - 15:40 Vassanelli & Petrinelli Pannocchia - Marble for Beads during the Copper Age in Italy: Products and Techniques.

15:40 - 15:45 Online posters - Theme 4

Ruta et al. - Testing backed lithic points as perforators to create ornaments. Experimentation results and new possible use from Riparo Villabruna (Belluno – Italy).

15:45 - 16:00 Discussion

Theme 5: Teeth in focus

Chair: Florent Rivals & Sergio Jiménez-Manchón

16:00 - 16:10 Martínez et al. - Buccal dental microtexture and dietary shifts in African Plio-Pleistocene hominins.

16:10 - 16:20 Redae et al. - Dietary ecology through dental wear analysis: Insights into the environmental context at the onset of the Oldowan in the Shungura Formation, Ethiopia.

16:20 - 16:30 Berlioz et al. - Dental microwear texture analysis of deer and large bovids from Combe Grenal (Dordogne, France): what does it tell us about Neandertal subsistence strategies?
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<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>16:30 - 16:40</td>
<td>Gluitz et al. - <em>What were prehistoric communities from the Northeast Iberian Peninsula in the Early Bronze Age eating? A buccal microwear analysis to approach the dietary habits in Plaça de la Gardunya’s site (Barcelona, Spain).</em></td>
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<td>16:40 - 16:55</td>
<td>Discussion</td>
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<td>16:55 - 17:25</td>
<td>Coffee break</td>
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*Chair: Ferrán Estebaranz & Laura M. Martínez*

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<tr>
<td>17:25 - 17:35</td>
<td>Estalrich - <em>Occlusal Molar Microwear Texture Analysis of the people from Indian Knoll, an Archaic shell middlen (Green River, Kentucky, USA).</em></td>
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<td>17:35 - 17:45</td>
<td>Correia et al. - <em>ISO variables as a complement to DMTA variables in in vivo studies of human dental microwear - [online].</em></td>
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<td>17:45 - 17:55</td>
<td>Getachew et al. - <em>Reconstructing the ecology of fossil megaherbivores: the case of dental wear applied to proboscideans.</em></td>
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<td>17:55 - 18:05</td>
<td>Livraghi et al. - <em>Reading the teeth: the application of dental wear analyses to infer the extent and the season of Neanderthals’ site occupation.</em></td>
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<td>18:15 - 18:25</td>
<td><strong>Online posters - Theme 5</strong>&lt;br&gt;Hernando &amp; Lozano - <em>A microscope tour: Exploring different microscopic approaches to dental microwear analysis on human populations.</em>&lt;br&gt;Hidalgo et al. - <em>Inter-tooth and inter-maxilla buccal microtexture variability in Papionini primates.</em></td>
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<td>18:25 - 18:45</td>
<td>Discussion</td>
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<td>18:45 - 22:00</td>
<td>Social dinner @ CosmoCaixa</td>
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07 April 2022

08:30 - 09:00  Registration

Chair: Almudena Estalrich & Laura M. Martínez

09:00 - 09:10  Micó et al. - Taphonomic and dietary marks in microwear studies: an experiment to identify trampling alterations.

09:10 - 09:20  Uzunidis et al. - “That’s gonna leave a mark”: taphonomical impact of sediments on tooth enamel.

09:20 - 09:30  Louail et al. - Exploring the impact of soil ingestion on dental microwear textures using a wild boar experimental model.

09:30 - 09:40  Gilson et al. - Shark teeth as tools: experimental and microwear analyses - [online].

09:40 - 09:55  Discussion

Theme 6: New issues, big methodological challenges

Chair: Noora Taipale & Marta Portillo

09:55 - 10:05  Galland et al. - The relevance of taphonomic analysis in the functional study of the early Oldowan quartz artifacts from the Shungura Formation (Lower Omo Valley, Ethiopia).

10:05 - 10:15  Macdonald et al. - Sharp Edges and Deep Cuts: Using microCT for the multiscalar characterization of edge curvature on Olduvai Gorge quartzite flakes.

10:15 - 10:25  Sorrentino et al. - Multiscale Surface Texture Analysis for EUP macro-lithic tools - [online].

10:25 - 10:35  Paixão et al. - Ground Stone Tools from the Middle Paleolithic of the Levant: High-resolution and multiscale functional analysis.

10:35 - 10:50  Discussion

10:50 - 11:20  Coffee break

11:20 - 11:30  Jiménez González et al. - Microscopic analysis of artefacts associated with textile processing and textile production during the Early Postclassic period in the south of the Basin of Mexico.


11:40 - 11:50  Ibáñez et al. - Harvesting variability of domestic cereals through texture analysis of sickle gloss.

11:50 - 12:00  Clemente Conte et al. - A Traceological and Quantitative Assessment of the Function of the Bone Awls from the Late Neolithic of the Cueva del Toro (Antequera, Malaga).

12:00 - 12:15  Discussion

Chair: Danielle Macdonald & Niccolò Mazzuco


12:25 - 12:35  Rodríguez et al. - Towards a modelling of Prehistoric technical gestures through monitored controlled experimentation and 3D optical profiler.
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<tr>
<td>12:35 - 12:45</td>
<td>Tydgadt &amp; Rots - <em>Mechanical performance tests to explore the resilience of prehistoric glues in hafting.</em></td>
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<td>12:45 - 12:55</td>
<td>Calandra et al. - <em>Robotic archeology: testing the influence of human variability on use-wear formation.</em> [online].</td>
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<td>12:55 - 13:10</td>
<td>Discussion</td>
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<td>13:10 - 14:40</td>
<td>Lunch break</td>
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<td>14:40 - 14:50</td>
<td>Mateo Lomba et al. - <em>Revisiting the basic methods on use-wear analyses. The case of cleaning protocols.</em></td>
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<td>14:50 - 15:00</td>
<td>Díaz Bonilla et al. - <em>Prehistoric handmade pottery and traces of production: a methodological approach to the study of surface treatment.</em></td>
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<td>15:00 - 15:10</td>
<td>Vieugué et al. - <em>Formation and degradation processes of pottery use-wear and residues: an insight from ethnography and experimentation.</em></td>
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<td>15:10 - 15:20</td>
<td>Fernández-Marchena &amp; Ollé - <em>What did we do with the methodology? Several reasons why we must rethink and adapt the traceological methodology to the sample analyzed.</em></td>
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<td>15:20 - 15:30</td>
<td>Longo et al. - <em>The devil is in the details: why increasing transparency on tool biography, sampling, experiment set-up and analytical techniques is as relevant as the results.</em></td>
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<td>15:30 - 15:45</td>
<td><strong>Online posters - Theme 6</strong></td>
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<td>Baumann et al. - <em>Neanderthal bone tools from inside, at Jonzac, Quina level, France.</em></td>
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<td>Asryan &amp; Rots - <em>Wear traces of Basalt Tools - an Experimental case for archaeological interpretation (BaTex): A new project on micro-wear studies of basalt tools.</em></td>
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<td>Michel &amp; Rots - <em>Stone tools in the sun: the effect of UV light on the preservation flint surfaces and adhesives.</em></td>
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<td>Lundin &amp; Boström - <em>Quantifying use-wear polish through 3D imaging software: first results from a preliminary study calculating usage time of Neolithic sickles.</em></td>
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<td>15:45 - 16:00</td>
<td>Discussion</td>
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<td>16:00 - 17:00</td>
<td>AWRANA Meeting</td>
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<td>17:00 - 17:15</td>
<td>Conference closing speech</td>
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THEME 1: TIMING TECHNICAL AND FUNCTIONAL PROCESSES

ORAL PRESENTATIONS
NEW DATA ON THE FUNCTION OF HOMO ANTECESSOR’S STONE TOOL ASSEMBLAGE (GRAN DOLINA- TD6, ATAPUERCA, SPAIN)

Andreu Ollé 1,2*, Juan Luis Fernández-Marchena 3,1, Adrián Arroyo 1,2, Antonella Pedergnana 4, Lena Asryan 5,1, Marina Mosquera 2,1

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Abstract

Latest fieldwork at Gran Dolina site (Sierra de Atapuerca, Burgos, Spain) considerably increased the stone tool assemblage retrieved from Unit TD6. Dated to 0.9 Ma, the excavation of TD6 has provided with detailed and fresh data of a unique and well-preserved Early Pleistocene home base, key to shed light on the behaviour of the first European populations and their lithic technology.

In this talk, we present an ongoing investigation about the functionality of the Homo antecessor’s toolkit which involves an integrative study of two technological categories. On one hand, we paid attention to the non-flaked assemblage, that includes a large group of quartzite and sandstone cobbles and pebbles transported by hominins to the cave. Our analysis has focused on the identification of the percussive traces that could reveal the activities beyond stone flaking performed at TD6. On the other, we revised the flaked assemblage. Our analysis has prioritised the study of quartzite and quartz flaked tools from the new collections that showed a better preservation for functional analysis. Methodologically, the microscopic analysis was carried out applying a multi-technique approach encompassing Optical, 3D Digital and Scanning Electron Microscopy, and Energy-dispersive X-ray spectroscopy for a basic elementary characterisation, as well as a first texture analysis by means of confocal microscopy.

Results obtained in this study, coupled with preliminary data and devoted experiments, enabled to expand our knowledge on the variety of subsistence activities carried out in the TD6 hominin occupation. Our work additionally allows to update hypotheses pointed in previous studies, in which butchery activities were considered predominant. New data inform about an intense tool usage and widen the type of activities recognised, including transversal actions on a variety of materials, and reveal that pounding activities had also a significant role within the daily life behavioural activities of H. antecessor.

Keywords: Early Pleistocene; use-wear analysis; home base; multi-technique microscopy; Homo antecessor
MICRO-WEAR STUDY OF THE GRAN DOLINA TD10.2 SUBUNIT LITHIC ASSEMBLAGE (SIERRA DE ATAPUERCA, SPAIN)

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Abstract

A microwear study was carried out on the lithic assemblage of the TD10.2 subunit of Gran Dolina site in the Sierra de Atapuerca dated between 350 to 400 ka BP. This subunit comprises the richest faunal and lithic assemblage of the site. Because of dominance of bison remains in the faunal assemblage the main accumulation of bones in this subunit is known as bison bone bed and it is interpreted as a bison kill-butchery site. Neogene and Cretaceous chert are almost exclusively used in the lithic production followed by some quartzite, quartz, sandstone and limestone. Flake products dominate in the assemblage showing high diversity of small flake tools and scarcity of large cutting tools.

The poor preservation of the main raw material makes the microwear study of this assemblage challenging. Here we focus mainly on the artefacts made of Cretaceous chert, as these are fairly better preserved than those on the dominant Neogene variety. Retouched and unretouched flakes were selected for low- and high-power approach analysis. Optical, 3D digital and scanning electron microscopes were jointly used for the study and characterisation of use-wear traces. This multi-technique approach resulted to be highly efficient for overcoming the microwear observation and recognition difficulties we had on this raw material when applying a single microscopic analysis method.

To provide reliable data that would be useful for comparing the archaeological results, a specific experimental program was carried out with both Atapuerca chert varieties. The study results show that despite the significant patina and internal alteration of the pieces, some of them have a good preservation of use-wear traces related mainly to butchery but also to bone, wood and hide working activities.

Keywords: Middle Pleistocene; kill-butchery site; micro-wear; multi-technique analysis
EARLY DIRECT EVIDENCE OF HAFTED BUTCHERING KNIVES, MULTI-PURPOSE AND PLANT PROCESSING TOOLS FROM A LATE MIDDLE PALEOLITHIC OPEN-AIR SITE ON THE LEVANT: THE CASE OF NAHAL MAHANAYEEM OUTLET (NMO, ISRAEL)

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Abstract

Much of what is known about past human behavior and subsistence strategies in the Levantine Middle Paleolithic comes from long sequences of cave sites and rock shelters. Functional studies here have traditionally focused on determining the use of points and triangular elements, either as projectile armatures or, more rarely, as multi-purpose knives. Little is known about such tool-uses and hafting in Middle Paleolithic open-air sites in the Levant through the systematic application of micro-wear analysis. We report the results of a low and high-power study carried out on the lithic assemblage of the late Mousterian open-air site of Nahal Mahanayaem Outlet (NMO, Israel), dated to 51 – 65 ka BP, to illustrate the very limited presence of projectile armatures at the site. Relying on an experimental reference collection comprising around 150 experiments, we demonstrate the use of points and blades predominantly as butchering knives, many of them while hafted, with a limited evidence of hide, bone and plant processing activities. Flakes were used at hand as butchering knives and only few of them for hide, bone, and plant-processing tasks. Most of the hafted tools were used in tasks for which hafting was not obligatory, demonstrating that hafting skills were already available and incorporated into the lithic production processes at NMO when needed, and that tool-use as well as repairing activities were planned in advance of game procurement activities at the site. These results reinforce previous interpretations of NMO as a short-term specialized site focused on animal processing activities with sparse evidence of hunting weapons. Finally, these also provide the earliest direct evidence of hafting and plant processing tools for a late Mousterian open-air site in the Levant inferred through use-wear analysis.

Keywords: Late Middle Paleolithic; Levant; open-air site; use-wear analysis; butchering knives; hafting
FILLING THE GAP: MICROWEAR EVIDENCE FOR AURIGNACIAN FIRE PRODUCTION AT ABRI PATAUD (DORDOGNE, FRANCE)

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Abstract

Archaeological evidence for the use of fire by early Upper Palaeolithic hunter-gatherers is well-attested to; yet artefactual evidence for fire production during this same period is virtually non-existent. This disconnect presents a glaring gap in our knowledge of the pyrotechnological capabilities of the earliest Homo sapiens entering Europe during the Last Glacial Period. In an effort to determine if this gap reflects an actual absence of fire making technology, focused microwear analyses of early Upper Palaeolithic lithic collections are presently underway in an attempt to identify mineral traces and associated residues on flint tools that are consistent with forceful contact with pyrite for the express purpose of producing sparks (i.e. strike-a-lights). Presented here are the initial results from one such analysis at Abri Pataud (Dordogne, France), a rock shelter site with a 9.25 m-thick sequence dating to between 40,000 and 20,000 Cal BP and containing 14 archaeological layers (Aurignacian, Gravettian and Solutrean), nearly all exhibiting evidence of fire having been used on site, including abundant hearth features. In total, 44 probable or possible strike-a-lights were identified in four of the eight Aurignacian layers—a surprising result considering, to my present knowledge, no Aurignacian strike-a-lights have been identified in published literature. Perhaps equally surprising, given these findings, is that none were observed in the younger Gravettian (n=4) and Solutrean (n=1) layers. Possible explanations for the apparent absence of strike-a-light tools in these and the negative Aurignacian layers will be discussed.

Keywords: fire making; strike-a-lights; Aurignacian; Abri Pataud; pyrotechnology
A QUALITATIVE AND QUANTITATIVE APPROACH FOR THE ANALYSIS OF BACKING RETOUCH TECHNIQUES IN UPPER PALEOLITHIC ARMATURES

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Abstract

Diachronically, the presence of an abrupt retouch opposed to a cutting edge is a recurrent feature within Upper Palaeolithic armatures. Besides their morphology, the ensemble of backing techniques and gestures applied for producing this retouch must also be considered as a key element to better understand technical traditions of hunter-gatherer groups.

In order to identify the techniques used to shape the lithic armatures from the Late Epigravettian layers of Riparo Tagliente (Verona, N-E Italy), four main backing techniques were tested: soft stone percussion on an anvil, pressure by soft stone, pressure by an organic tool (bone and antler) and abrasion. The experimental collection was analysed by combining qualitative (including analysis at low and high magnifications) and quantitative approaches. This integrated methodology has often been used in use-wear analysis, although rarely applied to reconstruct the techniques used to produce lithic artefacts. The morphoscopic analysis allowed to identify numerous macro- and mesoscopic criteria (e.g., back profile, morphology of removal scars, incipient cones, etc.) that vary according to the retouch technique applied, whereas the high-power approach permitted the observation of several micro-traces (e.g., polishes and striations) yielding important information concerning the nature of the used retoucher (mineral vs. organic). The quantification of experimental backs was based on the measurement of specific morphological parameters of the scars (angles, depth and size) using a motorized digital stereomicroscope and the MountainsLab v.7 (Digital Surf) software. The metric values of these parameters have proved to be an efficient tool for discriminating backing techniques.

The application of our combined approach to the archaeological assemblage of Riparo Tagliente permitted to identify the use of at least three different backing techniques, highlighting an important variability of technical solutions adopted for producing lithic armatures during the Late Epigravettian in North-Eastern Italy.

Keywords: Late Epigravettian; lithic armatures; backing techniques; qualitative and quantitative approach
GONE WITH THE WIND? EVALUATING THE FUNCTIONAL POTENTIAL OF A FEDERMESSERGRUPPEN ASSEMBLAGE FROM THE ERODED DUNE LANDSCAPE OF LOMMEL-MAATHEIDE

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Abstract

We present the results of a large-scale functional analysis performed on the lithic assemblages from the Federmessergruppen site of Lommel-Maatheide. This vast site is located in Northern Belgium on a large Late Glacial sand ridge on the edge of a paleo-lake. Different lithic concentrations attributed to the Final Palaeolithic were discovered within the context of preventive archaeology. Given their varying location with regard to the sand ridge, the site offers an excellent opportunity to study site activities and dynamics and to evaluate the extent to which post-depositional processes impacted the potential of functional studies.

Exhaustive screening revealed a differential preservation pattern between the different concentrations and permitted to evaluate the impact of excavation strategies on the surface state of the lithic artefacts. Specific functional insights were obtained thanks to the combination of techno-morphological, use-wear and residue analysis with experimental studies. Both animal and vegetal processing tasks could be identified in addition to hunting activities and particular propositions could be made with regard to the hunting techniques used. We conclude that large-scale comprehensive functional analyses of Final Palaeolithic contexts have the potential to reveal unique insights in past dynamics.

Keywords: Final Palaeolithic; Federmessergruppen; functional analysis; post-depositional processes
ON THE CONCEPT OF “MORPHONOMY” AS A KEYSTONE OF THE EVIDENCE-BASED INTERPRETATION OF ARTIFACTS

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Abstract

Starting from the preliminary, traditional formal-typological description of the artifacts shapes (morphography), their sizes and proportions (morphometry), we proceed to the search and interpretation of the reasons for the appearance of all types of traces found on their surfaces.

We construct an interpretation of each specific form on the basis of morphonomy - knowledge of patterns known to us through experiments. This is a very specific knowledge about cause-and-effect relationships between the type of technological processes and the forms of traces that arise as a result of their implementation.

These are data that determine the causes and nature of changes in the forms of objects participating in technological processes. In the course of archaeological experiments, we determine purely natural, independent of our will, cause-and-effect relationships between the technological processes we simulate and their results - traces. Processes caused by similar morphonomic laws lead to the formation of similar traces - the results of interaction.

The most important advantage of the experimental-traceological interpretation is its fundamental verifiability. Indeed, if necessary, experiments can be reproduced, and the morphonomic patterns studied in the course of such work can be specified or even revised. Depending on the nature of the origin, we distinguish between traces of processing, use, general non-utilitarian wear and traces of damage as a result of different post depositional effects. The most important source of information about the “life course” of each item is the stratigraphy (sequence) and distribution (topography) of the traces found on its surfaces. By the terms “biography” or “portrait” of an artifact, we mean, first of all, the interpretation of its morphology - a comprehensive interpretation of the shape of the product and all its elements, including traces, as an integral characteristic of its surfaces.

The purpose of archaeological experiments is to establish the morphonomic patterns of the traces formation in specific processes of material interactions.

Comparing the results of modern experiments with archaeological sources - the results of the original ancient production processes, we can determine to what extent our ideas about the causes of each specific form of formation correspond to the investigated original process carried out in antiquity.

The limits of the “sensitivity” of the experimental traceological method, and the personal level of training of each researcher are determined during the “blind testing”.

Keywords: evidential interpretation; morphonomy; morphology; morphography
AN EXPERIMENTAL APPROACH TO IDENTIFY HAFTING METHODS OF MESOLITHIC BARBED POINTS

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Abstract

The identification of hafting traces and residues on several bone/antler barbed points from Doggerland (Dutch North Sea coast) (Spithoven, 2018; Verhart, 1988) has raised questions on how they were hafted. Micro-polishes, binding impressions, and adhesive remains on archaeological tools point that they were hafted with the aid of bindings and adhesives with different hafting arrangements. So far, various hafting systems have been proposed based on archaeological and ethnographic examples of osseous projectiles (e.g. Pétillon, et al., 2011; Verhart, 2000).

We designed an experiment to 1) evaluate the identification of the hafting arrangements based on use-wear traces and residue distribution and 2) to test the performance of different hafting designs during use. Replicas of Mesolithic barbed points were made from deer metapodials (N= 18) and hafted to split (N=9) and bevelled wooden shafts (N=9) with experimental birch bark tar and bindings (deer sinew and lime bast). In total we tested four different hafting arrangements, and each set of experiments was repeated twice. We also included two sets of experiments hafted only with tar to evaluate the role of bindings in the hafting arrangements. We shot the arrows in a ballistic jelly cube covered with animal hide, using a bow mounted on a hand-made shooting mechanism. Each arrow was shot 25 times.

After the experiment, we analysed the points with a stereomicroscope and a metallurgical microscope for hafting wear. The split hafts and bevelled hafts are readily identified through the difference in use-wear and residue distribution. Regarding the performance, both hafting methods were efficient. However, the sinew bindings were more effective than lime bast bindings. The experiments carried out without bindings, showed that in split hafts bindings prevent the shaft from splitting, while in the bevelled hafts, they contributed to keeping the point in place. The role of bindings is thus fundamental.

Keywords: barbed points; projectiles; shooting experiment; hafting traces

References


NON-FLAKED TOOLS AND DENTAL CALCULUS REVEAL EVIDENCE FOR PLANT FOOD CONSUMPTION AND TECHNOLOGY IN THE MESOLITHIC DANUBE GORGES

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Abstract

In recent years, the combination of archaeological and bioarchaeological studies have provided new clues about the role of plants within prehistoric groups before the advent of agriculture. In the Balkan regions and specifically in the Danube Gorges area, the affirmed familiarity of Mesolithic hunter-gatherers with wild plant species have been demonstrated by thorough studies comprising dental calculus, aDNA and archaeobotany. While the information about the consumption of plants is abundant, little is known regarding the technology involved and how plant materials were processed. To shed light on this latter aspect, we analysed one of the richest non-flaked tools assemblages coming from the Late Mesolithic site of Vlasac. Our study combines techno-morphological, use wear and residue data obtained through qualitative and quantitative analyses with the direct evidence of plant consumption coming from dental calculus. The use-wear and residues identified on the non-flaked tools confirm the use of these tools in the working of wild grass grains, fruits, and seed, which according to the traces identified, were subject to coarse processing, as demonstrated by the retrieve of grit particles in the dental calculus. Our results highlight the complex life history of the tools, indicating their role primarily as active elements during the grinding process and their multiple uses, including activities not related to the processing of plant foods (i.e., knapping). Our study represents the first comprehensive dataset on non-flaked tools from the Mesolithic Danube Gorges. It provides new evidence suggesting the relevant role that non-flaked tools have played in the lifeways of Holocene hunter-gatherers of the area and supporting the importance of plant foods in their diet.

Keywords: non-flaked tools; use wear; residue; Mesolithic, Balkan
QUOTIDIAN LIFE OF PREHISTORIC GROUPS IN THE IRON GATES REGION DURING THE LATE MESOLITHIC AND EARLY NEOLITHIC PERIOD

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Abstract

The archaeological sites from the Iron Gates region dated to the Late Glacial and Early-Mid Holocene have been a subject of numerous studies targeting human and faunal remains or palaeoflora in the past. However, for decades there was no information about the function of the chipped stone tools, as one of the main indicators of human occupation. This paper aims to reveal the processes that took place in the Transitional period of the Iron Gates region, based on the use-wear and residue analysis. Addressed hypotheses are concerning the role of the lithic tools found at Lepenski Vir, Padina and Vlasac, but also the customs, traditions, and specialization inside the area, as various phases of skin processing are testifying about the complete system of hide production at the analysed sites. The data are indicating the alternating rise and fall in treating animal and vegetal matters during different chronological periods inside the territory. Furthermore, the idea is to step out of the classical background and to represent how the traceological results affected and complement the knowledge we possess about the local and incomer groups at the end of the 7th to mid-6th millennium BC in SE Europe. Both simple activities, as scraping bone or woodworking, and specific processes, as hide tanning, are viewed from a prism of results of the human diet, spatial analysis and technology and function of other types of household goods (e.g. ground stone or bone tools) found in the buildings, hearths, burials and open-air spaces. The integrated approach could be considered as a possibility to observe the everyday life of prehistoric groups that inhabited the region, their choices, needs and behaviour towards peculiar situations they confronted on the regular basis.

Keywords: use-wear analysis; residue analysis; chipped stone tools; Iron Gates; Transitional period.
DID THE NEOLITHISATION MATTER? A TECHNOLOGICAL AND FUNCTIONAL ASPECT OF THE ARTEFACTS DISCOVERED IN THE LATE MESOLITHIC GRAVE NO 57 AND NEOLITHIC GRAVES NO 164 AND 277 AT THE ZVEJNIEKI CEMETERY, LATVIA

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Abstract

The results of microscopic studies of bone, flint, and stone products discovered in three burials (no. 57, 164 and 277) at the cemetery in Zvejnieki (Latvia) will be discussed. These were the first traceological studies of artefacts from this unique site, in which a comprehensive technological and functional analysis of all artefacts found in the included graves was undertaken. As a result of the conducted research, many interesting, and in some cases very unique, technological and use-wear traces were observed, allowing for many interpretations relating to the method of making individual items, their original function and activities performed in order to adapt them to the role of grave goods. The discrepancies and similarities recorded in this respect between the products from the Mesolithic burial and both Neolithic ones allowed for preliminary suggestions on the degree and nature of the influence of Neolithisation on the community using the cemetery in Zvejnieki in the Early and Middle Holocene.

Keywords: Zvejnieki, Neolithisation, hunter-gatherers, bone, flint
UNDERSTANDING THE NEOLITHISATION PROCESS FROM FUNCTIONAL ANALYSIS OF LITHICS IN NORTHERN BELGIUM

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Abstract

Compared to the loess area of Central and Western Europe, the Neolithisation of the sandy lowland of the north-western European Plain was a gradual process which covered large parts of the 5th millennium cal BC. The transition from a foraging way of life to the settled farming and herding lifestyle at the coastal lowland area has been debated.

In Northern Belgium, recent finds suggest a possible functional difference between Swifterbant sites, close contact between Swifterbant and fully Neolithic groups, and continuous traditions in lithic technology and use from the Late Mesolithic to the Middle Neolithic in the Scheldt valley.

Results from the functional analysis of lithic tools are in agreement with the conclusions of the techno-typological analyses of lithic industries and pottery. The continuation of Late Mesolithic "traditions" throughout the Swifterbant and probably also the Michelsberg Cultures, is clear in all aspects of lithic analysis, just as the emergence of new elements in the lithic industries during the Swifterbant. The functionality of the new tool-kits supports the contact and transfer of know-how from Early Neolithic communities to indigenous foragers, that is shown also from the pottery.

Results support the Neolithisation model in which local foragers slowly adapted Neolithic technologies and strategies (i.e. pottery making and simple production in the Swifterbant) before an almost full acculturation in the Middle Neolithic.

In this presentation, we will show how lithic microwear analysis can be integrated into broader research questions and help to understand social dynamics during the Mesolithic-Neolithic transition in Northern Belgium.

Keywords: Neolithisation; Scheldt valley; microwear; lithics; integrated research
HEARTH ACTIVITIES AT THE DAWN OF THE NEOLITHIC - USE WEAR AND RESIDUE ANALYSES ON STONE PLATES FROM THE SITE NEUSTADT LA 156

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Abstract

Within a case study 16 stone plates from the submerged site of Neustadt LA 156 (Schleswig-Holstein, Germany) have been investigated. Neustadt dates to the late Ertebølle/ early Funnel Beaker culture and thus yields information on the transition from the Mesolithic to a Neolithic life way. The exceptionally well-preserved find material has been excavated in a coastal dump of cultural debris. The sandstone and quarzite plates stand out by their smooth and partly heavily soot-blackened surfaces. Nearly all stones have been used in connection with fire, some have been split by heating. Microscopic analyses in low and high resolutions reveal use wear traces from abrasive activities as well as organic residues. Plant remains in the carbon black surfaces may result from food preparation on the fire by cooking, roasting or smoking. FTIR analyses and experiments provide further information on the heating processes of the stones and the associated subsistence and crafting activities. The stone plates from Neustadt give evidence on fire technology, hearth structures and food processing. These parameters are distinctive for the intensified land use systems of the coastal Endmesolithic.

Keywords: Endmesolithic; ground stone tools; hearths; plant residues
HARVESTING CYCLES IN WILD BARLEY FIELDS AND THE IMPLICATION FOR RECONSTRUCTING PRE-AGRICULTURAL HARVESTING STRATEGIES

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Abstract

Lithic sickle blades and cereal harvesting by the Natufians in the final Pleistocene Levant (ca. 15,000–11,600 cal. BP) was a momentous technological breakthrough. Their standardized manufacture and use are a significant milestone concurrent with the rise of the earliest sedentary societies in the Levant. An ongoing project focusing on the analysis of Natufian sickle blades and experimentation in harvesting in natural fields of wild barley, brings new insights that help understand the reason for the appearance of sickle blades with polish characteristic of ripe cereal harvesting, alongside those that were used for harvesting semi-ripe cereals. Of particular interest, we demonstrate that wild barley can be harvested when stems are already yellow dry, right before the dispersal units detach, in a small window of time in the harvesting season. This experiment produced the characteristic ripe cereal harvesting use-wear polish, which in our view provides the explanation to their appearance in a Natufian context, where wild species were harvested. This is also evidence for repeated harvesting cycles in a single season, implying a strategy for maximizing the yields and obtaining surpluses. This is perceived as the earliest evidence for intensification in cereal consumption through a complex harvesting strategy, designed specifically for harvesting wild cereals.

Keywords: Natufian; Levant; sickle blades; harvesting cycles; ripe wild barley; pre-agricultural harvesting strategies
CAST IN STONE: EXPLORING CHANGING FOODWAYS AND GROUND STONE IN EPIPALEOLITHIC-NEOLITHIC SOUTHWEST ASIA

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Abstract

This paper explores the role ground stone tools (GST) played in the foodways of people during the Epipaleolithic-Neolithic transition in Southwest Asia (SWA) by looking at “food processing” ground stone, like querns and mortars, from two sites in eastern Jordan, Shubayqa 1 and 6. GST are operated by individual bodies and their movements (“gestures”) and in addition to being shaped before use GST are continuously shaped through use, these repetitive gestures expressing specific technological choices, and food processing practices, materially in tools. This is a social process where objects and subjects, tools and bodies, human agency and technology, interact and influence each other. However, the role that the body and gestures play in this process is rarely explored in GST use-wear analysis. This paper emphasizes the ways use, maintenance and resulting wear express technological choices taking place through gestures and bodies. It argues that there exists a dependent relationship between the overall tool morphology of GST, wear management and macro- and microscopic wear. By looking at this interplay between tool morphology, the presence and location of specific macro-/microscopic wear traces, and using qualitative naked-eye observations and low-power microscopy, this paper examines not just the traces of intermediate contact materials, but ways of use and the management of progressive wear: the material results of technological practices. This approach, i.e. synthesis of morphological and microscopic use-wear perspectives, allows the analyst to group the diverse GST from the Shubayqa assemblages into larger categories of “processing strategies” illuminating how gestures and tools changed over time: from circular to linear grinding, from mortars to querns to slabs. This is paired with traditional low-power GST use-wear analysis and microbotanical residue analysis to establish what would have been processed with these GST elucidating the complex foodways during the Natufian and early Neolithic in SWA.

Keywords: ground stone tools; Epipaleolithic-Neolithic foodways; technological change; bodies and gestures; artefact biographies
THE OBSIDIAN TOOLKIT FROM ÇATALHÖYÜK – A DIACHRONIC PERSPECTIVE FROM THE EARLY NEOLITHIC TO THE EARLY CHALCOLITHIC (7100-5550 CAL.BC)

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Abstract

Çatalhöyük is a well-known site in the Near East due to the well preserved remains and its long occupation from the Early Neolithic to the Early Chalcolithic, it was occupied from roughly 7100 to 5550 cal.BC. Throughout the sequence, the lithic industry is mainly composed of obsidian from the Cappadocian sources of Göllü dağ and Nenezi dağ. Chert is especially present in the earlier phases of the Neolithic sequence. The results of the use-wear analysis conducted on samples of the lithic industry from the entire sequence will be presented. This communication offers a synthesis on the activities practiced on site and will compare the material worked from the start of the occupation until its abandonment with a socio-economic perspective. The composition of the toolkit has changed and evolved during the occupation, as well as the relation between the raw material, the form and the function of the tools. It gives us the opportunity to reconstruct social dynamics as the inhabitants have developed several strategies to manage the toolkit efficiently with various objectives during the sequence. During the Early and Middle phases of Çatalhöyük, besides obsidian blades and bladelets, large blanks, especially blades, bifacially shaped are documented. In the Late Neolithic phases, the tool-kit becomes more standardized and composed, quite exclusively, by obsidian blades and bladelets often intentionally fragmented in pieces of small size.

At the end of the occupation, the main concern is to spare as much raw material as possible. The chalcolithic people multiply the used zones per tool, resharpen frequently the edges, and recycle the blanks. Generally, the tools employed are very little retouched, aside from drilling motions the activities performed do not require specific tools or edges. The standardized prismatic bladelets are not produced for a precise function, they are used daily for all the activities.

Keywords: lithics; Near East; toolkit; Neolithic
REPLICATION AND FUNCTIONAL ANALYSIS OF STONE TOOLS FROM THE CAMEL SITE (SAUDI ARABIA)

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Abstract

The Camel site is located in the north of Saudi Arabia in the province of al- Jawf and is characterized by three decaying sandstone hillocks on which ancient craftsmen have carved high and bas-reliefs depicting camels and equids of life-size stature dating possibly to the Late Neolithic (Guagnin et al. 2021). In 2019, an international team of specialists conducted excavations and surveyed the immediate vicinity of the sandstone formation as well as documenting the engravings/reliefs. Survey in the central area of the site identified clusters of flakes and knapping debris in the lower areas between the sandstone spurs as well as larger silcrete tools directly underneath the animal reliefs. Some of these tools presented abraded edges, possibly from prolonged contact with the soft and abrasive sandstone that constitutes the rock spurs. To test this hypothesis and in order to have a reference collection for further traceological analysis experiments were performed. Here we will present the results of these exploratory experiments conducted to classify traces from sandstone carving using silcrete tools. We will compare the traces from the experimental sample with the archaeological material in order to address the function of the tools found at the Camel site. The chaine opératoire of the experimental engraving tools, from raw material procurement, tool manufacture and use was conducted on site with locally available materials comparable to the archaeological specimens. Specific experimental variables including how the force was applied, in what direction the movement took place and the orientation of the stone tool during the experiment were also recorded. Three different time intervals were used to perform the activities and understand wear development during use. Macro and microscopic analysis of the experimental collection and of a sample of twelve artefacts was performed in order to assess if the ancient tools where used in the making of the camelid and equid reliefs at the site.

Keywords: traceology; experimental replication; silcrete; sandstone; mineral processing tools

References

TEL TSAF AND THE MYSTERY OF THE MIDDLE CHALCOLITHIC SOCIETY OF THE SOUTHERN LEVANT: TECHNOLOGY OF PAINTED POTTERY WITH A TEL TSAF DECORATIVE STYLE

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Abstract

Tel Tsaf, a large scale Middle Chalcolithic (ca. 5,200–4,700 cal BC) site in the southern Levant is still an enigma due to its size, findings, among which ample evidence for long-distance ties and large-scale storage. One of the characteristics of the site is pottery bearing distinctive decorative style termed the ‘Tel Tsaf decoration style’. These painted motifs that frequently characterized the upper part of mainly delicate vessels, like bowls and small jars, include a bichrome frize. It shows commonly two black, parallel lines and black geometric pattern between them and a combination of two different or the same geometric patterns on white slip. During the renewed project at Tel Tsaf a focused study of the Tel Tsaf decorations bearing shards was initiated, aiming at better understanding the technology of production, application of the paintings and the function of the vessels. This paper focuses on the technology of pottery with the “Tel Tsaf decoration” and a few imported Ubeid shards, probably originated from the northern Levant. Our goal is to establish the ground for functional analysis of the painted Tel Tsaf pottery in order to define its origin, purpose, economic and social organisation and consequently cultural links through time and space. Here we present the preliminary results of the use-wear analysis and systematic collecting of data from the surfaces of the studied objects and profiles, typological analysis and analysis of metrical characteristics of the artefacts.

Keywords: painted pottery; technology; Tel Tsaf; Middle Chalcolithic; Southern Levant
DIVERSITY OF THE USE AND TYPOLOGY OF GRINDING TOOLS AT THE NEOLITHIC SITE OF JIAHU, CHINA

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Abstract

The site of Jiahu in the central plain of China is known for its early rice cultivation 9000 years ago. The preliminary starch analysis implies that the Jiahu grinding tools were used for processing various plants, including rice. This paper presents the use-wear analysis carried out on a sample of seventeen grinding tools from Jiahu, nine of which were previously analyzed for the presence of starch. Use-wear traces associated with processing cereal and wood-like material were identified. This result confirms important evidence of cereal processing in the early Neolithic period. It also reveals the diversity of functions in the grinding tool assemblage. Furthermore, the use-wear distribution indicates that grinding slabs without feet and cylindrical rollers were mainly associated with the processing of cereals while grinding slabs with feet were mainly related to the processing of wood-like material. Quantitative analysis of the starch data also indicates that grinding slabs without feet possess more starch grains than the grinding slabs with feet. Therefore, it is argued that specific types of grinding tools were used for processing specific kinds of material. This study highlights the different roles grinding tools may have played in early farming societies.

Keywords: Neolithic; grinding tools; use-wear; starch grains; tool function
PLANT PROCESSING AND GROUND STONE EQUIPMENT IN EARLY NEOLITHIC: PHYTOLITH AND USE-WEAR EVIDENCE FROM LA MARMOTTA (ITALY)

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Abstract

We present an integrated spatial, technological, functional and phytolith study from ground stone tools from the early Neolithic site of La Marmotta, located on the shore of a lake of volcanic origin on the present-day Lake Bracciano in the Lazio region, central Italy. The settlement presents an extraordinary preservation of organic material by water-logging, with radiocarbon dates in the early 6th millennium BC. La Marmotta has provided remarkable and diverse basketry and ceramic material, such as decorated pottery vessels, and stone implements including extraordinary well-preserved sickles, in addition to a wide range of macrolithic stone tools, including grinding stones. We conducted integrated spatial, use-wear and phytolith analyses, building up on comparative experimental records, in an effort to gain a better understanding of grinding stone tool use and processing activities. Use-wear results suggest that ground stones were probably involved at different stages of food processing. Phytolith records indicated the nature of the vegetal processed matter, including cereals such as wheat and barley. Furthermore, the size of multicellular phytoliths from tool active surfaces points towards both dehusking and grinding activity, according to experimental datasets obtained through the processing of cereals, including hulled barley and einkorn wheat which dominate the macrobotanical records at the site, along with emmer and free-threshing wheat. These results further point to the value of integrated use-wear and microfossil evidence for tracing plant food processing activity and ground stone use.

Keywords: Neolithic; La Marmotta; ground stones; plant processing; phytoliths; use-wear
The purpose is to determine the resources processed at both sites and to identify if there are trends in the selection of morphological variables for the development of the different activities carried out by the artifacts by applying different statistical tests (Briz 2003). The functional analysis was carried out on over 160 artifacts from the pre-ceramic occupations, following the methodology already used in other lithic assemblages in the study area (Pérez 2017; Álvarez 2003). An Olympus BX52 metallographic microscope with a magnification of 200x was used to record the traces of use.

**Keywords:** use-wear; flake stones; statistical analysis; neotropics; Mexican southeast
TRIANGLES OF EL-GHORAB UNIT: WHAT DID THEY SERVE FOR?

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Abstract

One of the Early Holocene cultures distinguished in the Egyptian Western Desert is El-Ghorab Unit, dated to 10th millennium cal BP. These hunter-gatherer groups lived on the shores of seasonal lakes (playas) typical for the Early and Middle Holocene landscape of that part of Sahara. They manufactured a characteristic lithic assemblages that haven’t been studied so far from microwear perspective, dominated by morphologically distinct triangles, ca. 30-40 mm long and made of a relatively wide blades, ca. 10 mm in width.

This paper presents the results of morphological and functional analysis of El-Ghorab triangles from the site E-16-03 located in Gebel Ramlah/Nabta Playa area where remnants of a few camps were recorded on the northwestern bank of the Gebel Ramlah lake, composed of lithic concentrations dispersed around fireplaces. The function of triangles is discussed taking also into account their considerable size and specific paleobotanical record from the Northwestern Desert.

Keywords: Southwestern Desert of Egypt; Gebel Ramlah; Mesolithic; triangles; functional analysis
ORGANIC RESIDUE ANALYSIS REVEALS THE FUNCTION OF BRONZE AGE METAL DAGGERS

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Abstract

In this paper, we discuss results of organic residue analysis performed on copper-alloy daggers from Bronze Age Pragatto, Italy, c.1550-1250 BC. To the best of our knowledge, this is the first ever successful attempt to extract interpretable organic residues from archaeological copper-alloy tools/weapons. Metal daggers are widespread in Chalcolithic and Bronze Age Europe, yet their social and practical roles are still hotly debated. Are they symbolic or functional objects? Are they tools or weapons? How were they used? For what tasks and on what materials? The paper addresses these questions through the analysis of micro-residues extracted from 8 copper-alloy daggers found in a controlled excavation. The high-magnification method used for dagger analysis has identified residues located on cutting edges including bone, muscle, and tendons. These are interpreted as evidence of prehistoric carcass butchering, skinning, and carving. Further residues were observed on dagger blades and hafting plates or tangs, which are interpreted as remnants of bone handles and plant and animal-fiber sheaths. These readings are validated by original experiments with replica daggers, as presented for the first time in the paper. Overall, the analysis and experiments shed new light on Bronze Age metal daggers, showing that they were fully functional tools (and perhaps tool-weapons) primarily utilized for the processing of animal carcasses.

Keywords: Bronze Age; copper alloys; daggers; organic residue analysis.
MICROWEAR ANALYSIS OF CERAMIC VESSELS FROM THE EARLY IRON AGE SITES OF VIX-MONT LASSOIS AND HEUNEBURG

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Abstract

Within the context of the BEFIM project ("Meanings and Functions of Mediterranean Imports in Early Central Europe", PI Philipp Stockhammer) we were asked to perform a use-wear study of the pottery from the Early Iron Age hillforts of the Heuneburg (Germany) and Vix-Mont Lassois (France). At both sites imported Mediterranean vessels were found, often seen as evidence that the local Celtic elite emulated Mediterranean artefacts, practices and ideas. Additionally, locally produced tableware was present, which matched the craftsmanship of the imported vessels. The project’s research question was whether the imported vessels were used in the same way as in their area of origin. Were perhaps other beverages consumed from them? And what was the role of the highly crafted local pottery?

Apart from our microwear study, Maxime Rageot conducted organic residue analysis (ORA). Although ORA gives direct information about the contents of the vessels, the gestures involved in e. g. food and drink preparation and consumption, cannot be ascertained by residue studies. Our extensive experimental study with making and using ceramic vessels showed that distinct traces developed which could be linked to different stages of the vessel’s biographies. As such the residue and microwear studies perfectly complemented each other.

In this paper we will present the final results and conclusions of the microwear research of the Heuneburg and Vix-Mont Lassois material with special emphasis on the differences in the use of local and imported pottery at both sites. We will also address some of the methodological insights we obtained during our experiments and subsequent analysis, pertaining especially to alcohol consumption and the fermentation of beverages which leave distinct microwear traces.

Keywords: ceramics; imports; use-wear analysis; experiments
BONE AND AMBER ITEMS FROM THE ANTIQUE NECROPOLIS
VOLNA 1

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Abstract

To manufacture tools, household items, weapons and ornaments, the population of the antique states of the Northern Black Sea region used bone and horn, along with stone and wood, as raw materials. This study is devoted to the analysis of products made of bone and amber found in the burials of the ancient necropolis Volna-1 dated VI-IV BC (excavations of the Sochi expedition of the Institute of Archeology of the Russian Academy of Sciences in 2016-2018 in the Taman Peninsula, southwest Russia). 44 bone objects have been studied using traceological analysis. Among the items there are jewelry objects (ring 1, beads 22, pendants 2, and wreath 1), household items (rod-shaped fasteners 2), onlays (inserts) made of bone plates (2) and in the form of tubes (8), tool handles (4), details of musical instruments (2). Methods for processing bone included sawing, cutting, undercutting, drilling, carving, engraving, painting or gilding.

More than three dozen items made of amber have been studied. These are beads and pendants. One of them is of particular interest – a pendant in the form of a stylized image of an animal (bull) head. Traces of manufacturing (grinding, puncturing, drilling) are recorded on its surfaces. On the back side there are two groups of holes. Objects imitating the ears and horns of an animal were inserted into a pair of holes on the lateral surfaces (blind). Pair of others, through holes, was intended for hanging the product on a string. That is, the item was functionally used as a decoration. Agricultural ceremonies and cults were common in the Greek world.

The traceological analysis made it possible, in a number of cases, to quite accurately determine the purpose of miniature items made of bone and amber; and, among other things, to reconstruct the not preserved (wooden) parts of composite items.

Keywords: Northern Black Sea region; antique necropolis; traceological analyses; bone; amber
USE-WEAR AND MICRO-RESIDUE ANALYSIS IN BONE NEEDLES ASSOCIATED WITH TEXTILE WORK DURING THE POSTCLASSIC PERIOD (1100-1521 CE) IN SOUTHERN BASIN OF MEXICO

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Abstract

Among the artifacts frequently used for the manufacture of textile products in the lake communities of the southern basin of Mexico, bone needles of different sizes and morphology have been recovered from archaeological excavation. Although these materials are rarely cited in studies on the daily life of these communities, they are usually associated with other artifacts linked to textile production such as spindles whorls, scrappers and bone shuttles. To determine the specific traceology of these materials and to elucidate the type of fibers used with them, we carried out an analysis based on high magnification microscopy and Scanning Electron Microscope (SEM-EDS). An experimental archeology program was also carried out in order to distinguish between manufacturing traces from those traces resulting from continuous use.

Keywords: use-wear; bone; micro-residues; SEM-EDS; Basin of Mexico
INTERDISCIPLINARY APPROACH TO PAST AND PRESENT FOODWAYS IN SOUTH CASAMANCE (SENEGAL). A USE-WEAR STUDY ON CERAMIC POTS

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Abstract

As part of an international FNS project, a study combining use-wear, chemical and botanical analysis of residues has been conducted on archaeological and ethnologic pottery material from Casamance (Senegal). The main goals are to give in depth observations of past and current food practices in a culture dominated by rice, fish and citrus fruit consumption, as well as to establish strong reference collections for use-wear, chemical and botanical investigations on ceramic assemblages.

143 ethnologic vessels were investigated in the village of Edioungou, and a modern dump site from the same village has been excavated, yielding more than 400 archaeologically complete vases and 2000 sherds. Their combined use-wear observations have permitted the identification of the whole range of function and use of pottery from a domestic site, as well as the specificity of some morphotypes, from grinding tobacco to drinking fermented beverages. While the ethnographic investigation has helped build a strong reference collection, the archaeological study has highlighted some changes in food traditions and practices. The macroscopic approach of use-traces has helped answering questions regarding the diagnostic nature of traces, their formation mechanisms and their temporal aspects.

The result of our study has delivered significant information regarding changes in pottery function –and consequently, foodways–from the beginning of the colonial period to this day in south Senegal.

From a methodological point of view, this interdisciplinary approach demonstrates the potential of archaeological use-wear investigations on ceramic material.

Keywords: pottery; use-wear; foodways; ethnology; archaeology
THEME 2: ACTIVITIES IN SPACE

ORAL PRESENTATIONS
UNDERSTANDING MIDDLE PALAEOLITHIC ASYMMETRIC STONE TOOL DESIGN AND USE: FUNCTIONAL ANALYSIS AND CONTROLLED EXPERIMENTS TO ASSESS NEANDERTHAL TECHNOLOGY

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Abstract

Variability within the Stone Age archaeological record, including temporal and spatial diversification, is exemplified by its lithic technologies. Consequently, research questions centre upon conception, production and use of lithic tools; along with aspects of tool design, functionality and performance. This case study focuses on a Late Middle Palaeolithic asymmetric tool type (Keilmesser or bifacial backed knives) commonly found in Central Europe. Due to their morphology and publicised interpretations as tools in long-term use, Keilmesser offer great potential to address the questions above and adding those of raw material selection, tool maintenance and handling.

Three Keilmesser assemblages from the sites of Balver Höhle, the Buhlen Upper site (both Germany) and La Grotte de Ramioul (Belgium) were analysed. Applying a multiparameter approach, including a functional analysis combined with controlled experiments, common interpretations were tested and evaluated.

The influences of variables such as raw material, edge angle and applied movement (i.e. velocity, acceleration, force) on tool performance were isolated and tested in a series of controlled (second-generation) experiments. Use-wear traces on Keilmesser and corresponding (re-)sharpening spalls were analysed qualitatively and quantitatively for their spatial distribution and intensity.

The combined results show a technology applied in a standardised manner aiming at the production and use of a handheld backed tool with a single active edge. Designed with an edge angle increasing from the distal tip to the proximal base of the tool, the tool’s active edge may have served for different functions. The results of the use-wear analysis appear to support the multifunctionality of these tools. Experiments confirm the suitability of the varying edge angles to perform both cutting and carving movements. In sum, the study demonstrates the importance of systematically employing different methods and scales of analysis in order to achieve a more holistic view on the design of a specific tool type.

Keywords: Quantitative data; micro surface texture analysis; Keilmesser; lithic tool design; traceology
IDENTIFICATION OF KHARANEH IV BONE TOOL USE THROUGH TIP BREAKAGE

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Abstract

The Early-Middle Epipaleolithic site Kharaneh IV, located in the Azraq Basin of eastern Jordan, has a wealth of material culture, including lithics, bone tools, and perforated shells. The plethora of the objects at the site, as well as the variability, suggests that Kharaneh IV may have functioned as an aggregation locale during occupation for hunter-gatherers in the region. In this study, we explore the chaîne opératoire of the pointed bone tools from the site, reconstructing the biographies of these objects, beginning with the choice of raw materials, to their use, and eventual discard. The pointed bone tools from Kharaneh IV analyzed in this study are made from a variety of elements, including the metapodials and ribs of gazelle (Gazella subgutturosa). Building from the raw material, stereo- and reflected-light microscopy was used to identify and interpret the manufacturing and use traces on the bone tools, comparing the traces among the faunal morphological categories. Manufacturing traces include marks from cleaning, splitting, and scraping bones, with evidence of striations, grooves, and polish, while the morphology of the fractures on the bone tool tips was examined to determine tool function. The bone tools were separated into four categories for the analysis which included tools made on distal metapodials, proximal metapodials, ribs, and unidentifiable elements. The use-wear conducted on the bone tools showed that distal metapodials have traces of piercing soft material, whereas the proximal metapodials were used for drilling, ribs for piercing soft materials, and the unidentifiable category of tools had traces related to drilling or piercing. Through reconstructing the chaîne opératoire of pointed bone tools at Kharaneh IV, this research shows that the people of Kharaneh IV were deliberately creating specialized bones tools, designed for specific and predetermined functions.

Keywords: Epipaleolithic; use-wear analysis; tip breakage; bone tools; Jordan
Abstract

Mobility of the Sugikubo Industry population in the Upper Paleolithic Japanese archipelago is discussed based on use-wear analysis. This blade industry, dated to ca. 23,000 yr calBP, was distributed in the northeastern Honshu Island. Notably, very few sites yield evidence of on-site blade production, and almost all lithic artifacts appear to have been transported between sites in the form of retouched tools and unretouched blades. The occurrence of intra-site refitting between burins and burin spalls is significantly low despite the abundance of these items. This suggests that burins were transported from site to site, leaving their removed worn edges behind as burin spalls. Curated technology represented in these practices characterizes the Sugikubo Industry.

Samples from the Uenotaira site Loc. A and Loc. C. were analyzed for use-wear polishes. A distinctive difference in use-wear pattern was found between burins and burin spalls. While burins bear hide working as well as wood working traces, burin spalls bear only hide or possible hide working traces. It suggests that burins with wood working traces were used off-site and brought to these loci.

Lithic artifacts from the Shimohara I and Ijiri A sites were also examined. The sites were known for their inter-site refittings of lithic artifacts, and the former was interpreted as a residential base, and the latter as its task site. This author's use-wear analysis detected hide working traces at the former while possible bone/antler and wood working traces were found at the latter.

From these analyses, it is reasonable to assume that Loc. A and C of the Uenotaira site were residential bases with satellite task sites where burins were used for wood working. The use-wear pattern found on the burins and burin spalls represents logistical mobility of the group who occupied these loci.

**Keywords:** hide polish; wood polish; logistical mobility
PALAEO-BACKPACKS. TRANSPORTING LITHIC TOOLS AND RAW MATERIALS IN THE DOLOMITIC UPLANDS AT THE END OF THE PALAEOLITHIC AND IN THE MESOLITHIC

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Abstract

The ongoing LiMPH project (MSCA-IF n. 886476) is aimed at studying how final Palaeolithic and Mesolithic hunter-gatherer groups exploited mountain areas starting from the rich evidence of the South-Eastern Alps, one of the European sectors with the highest density of sites referable to these periods. For this purpose, the lithic assemblages of some reference sites located along the main valley bottoms and in the Dolomitic uplands are being studied following a traceological approach. Micro-wear traces and residues testify to numerous transformation activities being carried out at the sites, including both vegetal and animal material working. Along with these, consistent evidence regarding the way lithic raw materials were brought to the upland sites and exploited was identified. This kind of wear, although often overlooked, has a high informative potential for understanding raw material management strategies particularly in remote areas such as the Alpine highlands. In this paper, the data yielded by the open-air site of Casera Staulanza (1681 m asl) and by the grave goods associated to the Late Mesolithic burial of Mondeval de Sora (2130 m asl) will be presented. These highlight significant changes in the way lithic raw materials were brought to the same Dolomitic upland sector between the Final Palaeolithic (Early Epigravettian), Early Mesolithic (Sauveterrian) and Late Mesolithic (Castelnovian).

Keywords: Late Palaeolithic; Mesolithic; Alpine uplands; transport wear; lithics
INTERPRETING STRUCTURES: THE SOCIAL DIMENSIONS OF TOOL USING AREAS AT THE EARLY MESOLITHIC SITE OF STAR CARR, UK

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Abstract

This paper will present new microwear results from flint tools found in and around the three structures at Star Carr, an Early Mesolithic site located in North Yorkshire, UK. A combination of spatial and microwear data has provided rich insights at different scales: individual tool use, the use of space within each structure, and patterns of activity across the three structures. The types of tool-use observed has aided interpretations of possible activity areas where materials were processed and objects were produced. Zones of activity within each structure suggests cultural customs and behaviours influenced spatial organisation; the working of some materials was seemingly more spatially restricted than others. Although microwear analysis of flint shows that all three structures evidenced a similar range of contact materials, it is clear that the ways that individuals structured the spaces varied significantly. Through a spatial understanding of tool-using behaviours, more nuanced narratives into the social spaces of Early Mesolithic structures can be created.

Keywords: Mesolithic; flint tools; microwear; activities; structures
UNDERSTANDING THE USE OF FLINT AWLS AT THE MESOLITHIC SITE OF STAR CARR

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Abstract

The form and macroscopic wear of Mesolithic awls has been used to infer function, which has become an aspect of established typologies. However, verification of form/function relationships are needed to ensure typologies are robust. The paper presents the results of GIS and microwear analysis of 59 flint awls excavated from the Early Mesolithic site of Star Carr, UK, in conjunction with results from experimental research on awl use. Results demonstrate that awls were used for a range of activities at Star Carr, reflected in the different worked contact materials identified, including: mineral, wood, bone, and hide. The experimental programme provided important insights into macroscopic tip modification of awls working with different contact materials for varying lengths of time. While rates of tip snapping were found to be high in the Star Carr sample, the experimental data suggests that this is unlikely to be related to use. GIS plots of awl location integrated alongside the microwear results show that the majority of awls tightly cluster to the west of the site, with clusters composed of different contact materials. The combination of microwear, experimental archaeology, and GIS is applicable to other Mesolithic sites and holds potential to expand our knowledge of the spatial structuring of tool-using behaviours. Moreover, combined use of these methods has enabled greater understanding of awl typologies: providing a means to independently assess the relationship between tool morphology and use.

Keywords: Mesolithic; flint awls; microwear; typology; spatial analysis
FIVE MILLIMETRES OF CUTTING EDGE. WHAT FUNCTION FOR THE CHAMFERED PIECES FROM THE CHASSEY CULTURE SITE OF DAURELLE (MONTÉLIMAR, DRÔME, FRANCE): TOOLS ASSOCIATED WITH THE FUNCTIONING OF BURIALS?

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Abstract

Chamfered pieces are tools on bladelets with a distal or proximal transverse cutting edge, resulting from a chamfer blow, followed by an abrupt bilateral retouch. Although these tools are considered characteristic and even emblematic of the Late Chassey culture of southern France (~3950-3700 BCE), their function has never yet been defined. It must be said that when they are present in the assemblages they are, most of the time, isolated elements or represented by only a few individuals. The discovery and excavation of the Daurelle site (Montélimar, Drôme, France), which has produced a set of unpublished chamfers, offers, for the first time, the opportunity to learn a little more about this enigmatic tool. The functional analysis of these chamfered pieces is part of the study of the large Chassey culture sites in the Rhone Valley, some of which were undoubtedly organized around sepulchral and ritual functions and located in the heart of territories in which pastoralism played a predominant role. At Daurelle, the chamfered pieces were discovered in pits surrounding two neighbouring pits that contained the remains of two children and an adult. This corpus of chamfers (n = 23), the most abundant in the entire Southern Chassey culture, thus allows us to question the function of these tools. The functional analysis of these tools leads to the hypothesis that they were used for delicate and precise operations, probably on human or animal bodies. These tools could have played a role in complex funeral rites.

Keywords: Chasséey culture; chamfered pieces; funeral rites
WORKING AT HOME. RECONSTRUCTING ACTIVITIES WITHIN LBK HOUSEHOLD THROUGH THE SYSTEMIC USE-WEAR ANALYSIS OF FLINT INDUSTRIES, BONE AND ANTLER TOOLS AND GROUND STONE TOOLS

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Abstract

Rarely performed on early Neolithic sites from continental Europe, systemic use-wear analysis on flaked, as well as ground stone and bone tools, is a powerful mean to identify possible economic differences. Within the frame of the ongoing HOMES project, we explore the importance and nature of acquisition strategies (hunting, harvesting), food preparation techniques (butchery, cereal grinding) and other resources transformation (vegetal fibers) on a large series of LBK households within the Aisne valley (France). After reexamination and integration of new results on flint industries (366 tools), bone and antler tools (30 tools) and ground stone tools (100 tools), the aim is here to test whether working soft siliceous plants, hide and wood keeps the dominant activity, and how it co-exists with more marginal activities such as working soft mineral matter and textile fibers. The lack of certain activities will be questioned in relation to their location both within and outside the domestic and village space. Discrete functional traits will be tracked to improve our understanding of observed variations between domestic units: segmentation of production sequences, differences in the use of each type of blanks, intensity of use. This will allow us test the hypothesis of autonomous or interdependent households in terms of production and consumption, and investigate the economic structure of Lbk villagers.

Keywords: Early Neolithic; domestic unit; use-wear analysis; flint industries; bone and antler tools; ground stone tools
SETTLING THE ARGUMENT: THE CONTRIBUTION OF USE-WEAR STUDIES TO UNDERSTANDING SETTLEMENT IN NEOLITHIC BRITAINS

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Abstract

The Neolithic of southern Britain is understood primarily through monumental landscapes such as those around Stonehenge and Avebury. The remains of domestic structures dating to the Neolithic are rare, and when found, are often associated with only small assemblages of material culture. The most common forms of settlement evidence are unstratified artefact scatters, and isolated or clustered assemblages of pits, both of which have little evidence of associated structural remains. Our understanding of Neolithic settlement is therefore poor. We have limited knowledge of what craft and subsistence activities were associated with them, and we do not know how quotidian practices were organised at a settlement or landscape level.

One issue that may have exacerbated this problem is the lack of application of use-wear analysis to material from Neolithic settlement contexts in Britain. This talk will critically examine the role that use-wear analysis can play in addressing the deficiencies in our understanding. It will present the use-wear evidence from a range of settlement contexts, assessing the extent to which the application of use-wear analysis may help to highlight regional or chronological variability in Neolithic settlement practices. It is hoped that this contribution will build the foundations for use-wear analysis to become a routine tool in settlement studies in Britain.

Keywords: Neolithic; settlement studies; artefact scatters; pits; craft activities
VISUALIZING DOMESTIC CRAFTS AND MOBILITY: NEOLITHIC LIFE IN THE WETLANDS OF THE RHINE/MEUSE DELTA

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Abstract

Microwear analysis allows us to obtain information on hidden aspects of daily life, especially regarding the role of organic materials in past technological systems. However, our inferences are usually rather general like “scraping hide” or “carving bone”. In a scientific report such statements are perfectly acceptable, but when working in a public, educational context like an open air center, our visitors want more detail. In a new interdisciplinary project (www.puttinglife.com) we are entering into a continuing dialogue with, among others, microwear analysts, botanists, wood workers and other craft specialists, in order to bring more detail into our image of daily life in the Rhine/Meuse delta during the Late Neolithic: how did the inhabitants move around the landscape, what did their houses and yards look like? We closely collaborate with the volunteers of the Educational Open Air Archaeological center of Masamuda.

Departing from our various expertise we put forward questions many of us never posed ourselves before and which have led to more relevant experiments and to new insights about the analysis of the archaeological materials. Our dialogue, the data from experiments, the microwear studies and the other material research, as well as the “practical knowledge” of our team members, form the basis for the paintings our artist makes for the general public. In this paper I will show the first two of such visualizations of the results of our project. The first painting focuses on the organization in space and time of making a dug-out canoe, the second on ceramic vessels and the different tools involved in respectively making and repairing them. I will illustrate the importance of experiments and microwear analysis for our artists’ detailed depictions of past daily life, which, in turn, evoke comments and suggestions from the general public.

Keywords: microwear; experiment; practical knowledge; domestic craft; dug-out canoe
MICRO-WEAR ANALYSES AND RESIDENTIAL MOBILITY, USE-WEAR ANALYSES ON VLAARDINGEN CULTURE (3400-2500 BC)

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Abstract

The Vlaardingen Culture (3400-2500 BC) is a regional Neolithic group located in the wetlands of the western Netherlands. Vlaardingen settlements are located in different landscape zones, notably on coastal dune ridges, river dunes and levee's. It is thought that the levee sites were of a temporary nature while the coastal dune sites were permanently settled. This model implies that we would expect that the levee sites are more specialised focusing on the exploitation of specific (wild) resources while the coastal dune sites will be characterised by a wider range of (craft) activities.

As part of the project Putting Life into Neolithic Houses the author is studying the flint assemblages from sites in these different landscape zones. Micro-wear analyses will be an important part of this as this can help determine which craft activities were carried out on site. In terms of formal tools these sites mostly yielded flint scrapers. The working hypothesis we propose is that temporary exploitation camps will yield more fresh hide scrapers as they are used for the initial stages of hide-working while we expect that more advanced stages such as dehairing will mainly take place in the permanent settlements on the coastal dunes.

In contrast to earlier periods the flint assemblages from the Vlaardingen Culture hardly yield any formal tool types. Besides a few axes, arrowheads, scrapers and borers the assemblages mostly consist of unretouched flakes (blades are virtually absent). Previous studies have already indicated that these unretouched flakes play an important role in craft activities such as bone working and wood working. In addition to conducting micro-wear analyses on formal tools we are also studying these unretouched flakes in order to better assess which craft activities took place on these settlements and to see how this differed across the different landscape zones.

Keywords: Flint; micro-wear analyses; scrapers; residential mobility; Neolithic
THE MONUMENTAL WALL IN LEVEL VI B2 OF ARSLANTEPE (MALATYA, TURKEY): UNION OR DIVISION ELEMENT OF THE VILLAGE? THE CONTRIBUTION OF USE-WEAR ANALYSIS OF MACRO-LITHIC TOOLS AND CHIPPED STONE TOOLS

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Abstract

This contribution focuses on the use of space within the level VI B2 of the site of Arslantepe (2900-2750 Cal BC). The level discussed relates to a Near-East Early Bronze Age farmer’s village (Eastern Anatolia, Turkey), with no apparent internal hierarchy, developed on the exterior of a monumental wall with stone bases and mud brick elevation. The wall, erected in a phase shortly before the construction of the residential area (early VI B2), may have lost its defensive function in the phase examined here (late VI B2); inside the fortification, a row of single rooms, interpreted as non-domestic spaces, had been placed against the walls. These rooms show construction technique similar to that of the houses and they are in phase with them. The rest of the space inside the wall remained substantially empty. The rooms contained various raw materials and equipment that would suggest both storage places and places where activities were carried out.

The aim of this work is to investigate whether this division suggested by the wall corresponds to a differentiation of activities or production processes carried out in the area beyond the walls compared to the rest of the village. Through the use-wear analysis of macro-lithic tools and chipped stone tools found in the spaces located north of the walls, integrated with other data available from this area, we shed light on the activities carried out in them. Then, the results obtained are compared with the data obtained from multidisciplinary research still in progress throughout the level VI B2 to identify similarities or differences in the type of activities carried out between the two parts of the village.

Keywords: Early Bronze Age; Use of Space; Use-Wear Analysis; Macro-Lithic Tools; Chipped Stone tools
COMPREHENSIVE RESEARCH OF PRODUCTION EQUIPMENT AND INTERPRETATION OF ECONOMIC FEATURES OF ARCHAEOLOGICAL SITES

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Abstract

Comprehensive study of stone tools, including the characterization of raw materials, technical and morphological, experimental and traceological analyzes, determination of organic remains on the working parts of tools, as well as the involvement of the archaeological context, ethnographic observations, data from natural sciences, are widely included in the practice of archaeological research of sites of the Stone Age and Early Metals Epoch. Such a comprehensive analysis of mass materials makes it possible to fully reveal the interpretational capabilities of this archaeological source for solving many particular and general problems related to both cultural and chronological issues, as well as highlighting the main directions of development of technology and characterizing the features of human economic activity at different stages of ancient history. In this regard, the results of the study of materials obtained during the excavations of the Tripolye settlement of Bodaki (northwestern Ukraine, 4th millennium BC), distinguished by a unique abundance of flint products, are of great interest. Technical and morphological analysis revealed the technology of knapping Volhynian flint, aimed at obtaining macroblades - the main blank for most tools. Experimental and traceological studies made it possible to characterize the main types of industries that functioned in the village’s economy: flint processing, agriculture, processing of hides, leather, wood, bone, horn, mineral paint, ceramics, metal processing. These data, with the involvement of the archaeological context and planigraphy, made it possible to determine the places of the initial processing of flint at the sources of raw materials, to localize the location of the flint-processing workshops within the settlement, and to identify a set of tools typical for residential complexes. Based on the above facts, it became possible to establish the status of the settlement of Bodaki as a long-term settlement, the inhabitants of which specialized in the extraction and processing of flint, while the functional analysis of tools, paleobotany data, paleozoology indicate that all the production facilities necessary for life support of its population. In addition, finds related to the industrial cult were also identified. The facts of specialization of the flint processing industry are a common phenomenon for the Eneolithic cultures of Southeast Europe. Thus, similar workshops were found on the territory of the Eneolithic culture of Kodzhadermen-Gumelnitsa-Karanovo VI (Bulgaria), where near the sources of Dobrudzian flint there is a settlement - the Kamenevo workshop. The results of comprehensive studies of such objects indicate the complex organization of the economy of the Eneolithic, in the structure of which there were specialized settlements - workshops, the economy of which was based on the extraction and processing of flint, the manufacture of tools, which were the product of inter-tribal exchange. This work was supported by the Program of Fundamental Scientific Research of the State Academies of Sciences, State Assignment No. FMZF-2022-0012

Keywords: Eneolithic; Southeast Europe; comprehensive study; production equipment; workshop
USE WEAR ANALYSIS AND ACTIVITIES ORGANIZATION AT BAHIA COLORADA SITE, ENGLEFIELD ISLAND, SOUTHERNMOST PATAGONIA

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Abstract

We present the results from use-wear analysis of the lithics and bone artefacts from the Bahia Colorada site, a residential camp of hunter gatherers societies with a specialised maritime lifeway. The camp is located on the southeastern coast of the Englefield Island, in the meridional part of the Otway Sea, southern Patagonia. The excavation (92 m²) showed a single thin anthropic layer, dated in 5765 ± 20 BP (6616-6409 cal BP) on charcoal (Legoupil, 2013) and 5500 ± 40 BP (6308-6633 cal BP) on shells (Legoupil, 1997). Lithic technology includes mainly obsidian artifacts (bifacial and flake tool production), whereas bone technology is represented by harpoon points and multidenticulate points, chisels and retouchers. Use wear analysis was conducted in an exhaustive approach, using according to standard procedures in use-wear analysis (e.g Keeley, 1980) through the naked eye, on a stereomicroscope (8-60x) and on a reflected light microscope (100-400/500x). Interpretation was carried out considering the particularities of the raw materials used and 250 analytical experiments (including obsidian, other igneous rocks, and bone). Results show a variety of worked materials and actions, including wood and plant processing, butchering activities, and other soft elastic materials of animal origin, and, to a lesser extent, bone and mineral working. Special attention is given to wood working activities, due to the importance of wood in the emergence of specialized maritime lifeways. Use wear analysis results are confronted with other lines of evidence at the site and to the artefacts spatial distribution.

Keywords: use wear; obsidian; bone tools; hunter-gatherers societies; maritime lifeway; southern Patagonia
RECONSTRUCTION OF AGRICULTURAL ACTIVITIES ON THE GRAKLIANI HILL (BASED ON THE INTERDISCIPLINARY STUDY OF GRINDING STONES)

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Abstract

The present research aims to determine the role of grinding stones revealed on the archaeological site – Grakliani Gora (Eastern Georgia, Kvemo Kartli Region) in prehistoric farming and the intensity of its usage. For study grinding stones, typological, petrographic, and use-wear analysis were used.

As a result of a typological study of the grinding stones of the Grakliani Hill, we found 10 different types of grinder and 7 – quern which allows us to make suggestions about their diversity and usage. The grinding stones were treated by striking technique. Petrographic analysis showed that the artifacts were mostly made of basalt, however, sandstone and gabbro-diorite items were found as well. All type of raw material source is located nearby the Grakliani Hill.

According to the use-wear analysis, most of the grinding stones have traces of use-wear processing cereal; Besides, wheat (Triticum Aestivum) and millet (Panicum Miliaceum L.) were discovered on the site.

Based on the use-wear analysis of the grinders and querns we decided to classify the materials by the raw material categories and traces of use-wear on them. Using this method surfaces of the basalt grinding stones showed: 1. smoothening; 2. polishing; and 3. Linear traces. The use-wear trace as a smoothening is seen only on the grits of the grinders made on sandstone and gabbro-diorite fine grained rocks.

In addition, the grinder, according to the traces of use – polishing indicates that while working with the hand stones, it was held with both hands.

The understanding archaeological context of the Grakliani Hill rooms, placement of ovens and grinding stones inside the building, the discovery of the grains, typological diversity, variety of the raw material, and the traces of usage of the grinding stones found on the site indicates advanced agriculture.

Keywords: Grakliani Gora; Grinding stones; Typology; Use-wear analysis
GRINDING CEREALS: HOUSEHOLD SOCIOECONOMIC AND SUBSISTENCE VARIATIONS

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Abstract

Ethoarchaeological studies show that groundstone tools and their use are excellent indicators of socioeconomic and subsistence variations.

First, this paper explores how several communities in southern Ethiopia use different types of grinding stones. Depending on their social class, some have technically adjusted their tools (querns and handstones) to use them for milling as well as crushing different cereals. Therefore, in this context, tool design relates to food preparation and socioeconomic standards. The type of cereals and their state (fresh, dry, or roasted) plays a significant role in the process of preparation of a variety of foods; in the way cooking varies within households, and the way handstones and querns are used. Secondly, this paper presents a series of experiments on milling and crushing various types of cereals in different states to gain a better understanding of the usewear associated with this kind of activities.

This new ethnoarchaeological and experimental evidence contributes to a deeper understanding of food processing techniques and functions of stone tools, employed for milling and crushing. It also furthers our knowledge on subsistence and socioeconomic variation among households of agropastoral communities.

Keywords: Ethnoarchaeology; cereals treatment; Chaîne opératoire; experimentation; usewear
THEME 3: ADDRESSING PAST TOOLS-KITS TO RECONSTRUCT SOCIAL DYNAMICS

ORAL PRESENTATIONS
EARLY HOMO SAPIENS BEHAVIOR IN NORTH AFRICA: FUNCTION OF THE MSA STONE TOOLS IN MOROCCO

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Abstract

Recent discoveries have shown that Homo sapiens has Pan-African origin, and North Africa has been an important scenario for the development and expansion its biological and cultural traits. Early manifestations reflecting a complex cognition of Homo sapiens in North Africa are tied to the emergence of the Aterian culture around 150 ka BP. This includes bone and ivory tools, the exploitation of different animal, vegetal and marine resources, as well as the use of pigment and perforated shells for symbolic expressions. Within this cultural repertoire, by focusing on aspects such as ecological adaptations and technological transmission, stone tools represent crucial evidence to infer on the emergence and development of behaviors over time.

The study of the Aterian stone tool industries from different regions in Northern Africa seems to display significant variability and technological flexibility. However, the significance of such variability and organizations still unknown. Functional studies of stone tools will help to better understand techno-economy of the Aterian. Any scope for discussing the Aterian industries is still limited by the paucity of detailed lithic studies related to use-wear analysis. This work will tend to rectify this gap with new functional studies of these contexts which can now be extended back well to MIS 5 or even earlier. In this project, an experimental approach will be adjusted to the use-wear analysis of lithic tools from four key MSA sites in Morocco (Taforalt, Rhafas, Bizmoune and Jorf el Hamam).

This work will shed light on how stone tools were designed and used and how these reflect human behavioral decision-making processes, associated with different environments, including coastal adaptations and landscape resources use. It will also make a significant contribution to the debate of the early Homo sapiens origins and the emergence of the so-called Human complex behavior in Africa.

Keywords: MSA; Aterian; Lithic; Use-wear analysis; Human complex behavior; Early Homo sapiens
A TAILORED PROCEDURE DISENTANGLES THE ELABORATE ACTIVITIES OF THE EARLY UPPER PALEOLITHIC OCCUPANTS OF DZUDZUANA CAVE (CAUCASUS, GEORGIA): A MACRO-LITHIC TOOL PERSPECTIVE

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Abstract

Traceology and residue analysis was carried out on a select number of macro-lithic tools (6) from Dzudzuana Cave (Imereti), located in the southern Caucasus foothills of present-day Georgia. The cave’s stratigraphic sequence attests to the presence of Early Upper Paleolithic industries since 34.5–32.2 ka. The stone tools under investigation were retrieved in Unit D – the oldest – a mudflow deposit, where the pollen recovered suggests warm climatic conditions. The stone tools were roughly washed in the nearby creek, occasionally brushed, and once dried, stored separately in paper bags in the Georgian National Museum.

In this paper we present the various methodologies used to recognize the residues, namely VLM, SEM and SR-FTIR analysis. The use-related biogenic residues (U-RBR) in the form of starch grains, plant tissues, and fibers, retrieved from the active areas of the ground stones, suggest the mechanical transformation of underground and aerial plant storage organs for reduction into chunks or coarse flour for dietary purposes, or to soften fibers for further economic processing (cordage, textile, etc.). The nature of the U-RBR indicates the multifunctional purpose of these tools: for the processing of starchy plants but also their involvement in the knowledge-intensive preparation of plant fibers.

These results are significant in that they provide additional information on the possible diet of the early modern humans that occupied this cave. Furthermore, our data add lines of evidence regarding the use of the macro-lithic tools to process both plant fibers (e.g., Linum usitatissimum) – previously recovered from cave sediments – and other plants from which it is possible to obtain dyes.

Keywords: Early Upper Paleolithic; Macro-lithic tools; Residue analysis; Starch grain analysis; Fibers

References

TOWARDS A REFERENTIAL FRAMEWORK FOR THE IDENTIFICATION OF PROJECTILE POINTS AND PROPULSION MODES

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Abstract

Palaeolithic weapons and hunting practices have fascinated researchers since the beginning of the discipline and many efforts have been invested in tracing these back in time. Insight in projectile technology is indeed highly relevant for understanding broader technological evolutions, subsistence strategies and behavioural variability. However, accurate identification of weapon elements in archaeological assemblages as well as adequate insight into the design and use of weapons has proven difficult and has constituted an important methodological challenge for the field from the start. These difficulties stem from the high number of parameters that intervene in the case of an impact motion and that may affect the formation of fractures on stone points. Moreover, if one aims to not only identify projectile points, but also to approach propulsion modes, the issue becomes even more complex. Resolving this type of challenge necessitates a complete decomposition of the problem and simultaneous work on each of the different aspects. Such a structured approach permits to isolate the key parameters in the impact fracture phenomenon and to understand their interaction, but it needs to be nourished from different disciplines, including experimental archaeology, fracture mechanics, traceology and ballistics. A large-scale experimental program lies at the basis of this type of approach.

We will present how such a large-scale projectile referential framework was gradually build up at TraceoLab trough systematic controlled experimentation and how it serves as a basis for the identification of archaeological projectiles and propulsion modes in combination with data derived from fracture mechanics and ballistics. We discuss how we will further exploit this reference collection in view of an improved understanding of the evolution of projectile technology in the Palaeolithic period.

Keywords: Palaeolithic; stone projectiles; mode of propulsion; ballistics; fracture mechanics
CAN STONE TOOL HAFTING REFLECT UPPER PALAEOLITHIC SOCIAL DYNAMICS? NEW DATA FROM ABRI PATAUD, HOHLE FELS, AND MAISIÈRES-CANAL

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Abstract

Study of stone tool hafting extends the scope of traceological analysis into the reconstruction of composite tools, which aids in assessing the time and resources invested in Palaeolithic technology independently of the level of organic preservation. We present the results of a PhD project that investigated stone tool hafting at three Gravettian and Magdalenian sites located in Western and Central Europe. The data from a functional screening of tens of thousands of stone tools and a detailed use-wear analysis of over 1000 artefacts recovered at the rock shelter Abri Pataud, the cave site Hohle Fels, and the open-air site Maisières-Canal are used to describe and explain variability in lithic tool hafting. Domestic tools are given here particular attention and, in the case of Abri Pataud, studied in parallel with projectile armatures. We attempt to start from the simplest mechanical explanations for the observed patterns and proceed towards more complex ones involving the social organisation of subsistence and other activities. Our analysis demonstrates that while certain patterns, such as the difference in the relative frequency of scraper and burin hafting, are best explained by basic task mechanical requirements and tool use preferences, others, such as the varying frequency of hafted scrapers in different sub-assemblages, seem to require other explanations. We show that scraper hafting likely predates the oldest assemblages analysed here and is applied flexibly according to context. By ruling out explanations related to e.g. lithic raw material economy, we wish to show that the variability may be linked to the differences in the investment in hafted tool technologies, which is likely to have been related to social organisation. Based on these results, we argue that data on stone tool hafting can be valuable to enquiries into the ways in which past technologies were tied to their social contexts.

Keywords: lithic use-wear; hafting; Gravettian; Magdalenian
THE WADI HAMMEH 27 ‘DOUBLE SICKLE’ – AN EXPERIMENTAL ARCHAEOLOGY APPROACH

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Abstract

Placed in the later phase of the Epipaleolithic (13th – 11th millennia BCE), the Natufian cultural complex is believed to represent the first hunter-gatherers who practiced a semi-sedentary lifestyle in the southern Levant. Part and parcel of the Natufian cultural complex is the production of sickle blades used for plant harvesting, characterizing early ventures into agricultural practices. Natufian sickle blades can be found throughout the Levant in most sites associated with the culture, one site, however, stands out. Located in the Jordan Valley, the site of Wadi Hammeh 27 contains an exceptionally large number of mostly complete sickles, most of which are made of bone. It also contains the only known example of a sickle exhibiting two, parallel rows of hafted sickle elements, referred to as a ‘double sickle’ by the sites’ excavators. The nature of this ‘double sickle’ from Wadi Hammeh 27 has been debated among researchers; the sickle elements retrieved from this tool do not seem to exhibit any traces of use-wear, leading researchers to believe this tool was not purely utilitarian in nature but rather symbolic, bearing some form of ritualistic or cultic meaning. The current study is the first to focus on the possible utilitarian aspects of the Wadi Hammeh 27 ‘double sickle’ incorporating experimental archaeology methods and comparative use-wear analysis. In this research, we present preliminary results of our experiments, exploring the potential utilitarian nature of this tool and its possible inferred meaning on the Natufian technology-complex and subsistence strategies.

Keywords: Natufian; Wadi Hammeh 27; traceology; sickle; harvesting
TOGETHER WE GO FURTHER: USE-WEAR ANALYSIS OF LITHIC AND SHELL TOOLS FROM THE MESOLITHIC COASTAL SITES OF EL MAZO AND EL TORAL III

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Abstract

Coastal occupations in the Atlantic European façade during the Holocene show that the exploitation of marine resources is a major issue on the adaptation of human populations to these environments. Good examples of these coastal economies are the Asturian shell-middens (northern Spain), anthropic concentrations of marine detritus on caves and rock-shelters that are related to the habitational areas. Otherwise, the adaptation to the coastal environment of the maritime hunter-fisher-gatherer populations has being long time discussed 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 they 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 this coastal environment, different from terrestrial contexts, or if there is also a cultural foundation associated to the use of 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 lithic and shell toolkit, as proxies of the technical system of these populations.

The Mesolithic sites of El Mazo and El Toral III (separated by 1 km) are two good study cases to approach these questions. We have carry out complementary use-wear analysis on lithic and shell assemblages in order to get a deep understanding of the complementarity of these toolkits.

The results of this study show that the function of the knapped lithics and the shell tools are complementary: both toolkits seems to response to specific worked materials and specific kinematic. Furthermore, this study shows the importance of performing combined use-wear analysis on different raw materials, in order to have an improved vision of the human techniques.

Keywords: Mesolithic; shell-midden; use-wear analysis; shell tools; lithic tools
HIDE-WORKING WITH STONE TOOLS IN THE MESOLITHIC OF WESTERN EUROPE: HISTORICAL PROCESSES AND GEOGRAPHICAL DIVERSITY

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Abstract

Use-wear traces attributed to hide working are probably among the best known in traceology, by their characteristics and their frequency in prehistoric lithic assemblages. In the European Mesolithic, hide working tools are almost always recognised, but in lower proportions compared to the Upper Paleolithic. In general, this tendency limits the possibility of going beyond the simple observation of their presence: placing the results in a technical-economic perspective remains complicated.

Over the last 15 years, our studies have allowed us to identify several hundred lithic tools, retouched or not, used to work hide in Northern France and Belgium. This communication is an opportunity to provide a first synthesis focused on the question of Mesolithic hide-working in Western Europe. Starting with a general overview, we will discuss the place of this activity in the economic systems of this period and the differences compared with the Upper Paleolithic, in a historical perspective. Then, we will detail a few examples that illustrate the diversity of wear traces and lithic tools involved. The continuation of this research opens the possibility, in the future, of identifying various technical traditions in time and space and thus better grasp the complexity of social and cultural dynamics during the Mesolithic.

Keywords: Hide-working; Mesolithic; lithic tools; chronology; cultural traditions
MOVING BEYOND STATUS - NEW RESEARCH EXPLORING THE MEANINGS OF HUNTER-GATHERER GRAVE GOODS FROM NORTH EASTERN EUROPE

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Abstract

In order to reconstruct the life histories of goods placed with the dead, a combination of analytical methods are being applied. Two research projects Stone Dead (AHRC-funded) and ‘AMI’ Animals Make Identities (ERC-funded) are studying the lithic (flaked and ground) and osseous artefacts (teeth ornaments, bone tools etc.) from major hunter-gatherer-fisher burial sites in North Eastern Europe dating to the Mesolithic and Neolithic periods. Here, we present ongoing work which integrates provenancing, technology, experimental and use-wear approaches as a means of exploring the social and symbolic significance of these important objects within past life and death ways.

Keywords: Grave goods; Mesolithic; Neolithic; symbolism; social identity
TOWARDS A DETAILED RECONSTRUCTION OF MESOLITHIC PLANT-RELATED WETLAND ACTIVITIES AT THE LOWER SCHELDT BASIN (BELGIUM) THROUGH SYSTEMIC EXPERIMENTATION, RESIDUE AND USE-WEAR ANALYSIS

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Abstract

The frequent occurrence of similarly looking plant polish on stone tools from several Mesolithic wetland sites from Northwestern Europe (Beugnier and Crombé 2007; Cnuts et al. 2020; Guéret 2013; Guéret et al. 2014; Jensen 1994; Little et al. 2017) has allowed suggesting that plant-related activities played a crucial role for the presence of humans within these wetland landscapes. On these grounds, these sites have generally been considered short-term, seasonal occupations rather than more long-term residential campsites (Crombé and Beugnier 2013). Previous attempts to experimentally reproduce these plant traces were not successful, and the exact nature of these enigmatic plant wear traces has thus remained unknown (Little et al. 2017).

We present the preliminary results of a multidisciplinary functional approach to reproduce plant processing traces as observed on stone tools from the Mesolithic wetland site of Beveren-Schoorhavenweg, located within the Lower Scheldt basin. The approach relies heavily on extensive experimentation in combination with a detailed residue and use-wear analysis and strongly focuses on exploring the relationship between the composition of locally available wetland plants and the development of plant polish. The presence of mineral plant elements and the formation of plant polish are investigated through the systematic employment of scanning electron microscopy and energy-dispersive x-ray spectroscopy analysis.

Keywords: plant processing activities; Mesolithic; use-wear analysis; residues; experimentation

References


EARLY APPEARANCE OF THRESHING SLEDGES IN GREEK NEOLITHIC: A COMBINED TECHNOLOGICAL, TRACEOLOGICAL, AND QUANTITATIVE ASSESSMENT

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Abstract

Threshing boards represent an important innovation in agricultural techniques. It allows processing huge amount of cereals and it has often associated to an increased agricultural production. Their use is attested during the Late Neolithic/Chalcolithic and Early Bronze both in south-western Asia and Europe. In the Mediterranean area, their use lasted until few decades ago. Recently, as part of project focused on the analysis of the early agricultural tools of Neolithic Greece, a few elements bearing macro- and microscopic use-wear traces similar to ethnographic and archaeological threshing sledges have been identified from a number of Early and Middle Neolithic sites. In this communication, we present the result of their study, including raw-material, technological, and traceological analysis. In order to provide a stronger assessment of the nature of the observed use-wear traces a quantitative comparison with ethnographic and experimental use-wear traces is carried out by integrating confocal microscopy. Despite the low number of recorded artifacts, obtained results suggest that threshing boards were in use since early phases of the Neolithic in Greece.

Keywords: Neolithic; Farming; Greece; Threshing sledges
BEYOND HUNTING? THE USE OF ARROWHEADS AT THE PRE-POTTERY NEOLITHIC KHARAYSIN (JORDAN) IN THE CONTEXT OF TOOL RECYCLING IN THE LEVANT

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Abstract

Arrowheads are the most remarkable formal tool types in the Levantine Pre-Pottery Neolithic (PPN), whose study significantly contributed to the recognition of hunting practices in line with the primary zooarchaeological evidence. Previous use-wear analyses on the arrowheads and projectile points from the Pre-Pottery Neolithic in the Northern Levant (Tell Mureybet, Tell Halula) demonstrated re-use and recycling of these kind of tools in favour of other activities related to cutting, scraping, sawing and drilling. This trend was identified in the PPNA assemblages, while it seems to have been even more common during the PPNB in the 9th mill. BC in relation to the intensification of bidirectional blade production.

This paper introduces the assemblage of arrowheads from the PPNB levels of Kharaysin, located in the Zarqa Valley in Jordan, to investigate the tool function through macro- and microscopic observations and standard use-wear analyses involving the examinations of impact stigmata and other use traces. Newly obtained data will be used to compare this Southern Levantine dataset with the evidence from the Northern Levant, in particular with Dja’de el-Mughara, in order to inspect whether similar practices in the use of projectiles are encountered in both regions.

This study is an attempt to address issues concerning the primary and secondary use of “hunting tools” and their implications on socio-economic strategies during the PPN period. The outcomes of this talk regard the very first results of the ARROWFUNC project, a new research framework designed to study hunting at the onset of farming in SW Asia, where major economic, cultural and symbolic changes decisively reshaped lithic toolkits.

Keywords: Use-Wear; Arrowheads; Hunting; Pre-Pottery Neolithic; Levant
MANUFACTURING AND DECORATING CARDIAL POTTERY? SHELL TOOLS IN THE NEOLITHIC SITE OF CABECICOS NEGROS (VERA, ALMERÍA, SPAIN)

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Abstract

The traditional studies of pottery production based on typological and morphometric classifications have changed in favor of new ways of approaching for the knowledge of pottery production, one of them consists of the analysis of the technological equipment necessary to develop this activity. In this line, research on the use of shells as instruments is a subject that, although traditionally had no place in archaeological research, is currently in a state of development. In this work, the methodology of functional analysis has been applied to study the archaeomalacological material from the Neolithic site of Cabecicos Negros (Vera, Almería). This analysis has been completed with the development of an experimental program composed of two analytical and one prospective experimentation, carried out in order to provide new data about the cardial decorative technique and define the use-wear traces that appear on the active area of the shells after their technological use. The results obtained in this investigation show the use of shells to carry out different stages of the site’s pottery production. These have been, on the one hand, the modeling and regularization phase of the ceramic surface, and, also, the cardial decorative phase. In this way, through this work, it has been possible to know that the human groups who inhabited the archaeological site of Cabecicos Negros were producing pottery during their Neolithic occupation aimed for domestic consumption. Besides, new data has been provided on the technical process linked to cardial-type ceramic decoration, which has finally generated new hypotheses about the social and/or sexual organization related to the development of these activities in Cabecicos Negros site.

Keywords: use-wear analysis; pottery production; cardial decoration; Neolithic; Andalusia; Spain
DIFFERENT TOOLS FOR THE SAME FUNCTIONALITY. 
CHALCOLITHIC CASE STUDIES FROM THE LOWER DANUBE

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Abstract

In most Chalcolithic archaeological assemblages (fifth millennium cal BC) at the Lower Danube, three types of artifacts appear constantly: spatulas made from cattle ribs, abraded caprine astragalus and Unio sp. valves with traces of use. These are very different types of items, both as a raw material and degree of its processing. Thus, while spatulas were obtained by radical transformations of ribs, the astragali suffered only moderate changes (thus allowing for the identification of bone type and species) and the valves suffered no technological changes of their natural morphology. The main purpose of our analysis was to initiate a database of the way these tools were obtained technologically and how use-wear develops during their use. For this purpose, an experimental programme has been developed that allows for the recording of all details: means of gathering the raw material, time recorded for each operation, and processed materials. The experimental pieces obtained were used in different situations. The pattern of the use-wear development, including the frequency and distribution of polish micro-topography, the functional striations and the presence of worn surfaces were systematically analysed. The observations made on the archaeological specimens were compared to those on the experimental replicas. The final conclusion suggests such tools were employed during different stages of pottery manufacturing.

Keywords: Chalcolithic; Lower Danube; raw materials; experimental replicas; functional analysis

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ASSEMBLING TRACES AND PROCESSES: UNDERSTANDING EARLY BRONZE AGE METALWORKING THROUGH THE MICROWEAR ANALYSIS OF STONE TOOLS

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Abstract

The emergence and development of metallurgy is seen as an important stage in the technological development of Early Bronze Age societies. More commonly, research on metalworking has addressed questions about the chemical composition of metal objects, the sourcing, and the circulation of metals. Despite this, our knowledge of early metalworking is limited and we are still lacking an understanding of how metalworking activities were organised, the nature of the toolkit employed, and the associated processes. As part of the Beyond the Three Age System research project at the University of Leicester, UK, we have carried out microwear analysis on stone materials from a series of Early Bronze Age sites in southern England. These include Beaker-associated structures of temporary occupation, pit depositions and Early Bronze burials. The microwear analysis suggests the use of stone toolkits for the working of different type of metals and the finishing of metal artefacts including those made from gold. Variations in the size and morphology of the analysed stone tools, and the observed microwear traces suggest that these tools played a key role at different stages of the chaîne opératoire of metal object production. The identification of metal residues on the surfaces of stone tools using microwear analysis was further investigated by non-destructive compositional analysis using a scanning electron microscope (SEM-EDS) and pXRF. The analysis offers significant insights into the organization of different types of metalworking activities during the Early Bronze Age period in England and opens up new methodological avenues for the identification of early metalworking sites, the presence of which remains rather elusive in the archaeological record.

Keywords: Metalworking; stone toolkits; gold; microwear; residue analysis
SAME BUT DIFFERENT – A COMPARISON OF SOFT-STONE VESSEL PRODUCTION AT THE AREA OF AL-MUDHAIBI AND SHOKUR, SULTANATE OF OMAN

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Abstract

Vessels made of soft-stone such as chlorite or steatite, along with ceramic objects, constitute one of the largest artifact groups on the Oman peninsula from the Early Bronze Age (3000-2000 B.C.) to the Iron Age (1000-600 B.C.). In the past, the soft-stone vessel research of the Oman peninsula focuses mainly on stylistic, typological, and chronological aspects, whereas analysis regarding production techniques and processes is lacking. This deficit limits the understanding of this prominent group of finds. A detailed analysis of the applied production techniques and tools used in the manufacturing of these objects can offer significant insight into innovation, changes, the degree of specialization amongst craftsperson, and social and socioeconomic structures. This paper will present some results of an ongoing Ph.D. project, which includes a detailed microscopic study, especially evaluating tool mark traces visible in areas of decorations. Every tool trace is documented and recorded in different magnifications. Subsequently, the results of experimental tests with various reconstructed tools and materials such as copper, bronze, bone, flint, and wood are compared to the original traces. This process is repeated with all supposed production techniques to validate or eliminate assumed tools and methods.

The focus will be on Iron Age material found during the Al-Mudhaibi Regional Survey in Central Oman and from excavations in Shokur in Northern Oman. The goal is to compare the regions regarding differences and similarities in tools, production techniques, and degree of specialization.

Keywords: Soft-stone; Arabian Peninsula; Iron Age; tool traces; specialization
IDENTIFYING THE USE OF PLANTS IN PREHISTORIC SOUTHEAST ASIA THROUGH USE-WEAR ANALYSES. WHERE DO WE STAND?

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Abstract

For a few decades now, several researchers have reported use-wear and residues resulting from plant processing observed on lithic artefacts from Southeast Asia. It is crucial to be able to find the origin of these traces (e.g. what activities? what plants?) to broaden our knowledge of prehistoric adaptation to tropical environments: what was the botanical knowledge of people at the end of the Pleistocene and how did it evolve through time? What has been the influence of the rainforest on the material culture? Was there a bamboo or a lignic toolkit as many authors have suggested and what was its importance? In this paper, we will review the attempts made to understand plant related use-wear on Southeast Asian material and will present the results of our own methodological investigations of the question, combining qualitative and quantitative functional analyses, using a series of microscopes: optical stereo- and metallographic, digital (HIROX), SEM, and more recently confocal. Is it possible to reach a precise level of diagnosis and to unravel the entangled vegetal cover of the rainforest made of bamboo, palms, giant trees, ferns and vines?

Keywords: Southeast Asia; plants; quantification: Late Pleistocene
IDENTITIES, SOCIAL INTERACTIONS AND KNOWLEDGE TRANSMISSION IN THE UTTERMOST TIP OF SOUTH AMERICA: A USE–WEAR APPROACH

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Abstract

The study of human interactions, the production of social identity, and cultural transmission have been prominent topics in archaeological agenda. Within these lines of research, technology has played a prominent role to make inferences about past dynamics, linking the material world with social processes. Nevertheless, the analysis of the context of use of lithic and bone tools, generally receives scant attention to tackle these issues, in spite of its importance in the process of human socialisation.

The aim of this presentation is to identify social interaction networks and to explore the process of knowledge transmission focusing on the context of use of lithic tools.

Isla Grande de Tierra del Fuego and the rest of Fuegian Archipelago, located at the uttermost tip of South America, provide an interesting case study to accomplish this aim. This region was inhabited by different hunter-gatherer groups who occupied diverse landscapes, involving coastal and inland areas with specific ecological features.

Differences and similarities have been detected in the archaeological record of the region. Regarding technology, the circulation of raw materials as well as some artifacts morphologies between distant places revealed, in part, the connections between these hunter-gatherer groups. Likewise, the ethnographic sources acknowledge these relationships, for example, through marriage exchanges.

In order to address these questions we apply different statistical tests and use-wear analysis to lithic assemblages retrieved in the region with a three-fold purpose: to assess significant geographical distribution of technological practices; to compare the circulation of techniques designs and uses with the aim to unveil different rates of transmission between them; and to measure the intensity of the social interaction.

The final goal is to identify technological landscapes and to reveal the role of different technological elements in social interaction.

Keywords: Use-wear; Social networks; Hunter-gatherers; Tierra del Fuego
DOMESTIC, ARTISANAL, AND RITUAL ACTIVITIES IN A CLASSICAL MAYA CITY: FUNCTIONAL ANALYSIS OF FLINT DRILLS AND OBSIDIAN BLADES FROM THE CANCUÉN SITE (AD 650-800, GUATEMALA)

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Abstract

The difficulty in recognizing the activities that took place in Maya cities during the Classic period (250-950 AD) is at the origin of many debates on the nature and functioning of Mesoamerican cities. These activities are rarely identified because of the systematic cleaning of the occupation grounds and the conditions of conservation of perishable objects. To characterize the activities that took place in the spaces uncovered, we carried out a functional analysis of the lithic tools most frequently found during excavations. Our study focused on the site of Cancuén (Department of Petén, Guatemala) which, due to its short chronology, is an ideal case for determining the spatial distribution of the activities that took place there. Our analysis focused on two types of tools: flint drills, rare in the Mayan area but abundant within the Cancuén city, and obsidian blades, one of the most common tools in Mesoamerica. The selected tools for the functional analysis come from several contexts, whether domestic, public, places of artisanal production, but also ritual (burial, ritual deposit) to determine the different status of these objects according to their contexts of use.

The results of the functional analysis, reinforced by the use of reference collection that we built, showed that plant working activities took place throughout the city, whatever the context. Obsidian blades were largely devoted to these activities but were also used in the production of jade objects, while drills were used for a wide variety of tasks. The analysis of tools from ritual contexts has allowed us to assume that their use must also have been in the context of ceremonial activities. This analysis allows us to provide the first elements of understanding of the organization of artisanal, domestic, and ritual activities in the city of Cancuén.

Keywords: Maya city; Lithics tools; Functional analysis; Craft activities; Rituals
INVESTIGATING THE TOOLKIT OF THE EARLY SOCIETIES OF ALASKA. FUNCTIONAL ANALYSIS OF THE SWAN POINT CZ4B LITHIC ASSEMBLAGE

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Abstract

Pressure knapping technique develops ca. 25 ky cal. BP in Far East Asia and excels at producing highly standardised microblades. The adoption of this technology constitutes a major technical change given that until then prehistoric tools were obtained by percussion and were morphologically less homogeneous. This new method named Yubetsu spreads throughout most of Northeast Asia and in Alaska, in areas where the human presence was unknown. Swan Point CZ4b is the earliest evidence of human occupation of Alaska ca. 14 ky cal. BP and yields a microblade component produced with the Yubetsu method. The lithic assemblage is composed of over 11500 artefacts made of basalt, greenish igneous rock, chert, and rhyolite. Through the functional analysis of 632 pieces that represent the raw material variability and the different categories of lithic products, we seek to define the stone toolkit of the early Alaskan societies and to identify the technical purposes for which the Yubestu method was implemented. Results show that the burins on flake were mostly used to scrape hard materials, and that the single endscraper of the site was used to scrape dry hide; both tool types were resharpened. The frequent rounding and shine of the ancient removals of microcores and flakes suggest their transportation to constitute stocks of raw materials. This could be due to long-distance procurement strategies and to the seasonal snow cover that prevents access to raw materials. Microblades were used as knife inserts to cut and scrape varied materials (e.g., dry hide, butchery, soft and semi-hard materials), and probably as projectile inserts. This flexible use of Late Pleistocene pressure microblades is also found in Japan, Korea, Kamchatka, and Eastern Siberia, suggesting that the modes of use of the microblades accompany the diffusion of the Yubestu method and its variants over an immense territory.

Keywords: Alaska; Late Glacial; Pressure knapping; Stone tools; Functional analysis
THEME 4: TRACING SYMBOLS

ORAL PRESENTATIONS
POSSIBILITIES OF A MULTISCALAR APPROACH TO THE FUNCTIONAL STUDY OF THE HOMALOPOMA SANGUINEUM UPPER PALEOLITHIC SHELL BEADS

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Abstract

In recent years, studies focused on the functional analysis of shell ornaments have multiplied, usually using low magnifications. Here we propose an approach to the technological and functional analysis of Paleolithic Homalopoma sanguineum shell beads. This species is key to understanding the ornamental traditions during the Upper Paleolithic in the European Mediterranean façade. This has been considered especially problematic in archaeomalacology for several reasons. First, it is a very rare species in the taphocenosis of the current coasts, so conducting perforation and suspension experiments is logistically difficult. This leaves two unique routes for the acquisition of data: analogous experiments on other seashells (obtaining unreliable results) or directly through the study of archaeological specimens. Secondly, it has been considered almost impossible to successfully perform use-wear analyses using a low-power approach due to the physical characteristics of this species. Lastly, the high reflective capacity of the species’ inner nacreous layer can make its study via optical microscopy difficult. Given these issues, the goal of this study is to compare the advantages and disadvantages of the microscopy equipment conventionally used for use wear analysis. By comparing multiple microscopes’ accuracy in identifying polishing, striation, and micro-chipping patterns, a set of criteria has been generated which can be used not only in analyses of H. sanguineum, but in a wide range of nacreous ornaments.

Keywords: Upper Paleolithic; ornaments; shell beads; multiscalar analysis
TOP-NOTCH BONE IMPLEMENTS: EXPLORING THE TECHNOLOGY AND SYMBOLISM OF INCISED BONES AT THE EPIPALAEOLITHIC SITE, KHARANEH IV (JORDAN)

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Abstract

Hunter-gatherer aggregation and interaction during the Late Pleistocene highlight the complexities of movement and community prior to sedentism. At the Epipalaeolithic site of Kharaneh IV in the Azraq basin of eastern Jordan, there is evidence for intensive occupation across multiple strata with a wide diversity of material culture including quotidian objects like lithics and unique cultural items such as engraved stone ‘art’ and shell beads, indicating that hunter-gatherers returned to this location over thousands of years. Environmental reconstructions show that the area was a lush wetland supporting diverse flora and fauna immediately available to the human inhabitants. While gazelle appear to have been the predominante prey, faunal remains from aurochs, horse, fox, tortoise, hare, and various bird species indicate a diverse diet. Among the faunal remains are a number of enigmatic bone objects, which are found across the Early and Middle Epipalaeolithic occupations (c. 24,000–15,000 cal BP). These modified bone ‘tools’ exhibit series of patterned notches, incised into diverse modified and unmodified skeletal elements from taxa such as gazelle and aurochs. Previous excavations at Kharaneh IV as well as Jiita II and Ohalo II, other Epipalaeolithic sites in southwest Asia, have produced similarly incised bone objects. Earlier Paleolithic deposits in Eurasia and Africa with incised artifacts have been interpreted as hunting tallies, calendars, notation devices, or artistic expression, among other possible uses, however the cultural function of the Epipalaeolithic items is unknown. To further explore the Kharaneh IV bone objects, we present the results of microwear analysis using light-microscopy and confocal microscopy to both image and measure the manufacturing traces used to make the notches. Identifying patterns in notching, we ask whether these objects were notational devices, potentially linked to tracing movements, interactions, or events at the aggregation site of Kharaneh IV, or served other cultural purposes.

Keywords: Epipalaeolithic; incised bone; 3D microscopy; non-utilitarian; traceology
THE ORNAMENTS OF THE EARLY MESOLITHIC INFANT BURIAL OF ARMA VEIRANA (LIGURIA, ITALY): A USE-WEAR AND ARCHAEOTHANATOLOGY APPROACH TO RECONSTRUCTING AN INFANT’S LIFE AND DEATH, AND THE ROLE ORNAMENTS PLAYED IN IT

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Abstract

Personal ornaments are widely viewed as indicators of social identity and personhood, but to understand their use, one must rely on beads discovered in burials, which preserve the position in which they were placed on the body. Here, we present such an analysis of more than 60 perforated shells found in direct association with an Early Mesolithic female infant buried at the site of Arma Veirana (Liguria, Italy). In addition to piece-plotting all artifacts with a total station, we used photogrammetry during the excavation, which produced a 3D model of the burial that includes the precise location of all artifacts and human remains. Here, we combine this 3D model...
with microscopic analyses of the use-wear found on the beads to reconstruct the history of the burial, as well as infer how the beads were worn. The results suggest that the beads were worn by members of the infant’s community for an extended period before adorning the carrier used to transport – and possibly protect – the infant during the 40-50 days of her short life. Characteristics of the burial also suggest that the infant was likely buried in her carrier to avoid reusing the beads that had failed to protect her, as well as to possibly create a lasting connection between the deceased infant and her community.

**Keywords:** personal ornaments; use-wear; archæothanatology; Italy; Early Mesolithic
GROUND STONE ASSEMBLAGE FROM A GRAVE AT HILAZON TACHTIT (LEVANT): A USE-WEAR PERSPECTIVE ON MAKING MEMORIES

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Abstract

The study of burial practices and grave goods offer an invaluable window to past societies organizations, world view and belief. In the Southern Levant, symbolic and social changes associated with the transition from foraging to farming have been especially discussed based on Natufian burials grave goods. Excavations at Hilazon Tachtit have provided important information regarding these issues. Mainly occupied at the end of the Natufian, Hilazon Tachtit attests of the recurrent use of a small cave for burial events, while maintaining long lasting memories of previous inhumations. Detailed analysis of grave goods and reconstitution of ritual events also highlight feasting practices and importantly, suggests the presence of individuals with special status, interpreted as shaman. This paper focuses on the grave of such special individual and reports the retrieved associated ground stone implements. Twelve were intentionally placed in the burial pit, encompassing ad hoc (with no to minimal modifications) and formal tools (with evidence of manufacture), common and more exceptional objects. Use-wear approach is employed in this study to unravel the life history of the artifacts and explore the relationship between tool functions and the burial event, as well as the connection between the tools, the deceased, and the broader community. While several hypotheses have been suggested to explain deposition of ground stone tool in graves in the Natufian (e.g, food offering, grave marker, symbol of passage to afterlife), the use-wear analysis and life history approach of the assemblage from the grave at Hilazon Tachtit offers novel and nuanced interpretations as to how these tools were employed in the making of memories at the site.

Keywords: ground stone tools; burial practices; grave good; use-wear; Natufian
CATCHING THE LIGHT: STUDYING THE POLISHING TECHNIQUES OF THE NEOLITHIC CHALCEDONY BEADS FROM THE LEVANT AND UPPER NUBIA

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Abstract

Since the pioneering experiments of A. Gwinett and L. Gorelick in the 80s to solve enigmatic questions of ancient Mesopotamian and Egyptian lapidary technologies, little works has been dedicated to the study of ancient hard “semi-precious” stone beads (quartz, carnelian, agate, amazonite, obsidian, etc.). Rarer are studies of Neolithic assemblages of the Levant and the Nile Valley that gave rise to the development of beads production by full-time specialized craftsmen long before the early Urban societies. Beyond addressing the artisans’ skills and know-how, technological studies of hardstone beads are fundamental to reassess the techno-symbolic and social systems of the Neolithic communities. However, this task is quite challenging due to the scarcity of clearly identified Neolithic workshops, therefore the analyses are made on final products, the complex biographies of beads, and the lack of experimental referential that require, among other things, skillful experimenters.

Our paper focuses on the polishing stage of chalcedony beads from the Pre-pottery Neolithic Levant and the Middle Neolithic Upper Nubia. This stage, that implies the application of successive techniques (abrasion, polish and luster/shining), is one of the most time-consuming in the chaîne opératoire yet critical for determining the products’ quality(e)s. For this purpose, the method we applied combines optical and confocal microscopy with metrology software. To interpret the results, we applied the same analytical protocol on ethnographic chalcedony beads manufactured in traditional Indian and Yemeni workshops. As the Neolithic beads, the ethnographic ones were knapped prior to their surface treatments. By comparing the archaeological samples with the ethnographic specimens, the aims are to determine if the Neolithic beads have received successive polishing treatments including the luster, and to identify gestures and any potential use of mechanical devices.

Keywords: chalcedony beads; Neolithic; polishing techniques; ethnographic referential; quantitative micro-texture analyses
Abstract

Items of personal adornment are a notable feature of a number of Middle Neolithic (3500-2900 cal. BC) mortuary deposits and burial assemblages in Britain. This is a period which sees the widespread appearance of individual burial practices and personal grave goods in the British Isles, reflecting an increased desire to create identities for the deceased. The variety of local and non-local raw materials including jet, shale, amber, bone, stone, and shell references places both near and far, and highlights the diversity of the social networks through which these objects were obtained. Microscopic analysis has provided evidence for different stringing arrangements, ornament types and extents of wear, revealing diversity in the biographies of individual beads and ornaments. The extensive wear of some components, suggests that beads were circulated within and between social groups, both over long distances and through many generations, as significant heirlooms. The fragmentation of these ornaments also provides evidence of graveside mortuary rites and the importance of these objects in enchaining social relations between the living and the dead. This paper explores the role beads and ornaments played in Middle Neolithic society and what they can tell us about the creation of identities within Middle Neolithic communities and the nature of their material engagements with the dead.

Keywords: beads, ornaments; Neolithic; mortuary practices; social relations

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Abstract

Due to specific features of formation and bedding conditions in cultural layer of sites, artifacts made of organic material have remained. According to the traceological results, a separate category of artifacts (20 examples) made of animals bones was identified. These items are small (from 19 to 51 mm in length) sharpened prongs with a worked or not base. Analysis of wear traces on the surface of the prongs showed their functional difference. Thus, traces associated with plant and soft (wool) materials were recorded. Some of the items find analogies in bone artifacts related to fishing. To correctly interpretation the wear marks found on the prongs, the author of the study conducted a series of an experiments on the manufacture and use of bone prongs. The results of the experimental-traceological analysis indicate the presence of special composite tools (combs) for carding plant fibers, wool, which was previously unknown for the material culture of hunter-gatherers of the forest zone of Eastern Europe. This may reflect the penetration of cattle breeding into the region, which correspond with the appearance of GAC and CWC materials and bones of domestic animals in the of settlements.

Keywords: Neolithic; bone; traceology; experiments; wool and plant treatment
A total of 330 fragments of female ceramic figurines were found on the postlinear Neolithic settlement site Těšetice – Sutny. The figurines were manufactured, fired, used and discarded in a narrow span of 4750–4500 BC. They form the largest collection of Neolithic ceramic figurines in central Europe. All figurines were fragmented, and all the fragments in one location were preserved in only two cases. Most fragments do not match any other. Although some of fractures might be caused by post-depositional processes of waste accumulation on the settlement, many of them were intentional. The Koré myth, her violent death and rebirth in cereals is reminded by such a finding situation. The hypothesis of the existence of some kind of socially cohesive activity of re-playing the story and fertilising the fields with fragments of Koré’s body is confronted by ceramic-mass petrography, use-wear and 3D analysis and spatial data of all fragments.

Keywords: ceramic female figurines; Neolithic; intentional destruction; social cohesion
MARBLE FOR BEADS DURING THE COPPER AGE IN ITALY: PRODUCTS AND TECHNIQUES

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Abstract

From the beginning of the Copper Age in Italy we can observe a remarkable production of marble beads. These ornaments were mainly recovered from funerary contexts distributed in the central and northern part of the Peninsula. Through an experimental and traceological approach, our research aims to reconstruct the operational chain for the production of these artefacts and their use as body ornaments as means to investigate their role within the socio-economic structure of the Copper Age in Italy.

Keywords: Chalcolithic; beads; marble; use wear; personal ornaments
THEME 5 : TEETH IN FOCUS

ORAL PRESENTATIONS
BUCCAL DENTAL MICROTEXTURE AND DIETARY SHIFTS IN AFRICAN PLIO-PLEISTOCENE HOMININS

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Abstract

During the middle Pliocene and early Pleistocene, the diversity of local East African ecosystems changed gradually as a response to variable climatic conditions. In this scenario, early hominins had to deal with ecological selective pressures that influenced the evolution of hominin morphology. Gracile and robust australopithecines showed an adaptive shift from diets dominated by soft C3 fruits to more abrasive, brittle, and tough resources. On the other hand, early members of our genus showed smaller teeth, thinner dental enamel and greater occlusal relief than did their Australopithecus ancestors or contemporaries Paranthropus. However, craniodental morphology and dental-microwear have challenged the dietary ecology interpretations. Diet reconstruction through scanning-based buccal dental-microwear has demonstrated a valuable tool for analyzing the highly diversified primates’ diets and interpreting the hominin microwear signal. Now, it is time to move forward using 3D microtexture analysis and exploring their methodological potential. In the present study, for the first time, we have analyzed the buccal microtexture patterns in a large sample of East and South Africa Plio-Pleistocene hominins to test the potential of 37 roughness parameters (ISO/FDIS 25178) to discriminate dietary signals. Microtexture parameters were measured as the median of four independent observations of buccal surface and a stepwise Linear Discriminant Analysis (LDA) of roughness parameters showed that Sal, Sda and Vm parameters significantly discriminate between Australopithecus-P. aethiopicus and H. habilis-H. ergaster, suggesting a shift in the microtexture signal between australopithecines and early Homo. Otherwise, the South African P. robustus showed more buccal-microtexture variance than east African australopithecines, suggesting the incorporation of a wide variety of hard items in their diet. Our findings demonstrate the potential of buccal microtexture to discriminate the ecological niches that hominin occupy during the Plio-Pleistocene transition and emphasize the different pattern of H. ergaster that probably had a different foraging strategy.

Keywords: hominins; buccal microtexture; Plio-Pleistocene; diet; teeth
DIETARY ECOLOGY THROUGH DENTAL WEAR ANALYSIS: INSIGHTS INTO THE ENVIRONMENTAL CONTEXT AT THE ONSET OF THE OLDOWAN IN THE SHUNGURA FORMATION, ETHIOPIA

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Abstract

The Shungura Formation exposed along the Lower Omo Valley yields a nearly continuous faunal and environmental record that spans from ~3.6 Ma to 1Ma. This record provides crucial evidence of environmental and faunal evolution including hominid diversification and new behavioral adaptive skills. The archaeological record indicates a very high density of Oldowan artifacts starting at ~2.3 Ma (basal Member F). Paleoenvironmental studies from the Shungura Formation show a general trend of environmental shift towards more open landscapes. However, local scale studies show ecological variations across space and time within Shungura. This work presents the paleoenvironmental context of the basal deposits of Member F providing the background for the emergence of the Oldowan at Shungura. This part of Member F shows peculiar taxonomic composition, mainly marked by a sudden incursion of alcelaphini at the onset of the Oldowan. The palaeoecological context and the link to the hominin’s behavioral shift during this period is thus crucial. In order to investigate this link, 3D Dental Microwear Textural Analysis (DMTA) were performed coupled with faunal abundance distribution and taphonomic investigations. The DMTA was conducted on five bovid tribes and giraffid from two excavation localities. Standard Scale Sensitive Fractal Analysis (SSFA) parameters were used to detect the dietary traces. The results are being compared to published isotope data from this site and dental wear on modern taxa. The data provides an insight into the importance of landscape scale studies for understanding hominin’s habitat structure during this period in the Lower Omo Valley.

Keywords: DMTA; ecology; taphonomy; Shungura Fm
DENTAL MICROWEAR TEXTURE ANALYSIS OF DEER AND LARGE BOVIDS FROM COMBE GRENAL (DORDOGNE, FRANCE): WHAT DOES IT TELL US ABOUT NEANDERTAL SUBSISTENCE STRATEGIES?

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Abstract

Large bovids and cervids constituted major components of the European Middle Paleolithic faunas, and hence a key resource for hominid populations. In paleoenvironmental reconstructions, red deer (Cervus elaphus) occurrence is considered as a tree-cover indicator while Bovinae (Bison priscus and Bos primigenius) and reindeer (Rangifer tarandus) occurrences are typically associated with open landscapes. However, insights into the ecology of extant ungulate populations attest of the relative ecological plasticity of these species, thus highlighting a reality that is much more complex. Exploring the feeding behavior of extinct ungulates constitutes a key to better apprehend the hunting strategies of past human populations as well as to characterize paleoenvironments and their variations through time.

By reflecting what an animal has eaten during the last few days or weeks of its life, dental microwear textures of herbivores constitute a bridge between a population and its environment. Here we analyzed, via Dental Microwear Texture Analysis (DMTA), the diet of 59 Bos/Bison, 202 R. tarandus and 116 C. elaphus preyed by the Neanderthal populations that occupied Combe Grenal. Spanning MIS 6 to 3, this site is one of the most important Mousterian archaeo-sequences in southwestern France, characterized by an abundance of faunal remains (>12,000 remains) and ample variation in Paleolithic material culture.

Results reveal that grazers and mixed-feeders are the most represented dietary categories for both large bovids and cervids along the sequence. These results shed light on the available resources and the structure of the vegetation in the habitats where these animals have been hunted, thus providing insights into Neanderthal hunting strategies at Combe Grenal during the period covered by this study. These results are discussed and compared with paleoenvironmental inferences already documented in the sequence for hunted prey and Neanderthal productions (lithic industries and pigment use).

Keywords: Middle Paleolithic; ungulate feeding ecology; climate change; paleoenvironments; hunting strategies
WHAT WERE PREHISTORIC COMMUNITIES FROM THE NORTHEAST IBERIAN PENINSULA IN THE EARLY BRONZE AGE EATING? A BUCCAL MICROWEAR ANALYSIS TO APPROACH THE DIETARY HABITS IN PLAÇA DE LA GARDUNYA’S SITE (BARCELONA, SPAIN)

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Abstract

The study of the subsistence economy in the Prehistory of the Barcelona plain has attracted a lot of interest from researchers due to the richness of the archaeological register. By contrast, few Early Bronze Age archaeological sites have been documented. To deepen knowledge into this understudied era, we have conducted a buccal microwear analysis to characterize the dietary habits of the Barcelona plain communities. Molars and premolars from 20 individuals from Plaça de la Gardunya and 1 individual from Mercat de Santa Caterina’s sites have been analyzed using SEM (Scanning Electron Microscope) and its microwear patterns have been compared to reference patterns linked to known dietary habits and subsistence economy strategies. Then, comparisons with other archaeological communities from the Iberian Peninsula and the information from the archaeological register of the Barcelona plain has been taken into account to interpret the dietary habits. The results show differences in dietary habits between age groups and between sexes: males had a more carnivorous diet than females, and subadults ate harder foods than adults. Plaça de la Gardunya’s microwear pattern has similar values to carnivorous diets from anthropological populations. We propose that the community of Plaça de la Gardunya had a soft mixed diet with a high intake of fish, meat and secondary products such as milk or cottage cheese. Agricultural produce was also consumed, mostly by subadult individuals, which was stored in grill plan structures and silos and processed with more refined milling techniques.

Keywords: Dietary habits; Buccal dental microwear; Early Bronze Age; Plaça de la Gardunya; Iberian Peninsula
OCCLUSAL MOLAR MICROWEAR TEXTURE ANALYSIS OF THE PEOPLE FROM INDIAN KNOLL, AN ARCHAIC SHELL MIDDEN (GREEN RIVER, KENTUCKY, USA)

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Abstract

Dental microwear texture analysis has been proved to be a valuable technique for inferring the diet and behavior of fossil and extant taxa. Few studies have documented occlusal microwear of pre-agricultural modern humans. 25 adult individuals from the Indian Knoll shell midden were studied and the results were compared with published data for historic/prehistoric hunter-gatherer populations, aiming to gain insights into the daily life of this prehistoric group.

Indian Knoll (15Oh2) is a well-known shell midden from the late Middle to Late Archaic period (5590 to 4530 cal yr B.P.) along the Green River in Kentucky (USA), where more than 1,000 human burials along with 55,000 artifacts have been recovered. They were hunter-gatherers whose diet was mainly meat-based. They lived near shell middens, and mussels might have been also an important contribution to their diet, at least seasonally. The studied material is curated at the National Museum of Natural History (Smithsonian Institution, Washington DC, USA).

Microwear texture analysis, an automated and repeatable approach to the study of dental microwear in 3D, was performed with the use of scanning confocal profilometry and scale-sensitive fractal analysis at the Department of Anthropology from the University of Arkansas (USA).

The major results of the occlusal molar microwear texture analyses indicate that both females and males had no significant differences on their microwear signatures. In addition, the study reveals that these individuals had microwear variable values comparable to meat-eaters hunter-gatherers, and like that of the Tigara and Andamanese groups for whom ethnographic documents indicate, Indian Knoll individuals had a highly abrasive diet. It is possible that this abrasiveness detected on the Indian Knoll sample could be also reflecting their food preparation techniques, as well as the seasonal consumption of mussels.

Keywords: Diet reconstruction; Archaic period; Shell midden; Confocal profiler; Scale-sensitive fractal analysis
ISO VARIABLES AS A COMPLEMENT TO DMTA VARIABLES IN IN VIVO STUDIES OF HUMAN DENTAL MICROWEAR

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Abstract

The food that people and other animals consume leave microscope traces on teeth, named dental microwear. The analyses of these markings are used to study the diet of past societies. This approach gained popularity following the development of dental microwear texture analyses (DMTA), an automated approach that decreases observer error. However, it is difficult to interpret microwear patterns as we still know little about which foods and processing techniques produce which type of markings. Given the subtle variation within human diets when compared to other species, we need more and better in vivo data on microwear production.

Unfortunately, oral biofilm – a bacterial layer that covers the teeth of living animals – hinders the correct moulding of dental microwear. Here, we show how International Organization for Standardization parameters for surface texture (ISO 25178-2) may complement traditional DMTA variables (e.g., complexity and microwear). In this study, we collected dental impressions from five Kenyan communities: El Molo, Turkana (Kerio), Luhya (Webuye), Luhya (Port Victoria), and Luo (Port Victoria), representing a range of subsistence strategies — fishing, pastoralism, and agriculture. The presence of biofilm constrained the sample to only 38 usable surfaces. But while DMTA variables failed to distinguish between populations, ISO 25178-2 parameters distinguished the El Molo and the Luhya (Port Vict.) from the remaining populations.

Our results suggest that these additional data provide a more complete view of microwear variation and may prove useful when sample size is low due to methodological issues. If dental microwear studies of past societies are to remain relevant, we must improve our understanding of the association between patterns of dental microwear and complex, mixed human diets, and resolve the current pitfalls of the technique. Including ISO 25178-2 offers one way to achieve this goal.

Keywords: ISO 25178-2; dental molding; diet; in vivo microwear studies; Kenya
RECONSTRUCTING THE ECOLOGY OF FOSSIL MEGAHerbivores: The Case of Dental Wear Applied to Proboscideans

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Abstract

The study of fossil proboscidean dietary behavior based on dental wear, particularly dental microwear texture analysis (DMTA), are at an incipient stage. With the goal to observe variations in DMTA values within tooth, within taxa and between different regions, both mesowear and microwear methods were employed. The extent to which these dental wear proxies are efficient in describing the dietary preferences of proboscideans was evaluated. Undescribed fossil elephantids from Chad and Ethiopia, as well as extant specimens, all stored at PALEVOPRIM (university of Poitiers), were used for this study. Taxonomic descriptions based on biometric measurements were conducted. Mesowear angles for both extant and fossil species were measured. A test on mesowear angles between two and three angles show that both methods can be used for the same purpose. DMTA and its application to elephantids were assessed. Identification of wear variations on the enamel bands was conducted for the first time for these taxa. Wear facets revealed no significant differences in microwear among enamel surfaces. Both meso- and microwear showed a clear dietary difference between extant and fossil species. Results indicate predominant browsing for extant species and predominant grazing in fossil taxa.

Keywords: Dietary ecology; DMTA; Mesowear; Proboscidea; Neogene
Abstract

The study of the settlement dynamics and the spatial temporal organization of the human groups during the Middle Palaeolithic has always been a challenging task. A valuable help is offered by the observation of the seasonal organization of the activities and the timing of site occupation, which both document the choice made by Neanderthals about managing the environmental resources.

In this scenario, some valuable methods can be applied to teeth, such as the analysis of carbon and oxygen stable isotopes, the study of tooth eruption and replacement patterns, the dental micro- and mesowear analyses and the cementochronology technique.

With this aim, we applied meso- and microwear analyses to molars from large game exploited by the human groups at De Nadale and San Bernardino Caves, two Middle Paleolithic sites in the North-east of Italy. Focusing on the traces observable on the occlusal surface of the teeth and comparing them with samples of extant ungulates, dental wear analyses gave positive results in defining the extent of site occupation and the season during which the human groups inhabited the two caves.

Moreover, the present study also comprises the application of the cementochronology technique to double-check the dental wear results and to obtain higher resolution data. This combined approach allowed us to overcome possible lack of data caused by the use of a single technique.

The present study also gives significant information about the nature of the anthropogenic deposits themselves, which were characterized as short-term occupation sites.

Keywords: Seasonality; tooth wear analyses; Middle Palaeolithic; settlement dynamics; large-sized game
INVESTIGATING THE EARLY DOMESTICATION PROCESS OF GOAT IN SOUTHERN LEVANT: A NEW CONTRIBUTION THROUGH DENTAL MICROWEAR TEXTURE ANALYSIS

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Abstract

Earliest evidence of animal domestication have been found in the northern Levant and are dated to the middle of the 9th millennium cal BC. In southern Levant, pig, cattle and sheep husbandry was probably introduced from northern Levant by the late 8th cal millennium BC, but concerning goat management, the available data are far from clear.

The southern Levant is being increasingly considered as another presumed primary centre of goat domestication. However, assessing the status of these animals in this region is hampered by the difficulty of morphologically distinguishing domestic goats from their wild relatives. Diet reconstruction is a powerful approach to address this issue since feeding of managed animals is partially controlled by their owners, unlike free-ranging wild populations. For the first time, we propose to contribute to this question through dental microwear texture analysis (DMTA) using confocal microscopy.

At first, we built a reference collection of extant wild (Capra pyrenaica) and domestic (Capra hircus) goats, whose origin, period of death and diet are known. Two groups of domestic goats have been chosen: a first group was fed by fodder. The second lived in the Mediterranean mountains and were raised in an extensive breeding system. Secondly, we identified the more discriminant microwear texture parameters (ISO parameters), that allowed distinguishing between domestic and wild goats.

Finally, we tested these parameters on goats (Capra format aegagrus) from two key Pre-Pottery Neolithic sites in the southern Levant, Tell Qarassa (Syria) and Kharaysin (Jordan), to characterize their paleodiet.

Keywords: Near East; goat; domestication; dental microwear, confocal microscopy
TAPHONOMIC AND DIETARY MARKS IN MICROWEAR STUDIES:
AN EXPERIMENT TO IDENTIFY TRAMPLING ALTERATIONS

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Abstract

Postdepositional damage to fossil remains are of great interest if considering the possible distortion they could produce in the archaeological and paleontological record. These damages are particularly relevant for the dietary reconstructions based on dental microwear which was formed during the lifetime of an animal. The taphonomic processes have the potential to affect microscopic tooth wear and to modify or to obliterate the microwear features. Even though studies about sedimentary transport and chemical erosion caused by digestions and soil acidity have been carried out, the effects of the taphonomic agents involved in the biostratinomic and fossil diagenetic processes are still poorly known.

The aim of this research is to characterise the taphonomic features produced by trampling on the dental surfaces and to differentiate them from the dietary marks. Here, we experimentally investigate for the first time the effect of trampling on the dental occlusal surface. To carry out the experimental series we used sediment from Toll Cave (Moià, Catalonia, NE Iberian Peninsula) and modern teeth collected from a dunghill located in Mecerreyes (Burgos, Castilla y León, N Iberian Peninsula). The latter mainly belongs to 5 species: Equus ferus, Bos taurus, Ovis aries, Sus scrofa and Cervus elaphus. After trampling simulation during 5 and 10 minutes, the teeth were moulded, and the casts were analysed with a stereomicroscope (Zeiss Stemi 2000-C).

This study shows that taphonomic features can be differentiated from dietary marks on the basis of their morphology, orientation, and distribution on the tooth surfaces. The relevance of this study lies in the fact that it helps to avoid analytic bias by discarding remains with significant taphonomic modifications, and thus to improve the validity of dental microwear studies.

Keywords: Taphonomy; microwear; trampling; Toll Cave; experimental archaeology
Dental microwear analysis, initiated in the 1960s, has undergone numerous developments and for several years has been widely used in a variety of settings. Enamel is a very hard and solid material and this method postulates that the majority of the micro-traces present on its surface result from the dietary behaviour of individuals and what they have ingested. However, very little research has been done on the taphonomic alterations that teeth may have undergone and their possible impact on micro-traces. For this reason, we conducted an experiment to evaluate the impacts of sediment abrasion on tooth enamel. We used a tumbling machine in order to reproduce abrasion marks on 57 molars and premolars of Equus sp., Capra hircus and Sus scrofa employing two types of sediments: a mixture of clay and sand sediment with small and rounded particles and a sandy sediments with larger and sub-angular particles. The teeth underwent up to 2 h of tumbling simulation, and casts were made at regular intervals in order to evaluate the evolution of the taphonomic impact over time. As a result of this experiment we were able to determine that the impact of the clay-sand sediment was stronger than that of the more abrasive particles. We also found that different taxa were affected in different ways depending on their tooth morphology and structure. Finally, we were able to identify morphological differences between the traces of dietary origin and those of sedimentary origin. This work illustrates the effects of one type of post-depositional phenomena on dental enamel. Furthermore, it provides data that allows us to distinguish between tumbling striae and dietary striae and underlines the importance of the observer’s expertise in the recognition of these marks.

**Keywords:** Tooth wear; Taphonomy; Tumbling; Sequential experimentation; Mechanical alteration
EXPLORING THE IMPACT OF SOIL INGESTION ON DENTAL MICROWEAR TEXTURES USING A WILD BOAR EXPERIMENTAL MODEL

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Abstract

Dental microwear has been widely used to reconstruct the diet of past mammals. However, understanding the respective impact of exogenous mineral particles on dental wear is an ongoing challenge. Among palaeontologists and evolutionary biologists, this topic is a key issue in the debate on the selective pressures driving dental phenotypes, such as molar hypsodonty in ruminants, molar lengthening in suids or enamel thickening in hominins. Among archaeologists, it can help better understand ancient herd-feeding systems. Particularly, few studies have shown that soil ingestion generates different microwear traces. To fill this gap, this study relies on the first large-scale controlled-food experiment on wild boars (Sus scrofa). It provides the opportunity to investigate the impact of natural soil ingestion over microwear traces by comparing penned wild boars that were able to root with stalled wild boars that were not. Dental microwear textures (DMT) variations were measured on 22 controlled-fed boars kept captive from 6 to 24 months old, either in an indoor stall with no soil ingestion (n=10), or in an outdoor wooded pen (n=12) with rooting behaviors and natural soil ingestion. We conducted particle size distribution analyses on two soil samples. They indicate that the soil is mainly composed of sand (38 %) and silt (43 %), with few clay fractions (19 %), which can be classified as a loam texture. We analyzed shearing and crushing facets of upper and lower first and second molars using two sets of texture parameters. In line with previous works, our results show that the consumption of exogenous abrasives in rooting boars leads to less rough and complex wear surfaces and more anisotropic than in stall-fed boars, even though they received the same diet. Thus, as previously stated, we highly recommend studying DMT when investigating ancient pig husbandry systems, particularly local changes in food management.

Keywords: feeding experiment; grit; dust; tooth wear, husbandry systems
SHARK TEETH AS TOOLS: EXPERIMENTAL AND MICROWEAR ANALYSES

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Abstract

Shark teeth, with evidence of use or not, are commonly found in numerous archaeological contexts in several places in the world. Despite its importance for ancient and traditional coastal groups, only recently the first experimental and microwear analyses were carried out on this material. Fourteen experiments were undertaken to create a variety of microwear types on shark teeth. The experiments included scraping, sawing and barking green wood, scraping and cutting fresh and dry bone, piercing and cutting fresh skin, hide and leather, as well as cutting and scaling fish, and, finally, the use of shark teeth as arrowheads. The methods for each experiment and the resulting microwear analyses are presented here, along with some first-hand observations on the experimental use of shark teeth as tools. Archaeological shark teeth were also analyzed offering a glimpse to the functional, technologic and cultural role of sharks in Brazilian precolonial groups.

Keywords: Microwear; Experimental archaeology; Bone technology; Shark teeth; Brazilian archaeology
THEME 6: NEW ISSUES, BIG METHODOLOGICAL CHALLENGES

ORAL PRESENTATIONS
THE RELEVANCE OF TAPHONOMIC ANALYSIS IN THE FUNCTIONAL STUDY OF THE EARLY OLDOWAN QUARTZ ARTIFACTS FROM THE SHUNGURA FORMATION (LOWER OMO VALLEY, ETHIOPIA)

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Abstract

The function of early Oldowan tools is still a main research question in the field of Early Stone Age in eastern Africa. The rarity of the sites, the preservation of the assemblages and raw materials are limiting factors in the functional study of assemblages older than 2 million years. The archaeological occurrences from the Member F of the Shungura Formation (Lower Omo Valley, Ethiopia) have a precise chronological frame (2.324 ± 0.020 Ma to 2.271 ± 0.041 Ma), a detailed stratigraphy of successive fluvial deposits and artefacts produced mainly from small quartz pebbles that are highly resistant to chemical and mechanical alterations. In order to evaluate the preservation of use-wear, we implemented a multi-scale taphonomic analysis using size sorting, macroscopic and microscopic surface alterations. In addition, post-depositional surface modification experiments on quartz material are scarce. Therefore, fluvial and aeolian experiments were set up to characterized the wear produced by fluvial transport and aeolian abrasion on the ground. The studied archaeological material comprises 1033 artefacts from 12 occurrences and three environmental contexts (floodplain, point bar and channel lag). Despite the good preservation of the lithic assemblage at a macroscopic scale, there is a nuance at a microscopic level and a variability of wear according to the contexts. Understanding the taphonomic alterations on quartz and making a link with the type of deposits lead to a better recognition and interpretation of the use-wear found on the material.

Keywords: quartz; Oldowan; Shungura Formation; taphonomic analysis; use-wear analysis
SHARP EDGES AND DEEP CUTS: USING MICROCT FOR THE MULTISCALAR CHARACTERIZATION OF EDGE CURVATURE ON OLDUVAI GORGE QUARTZITE FLAKES

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Abstract

The angle and shape of lithic tool edges have long been used as a method of inferring prehistoric tool function. However, accurately measuring and characterizing edge angles of lithic tools is notoriously difficult. Studies using goniometers, calipers, or morphometrics often rely on two-dimensional representations of edges. Furthermore, there have been limited attempts to quantitatively document stone tool edges based on surface metrology, most notably edge curvature. In this study, we use microCT to capture models of the complex geometry, or ‘freeform’ surfaces, of experimental quartzite flakes from Olduvai Gorge (Tanzania) to document and mathematically characterize edge geometry using multi-scalar length-scale and curvature analysis. Through this analysis, we also explore the quantification of re-entrant [overhang] features on lithic edge cross-sections. On lithic tools, especially coarse-grained rocks with complex surface topographies such as quartzite, traditional techniques for edge angle measurement are incapable of capturing re-entrant features on edge profiles. Here we present the first archaeological study that addresses the measurement of these re-entrant features, using novel length-scale and curvature analysis methods of calculating edge angles for complex freeform surfaces. With these new methods for measuring edge angles, we can consider the impact of complex geometry, including re-entrant features, on the function of lithic tools in the past.

Keywords: edge angles; microCT; lithics; Olduvai Gorge; quartzite
MULTISCALE SURFACE TEXTURE ANALYSIS FOR EUP MACRO-LITHIC TOOLS

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Abstract

Lithic assemblages, according to their operative chain, are split into two main groups: flaked/chipped industry and macro-lithic tools. The latest define a group of instruments involved in a wide array of functions like hammering, battering, pecking, grinding, pounding, polishing and abrading. Within this broad category, our research is focusing on task-specific tools mainly used to mechanically transform plants organs, through grinding and pounding activities. The test-case are the macro-lithic tools from the Aurignacian site of Brînzeni I, in NW Moldova. To determine the function(s) of these tools, we set up a procedure for surface texture (and residues) analysis – STA2 – based on a sound reference collection, built on the principles of experimental archaeology. The difficulty of acquiring measurable data can bias the results and, therefore, concerns the STEM community. Recent efforts – according to heuristic approach – to achieve quantitative data is minimising the importance of the qualitative approach. On the other hand, the focus on “describing and interpreting” the qualities of a phenomenon, can affect the modalities of data acquisition and data interpretation.

Our experiment set-up integrates numerical and descriptive observations to reproduce the use of macro-lithic tools by considering different variables that can be controlled (1-3) and monitored (4-5):
1) petrographic and morphological characteristic of the raw materials,
2) duration of the experiment, nature and amount of processed materials,
3) standardised procedure for documentation at different scale of magnification,
4) traces localization, intensity and nature,
5) operator(s) physical characteristics and gestures.

Our mixed methodology informed that variations in the development, distribution and quantity of traces are not easily standardized, however REVEALED to be suitable for a diachronic evaluation of the surface modification for each of the involved experimental tools, and also a synchronic comparison of different processed materials.
Keywords: macro-lithic tools; experiment in archaeology; mixed methods; lab controlled experimental collection; surface texture analysis

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GROUND STONE TOOLS FROM THE MIDDLE PALEOLITHIC OF THE LEVANT: HIGH-RESOLUTION AND MULTI-SCALE FUNCTIONAL ANALYSIS

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Abstract

Ground Stone Tools (GST) analysis is a growing topic of research in archaeological studies, contributing key insights to the understanding of some of the most crucial technological processes marking out the evolution of human behavior. As a clear and direct evidence for past human daily tasks, such as percussive activities, these artifacts are a testimony of the oldest, most persistent, and durable technological choices in Prehistory. However, functional approach of GST associated with early hominin occupations are rare and there is also a lack of experimental reference collections for different type of highly used raw materials.

The Middle Paleolithic record of the Levant comprises several sites from which GST have been recovered, showing variability in tool types and raw materials. Here, the predominance of limestone is evident. To better characterize the technological systems of MP populations and deepen our understanding of the design and function of GST, the development of experiments using limestone is essential.

This paper will present three case studies from open-air MP Levantine contexts (Nesher Ramla, Far’ah II and Ein Qashish) where GST were identified and analyzed. Functional studies were applied using a combined high-resolution and multi-scale approach, including 3D analyses and microscopic use-wear analyses. The study was supported by a dedicated experimental program where mechanical experiments were developed to explore use wear formation on limestone tools used by percussion and abrasion, to process organic and inorganic products, namely flint knapping, bone braking and grinding of acorn seeds.

Our study shows that several tools bear diagnostic use-wear that can be associated with diverse activities including percussion, such as flint knapping and bone breaking. Some tools also reveal traces that suggest the presence of grinding motions, where some polish being indicative of the processing of organic materials.

Keywords: ground stone tools; Middle Paleolithic; Levant; use-wear; experiments
MICROSCOPIC ANALYSIS OF ARTEFACTS ASSOCIATED WITH TEXTILE PROCESSING AND TEXTILE PRODUCTION DURING THE EARLY POSTCLASSIC PERIOD IN THE SOUTH OF THE BASIN OF MEXICO

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Abstract

In this study, we showcase the functional analysis of a lithic ensemble recovered from the south of the Basin of Mexico, specifically from the Early Postclassic period (900-1250 AD). These artefacts have been generally described as hoes or mattocks due to the similarity they present with the instruments used for agricultural work. Nonetheless, authors like Parsons & Parsons (1990) suggest, based on ethnographical analogies, their employment as defibrators or pulpers used in textile work for the processing of ixtle (Agave sp.) fibers.

With the objective to corroborate the artefacts probable use in the work process of manufacturing ixtle textiles, several studies were realized to evaluate their functionality, like functional analysis through optical microscopy and scanning electron microscopy (SME_EDS). These analyses were also done on experimental artefacts and the results were used to compare the archaeological pieces.

This methodology implies the identification of microscopic traces on the surface of the archaeological and experimental artefacts, allowing us to differentiate between different raw materials (wood, bone, vegetal, etc.) In our study we used impressions from siloxane polyvinyl (PVS) to sample the archaeological and experimental artefacts, micro samples were also recovered from the surface of the tools and were characterized using SEM-EDS to determine their elemental composition.

The results of this study establish the utility of this type of techniques to evaluate the functionality of the archaeological artefacts beyond their morphological description.

Keywords: use-wear; functional analysis; micro-residues; SEM-EDS; Basin of Mexico
QUANTITATIVE FUNCTIONAL ANALYSIS ON EXPERIMENTAL OBSIDIAN TOOLS: TESTING THE CAPACITY OF USE-WEAR DISCRIMINATION THROUGH CONFOCAL SCANNING MICROSCOPY

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Abstract

Over the last decade, confocal microscopy has been increasingly employed to investigate changes in stone tool surfaces and has proved to be an accurate technique for use-wear quantification. Promising results have been obtained characterising polish formation on both experimental and archaeological flint tools. Recent studies also highlighted the potential of confocal microscopy for the analysis of tools made on reflective materials, such as quartz and quartzite.

In this contribution, we explore the capacity of confocal microscopy to quantitively discriminate use-wear on obsidian tools. The experimental samples used in this study are part of the larger reference ObsiLab collection, hosted at the Laboratory of Sardinian Antiquities and Palaeoethnology in Cagliari (Sardinia, Italy). Experimentally worn areas produced by four contact materials (meat, dry hide, cereals, and wood) were scanned using a Sensofar PLu Neox confocal microscopy, with 20x and 50x objectives, and then processed with surface measurement parameters through metrology software. The analytical protocol will be presented and discussed in order to evaluate the ability of texture parameters to discriminate use-wear surfaces on obsidian tools.

Keywords: confocal microscopy; quantification; obsidian; experimentation
HARVESTING VARIABILITY OF DOMESTIC CEREALS THROUGH TEXTURE ANALYSIS OF SICKLE GLOSS

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Abstract

In previous studies, we have dealt with the variability of harvesting gloss through confocal microscopy and texture analysis at the origins of agriculture in the Near East. We considered that harvesting variability was mainly caused by the different degree of humidity of cereals when reaped, as the transition from wild to domestic cereals implied the progressively riper harvesting of crops. However, an important variability of harvesting gloss can also be observed in contexts in which exploited cereals were fully domesticated. In order to understand this variability, we are carrying out a new set of sequential experiments in which sickles are used for cutting high and low different species of cereals in varied ecological contexts. In this presentation, we will show how these variables affect the characteristics of harvesting traces.

Keywords: sickle gloss; Near East; confocal microscopy
A TRACEOLOGICAL AND QUANTITATIVE ASSESSMENT OF THE FUNCTION OF THE BONE AWLS FROM THE LATE NEOLITHIC OF THE CUEVA DEL TORO (ANTEQUERA, MALAGA)

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Abstract

In this communication we present the results of the experimental and traceological analysis of some of the bone awls from the site of Cueva del Toro (Antequera, Malaga, Spain), proceeding from the Late Neolithic layers dated to the last quarter of the fourth millennium cal BC. The cave is one of the most important Neolithic sites of the southern façade of the Iberian Peninsula with human occupations spanning, basically, from the Early to Late Neolithic. In order to quantitatively approach the use of the archaeological tools, a reference collection of the use-wear traces from different materials and different kinematics have been included: boring hide, scraping wood, scraping pottery, drilling bark, working linen and wool, scraping fish skin, etc. Each experimental tool has been measured with a Sensofar S Neox confocal microscope, and sampled images processed with Mountains@ software. After that, this quantitative reference collection has been used to statistically classify the archaeological tools. Results confirm previous analysis through optical reflected-light microscopy suggesting that the awls from Cueva del Toro were used for textile activities.

Keywords: Neolithic; awls bone tools; experimentation; confocal microscopy
MAKING A GOOD IMPRESSION: TESTING ACCURACY AND DURABILITY OF SURFACE MICROTEXTURE ON MOULD REPLICA
S AND ITS CONTRIBUTION TO THE TRACEOLOGICAL STUDY OF EXPERIMENTAL AND ARCHAEOLOGICAL OBJECTS

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Abstract

To investigate tool use, archaeologists examine the characteristics of use-wear traces left on the tool’s surface after use. Despite the ongoing development of microscopy technologies, archaeologists continue to struggle with various factors confounding analysis of microscopic features of experimental and archaeological objects: these encompass material properties of the samples themselves such as size, topography, and reflectivity of surfaces, and practical considerations such as access to samples, the immobility of analytical equipment or its unsuitability for field experiments. Therefore, researchers often replicate artifact surfaces with dental impression (moulding) materials.

While several studies claim that high-resolution moulds provide an accurate replica of the original surface, others indicate that inaccuracies in the replication of specific surface texture characteristics of certain materials may still pose limitations. As many reference collections also include moulds that researchers might repeatedly analyse, mould durability over time is crucial, though still untested. These questions become even more critical within the field of quantitative artifact microwear analysis, as miniscule alterations may result in large measurement discrepancies. Our study presents and discusses an experiment designed to quantify the accuracy, resolution and durability of mould replicas made from one of the highest-resolution materials (Provil Novo) used in traceology. Moulds were taken from the surfaces of different raw materials (flint, quartzite and bone). Next, they were measured using confocal microscopy and compared against the original surfaces, and subsequently remeasured at pre-defined
intervals over time. Our results corroborate previous observations that objects’ original surface textures can affect the accuracy of mould impressions, but also provide new and positive evidence for the long-term reliability of the moulds. These results have significant implications for the way researchers design sequential experiments, build and manage reference collections, and study archaeological artifacts. Furthermore, we expect our research to contribute to establishing and advancing reproducibility and standardization in the discipline.

*Keywords*: traceology; moulding; surface texture analysis; experiments; standardization
TOWARDS A MODELLING OF PREHISTORIC TECHNICAL GESTURES THROUGH MONITORED CONTROLLED EXPERIMENTATION AND 3D OPTICAL PROFILER

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Abstract

It is a basic tenet of anthropology that gestures are culturally learned and transmitted. In the context of human evolution, they also depend on biomechanics and the degree of motor control, all of which may have differed for pre-modern hominins. Although prehistorians have recognized the importance of reconstructing gesture, such research has been mostly restricted to the gestures involved in manufacturing objects, rather than using them. In particular, use-wear studies of gesture have traditionally been limited to determining the motion performed with tool edges (e.g., transversal, longitudinal). Ethnoarchaeological studies of hide working have shown that certain features of endscraper wear (e.g., the location and extent of wear) differ for different technical processes and gestures. Based on this observation, we present the first results of a research on hide scraping where technical gestures (tool grip, amplitude, direction and speed of the gesture) and contact mechanical parameters (force, torque) were recorded by sensors. Through the decomposition of the parameters involved in hide scraping, the ultimate goal of this research is to establish a precise connection among use-wear traces on the one hand, and hafting type and kinematics on the other hand. Fifty (50) flint end-scrapers were used by two individuals (novice and expert) using five different ethnographically documented gestures (10 stone tools per gesture). The wear was then documented using a 3D optical profiler focusing on the location, type, and orientation of wear along the edges. We show that the gestures associated with different methods differ in terms of force applied, stroke lengths, and other parameters that have a direct impact on
wear traces. Moreover, differences between the novice and expert are also detectable from the sensor data. Two different teams, one in New York, and another in Nice analyzed the samples independently, allowing for a blind test of the results.

Keywords: controlled experiment; hide working; use-wear; ethnoarchaeology; kinematics
MECHANICAL PERFORMANCE TESTS TO EXPLORE THE RESILIENCE OF PREHISTORIC GLUES IN HAFTING

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Abstract

Adhesives are rarely preserved for the Palaeolithic period, but they have been important in current debates on prehistoric technologies. The use of glue and more in particular specific glue mixtures (i.e., resin with ochre) or birch tar, has been used as a proxy to evaluate hominin cognition. Several experiments with glue have been performed, either with regard to glue used in the hafting of stone tools, glue production or glue performance tests. In spite of that, problems remain with regard to the current body of available experimental data and inferences relying on these experiments. We present the results of an experimental study in which a broad range of glues, both protein and vegetal-based, with varying additives were submitted to mechanical bench testing in order to improve our understanding of prehistoric glue use. Glues were tested in combinations directly relevant to prehistoric hafting arrangements in which a mineral and an organic component are joined together in an effective composite arrangement. Use of such tripartite samples allows for a realistic reproduction of hafted tools and a reliable evaluation of their mechanical behaviour under stress. We conclude by highlighting the versatility and effectiveness of each adhesive and substrate combination and by emphasizing the necessity to consider tool use when reflecting on the choice and manufacturing process of glues.

Keywords: adhesives; mechanical testing; experimental archaeology; hafting; composite systems
ROBOTIC ARCHEOLOGY: TESTING THE INFLUENCE OF HUMAN VARIABILITY ON USE-WEAR FORMATION

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Abstract

Use-wear analysis relies on reference collections created via experimentation to identify the use of archeological tools. Traditionally, experiments are performed manually by the experimenters (first-generation experiments). While such experiments are important to identify which factors influence use-wear formation, a mechanistic, cause-effect relationship is out of reach. Conversely, mechanized, highly controlled (second-generation) experiments can resolve such causal relationships but lack the variability typical of human use. However, the way to bridge the two types of experiments to answer archeological questions is still debated.

We designed a series of experiments, from a highly controlled setup characteristic of material testing experiments to human actions, to test the influence of movement variability in use-wear formation. First, we used a material tester (Inotec SMARTTESTER) in a straight uni-directional cutting action. Second, we used a collaborative robot (Universal Robots UR10e) in a similar action. Third, we recorded a manually-guided uni-directional cutting action (human-like, i.e. not perfectly straight) on the robot. Fourth, we introduced variability in linear movement: small random variation in position and force exhaustion. Finally, we performed the cutting action manually.

In order to isolate the effect of the movement itself, force, speed, acceleration, movement length (except for the manual experiment) and number of strokes were kept constant. Additionally, both the tool and the contact material were standardized: the flint tools were cut to a standardized 45° edge angle with a constant surface roughness, and the contact material was synthetic bone plate.

We applied qualitative and quantitative use-wear analysis and tested for the presence of significant differences using Bayesian modelling.
Control via the use of robots is necessary for a mechanistic understanding of use-wear formation. Nevertheless, these experiments demonstrate that “robots” can go beyond highly controlled experiments by incorporating repeatable and/or random (human) variability, filling the existing gap toward actualistic experiments.

**Keywords**: collaborative robot; controlled experiments; human variability; material tester; quantitative use-wear analysis
Abstract

Functional studies have been the subject of continuous methodological advances since the beginnings of the discipline. However, basics such as sample preparation prior to analysis have hardly been discussed. Cleaning usually appears in literature in the form of a short list of used products and sometimes how was performed, but without a clear explanation for the choice of the protocol. Even much of the research does not even include this information. This issue is noteworthy since residues and contaminants present on the surface of artefacts can conceal or even be mistaken for use-wear features, thereby affecting their interpretation. Therefore, the aim of this work is to propose a reliable, effective, and non-destructive cleaning protocol. For this purpose, an extensive bibliographic review of use-wear publications of both lithic and bone materials has been performed. In this task we have been considering which cleaning protocols have been used (if applied) and how to execute them.

Based on these data and those extracted from our own experience as analysts, different experiments have been designed to test the effectiveness and degree of alteration of some cleaning protocols on both archaeological and experimental materials. In addition, the in-depth knowledge of the characteristics of the raw materials to be treated is essential to apply the different cleaning protocols. Given the different nature of these raw materials, the cleaning protocols have had to be adapted. In fact, different experiments have been performed both with bone and with different lithic varieties.

The data obtained are intended to test the effectiveness of cleaning and to create a proposal for a standardized protocol adapted to different raw materials. In this way, we intend to discuss and contribute to solve some of the methodological uncertainties that have created a lack of confidence in the results and interpretations obtained by the functional studies.

Keywords: use-wear; cleaning; lithic; bone; methodological issues
Abstract

The surface treatment of handmade pottery is often considered and described in ceramological studies of prehistoric collections, but it has rarely been approached from a global and experimental perspective. The comprehension of some phases of past productive processes through material remains often requires the creation of references that can guide the identification and characterisation of the actions that generated them. In this sense, experimentation can reconstruct the connections between the archaeological record and past technological processes. It is therefore an excellent way to obtain information about productive activities and the economy of ancient societies, as well as to develop new analytical methodologies at macro- and microscopic levels.

We propose an experimental program about surface treatment on pottery and the used toolkit, where the main variable being explored is the category of tool involved in the fabrication of prehistoric handmade pottery. Therefore, we start from the hypothesis that different tools generate differentiable traces. A catalogue of traces generated by several pottery tools (pebble, flint spatula, pottery spatula, shell spatula, linen rag, grass, leather, etc.) was created, with the aim of characterizing and systematizing them.

The catalogue is composed of visual information and qualitative data about traces and surface appearance. Likewise, to test whether the visual differences observed between the various surface treatments can be quantitatively measured, laser-scanning confocal microscopy (LSCM) has been tested. Laser-scanning confocal microscopy has proved to be an accurate and easy to use technique for surface microtexture measurement.

The potential of the proposed methodology for traceological and textural analysis of surface treatment in ceramics is highlighted. The possibility of discriminating different surface treatment techniques opens new perspectives for the study of prehistoric pottery.

Keywords: traceology; pottery technology; experimentation; toolkit; LSCM
FORMATION AND DEGRADATION PROCESSES OF POTTERY USE-WEAR AND RESIDUES: AN INSIGHT FROM ETHNOGRAPHY AND EXPERIMENTATION

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Abstract

Use-wear analyses of archaeological pottery assemblages have often shown the presence of various use-traces visible in the form of matter deposits (outer soot deposits, inner carbonized residues, etc.) or removals (abrasion, dissolution of tempers, desquamations, etc.). Such use-traces often remain difficult to interpret in terms of pottery content(s), mode(s) of use and use duration/frequency due to the scarcity of interpretative references focused on the function of pottery. In order to fill this gap, we have carried out, within the framework of the SNF Sinergia project “Foodways in West Africa”, a thorough use-wear analysis of 500 ethnographic pottery from Senegal and Mali coupled with that of 20 experimental pottery. The use-traces visible on the surface of these ceramic vessels were systematically examined macroscopically (naked eye) in the field, before the residues trapped in the porous walls of 65 of them were the subject of an accurate microscopic (MO) and molecular (GC-MS) characterization in laboratory. This multi-scalar approach to use-traces of present-day West African pottery (used for boiling fish, boiling rice, roasting peanuts, steaming cereals, frying, storing water, serving palm wine, fermenting millet beer, etc.) has led to a better understanding of the formation and degradation processes of residues and attritions during the use of ceramic vessels. The research has particularly shown that use-traces develop and deteriorate according to various patterns both determined by the use of the ceramic vessels (contents, modes of operation, use lifespan) and the materials used for the manufacture of the pots (type of clays and tempers, type of surface treatments).

Keywords: Pottery; use-wear; West Africa; ethnography; experimentation
WHAT DID WE DO WITH THE METHODOLOGY? SEVERAL REASONS WHY WE MUST RETHINK AND ADAPT THE TRACEOLOGICAL METHODOLOGY TO THE SAMPLE ANALYZED

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Abstract

Functional studies are one of the archaeological disciplines that generated the most debate in favor of scientism in the analysis of material culture. However, much of these debates that took place in the 1980s and 1990s did not end, leaving part of the issues in oblivion. This fact caused methodological gaps that were never fully resolved. In addition, it must be considered that the development of the discipline was developed on high quality flint, and with means that did not allow obtaining the results that can be obtained today. This work aims to discuss the need to rethink and homogenize the methods in use-wear and residue analyses. Some of the basic aspects of the methodology were left unsolved for the enormous time required for analysis. This has caused that on many occasions the use-wear features are described without having an exhaustive knowledge of the raw material itself, which lead to confound natural features or those caused by knapping with functional ones.

In this sense, the sequential approaches, especially when applied to the less frequent materials, are fundamental to understand the wear formation processes. In this sense, it is no less important to choose the appropriate microscope for the characteristics of the material to be analyzed. Choosing an optical, digital, or electronic microscope can be the difference between obtaining satisfactory results or not, since each one offers a different type of information. Definitely, using them in a complementary way reinforces the results. The objective of this communication is to present our methodological proposal that consists of equalizing in importance the processing of samples, the characterization of the raw material, the multi-technical analysis and documentation, as well as the use of dialectically programmed experiments. Taking these 4 aspects of functional analysis into account will allow obtaining much more reliable and verifiable data.

Keywords: use-wear; residue analyses; experimental archaeology; multi-scalar approach; multitechnique approach
THE DEVIL IS IN THE DETAILS: WHY INCREASING TRANSPARENCY ON TOOL BIOGRAPHY, SAMPLING, EXPERIMENT SET-UP AND ANALYTICAL TECHNIQUES IS AS RELEVANT AS THE RESULTS

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Abstract

In S.A. Semenov’s original theoretical approach, Traceology (aka Functional analysis), was intended as the fundamental investigative tool for the understanding of past human behaviours and designed to disclose the technology involved in almost every aspect of the prehistoric human’s material world. Since the early 1960s the oxymoron Prehistoric Technology greatly influenced the development of a cultural ecology perspective (Odell 2004). Technological and analytical instrumentation improvements allow us nowadays to investigate traces of past human activities down to the micro- and even to the nanoscale.

Using Late Pleistocene ground stones and dental calculus as examples, the audience will be driven to a reflection on the discrepancies that occurred when the evaluation of the investigation quality was more focused on results, rather than on the whole procedure leading to data mining. Starting with the archaeological context, the object biography, the conservation modalities, and sampling conditions, these data are key to inform the scientist on the sound analytical methods needed to address the research questions and on how the output dataset is relevant to the questions themselves. This information - quite often “exiled” as considered non-essential, or even absent in many publications – is indeed crucial for a critical evaluation of the results.

According to the Singapore Statement for Research Integrity, the acknowledgment of theoretical frameworks, of significant contributions to the investigation, and of critical analysis' methods represent other essential aspects which contribute to the trustworthiness of research, in order to allow for verification and replication of the analysis by other scholars. Research Integrity principles such as honesty and accountability, or better said, transparency, are needed to help the community to make-up an intelligent and critical reading of the research process.
Keywords: macro-lithic tools; calculus; residues; reproducibility; research integrity

References
POSTERS SESSION
THE MYSTERY OF STONE BATTLE AXES OF THE CORDED WARE CULTURE: THE COMPLEX BIOGRAPHY OF THE AXES FROM BUDZISZÓW WIELKI 2/3, SOUTHWESTERN POLAND

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Abstract

Battle axes are one of characteristic artefacts of the Corded Ware Culture. They were often made of serpentinite, a rock which was obtained at the Ślęża Mountain in the vicinity of Wroclaw in SW Poland. Most of the axes in this region are stray finds, without any context. Despite their meaning as one of the most important artefact of Corded Ware Culture, no detailed research on their production and use was performed. The Budziszów Wielki 2/3 site was discovered in central part of Lower Silesia, southwestern Poland during rescue research conducted by Institute of Archaeology and Ethnology of Polish Academy of Science, Wroclaw Branch, in 2008. In one of pits, presumably a grave (although no skeletal remains were found), researchers discovered an assemblage of four battle axes made of different types of raw material. One of the axes was also found to be ornamented which is extremely rare amongst Polish finds. The aim of my research was to reconstruct complex biographies of the axes in question, starting from raw materials used through the way of production and the use of the artefacts. For this purpose I utilized technological analysis and use wear analyses based on macroscopic and microscopic studies of the battle axes. My project was supported by a programme of experimental research which contained the production and use of battle axes and the comparison of traces. Thanks to this multidimensional approach I was able to gain some fresh data on the way of production and use of the battle axes. Due to these results we can get more precise knowledge of the technological skills of the people of the Corded Ware Culture.

Keywords: Neolithic; Corded Ware Culture; battle axes; use-wear analysis; technological analysis
MICROSCOPIC MANUFACTURING TRACES AND IDENTIFICATION OF THE KNAPPING TECHNIQUES OF BLADES AND MICROBLADES IN THE LGM LITHIC ASSEMBLAGES OF NORTHERN JAPAN

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Abstract

Until recently, various technomorphological indicators have been proposed to identify the knapping techniques applied in lithic production. In particular, the characteristics of the butt (size, angle and presence of a lip), the bulb of percussion (size, presence of scar and undulations) and the longitudinal convexity of stone tools have been regarded as the key to identifying various knapping techniques (direct percussion using hard hammers or soft hammers, indirect percussion and pressure). These indicators have been employed to analyse the knapping techniques in the LGM microblades assemblages of Northeast and East Asia. However, it should be noted that these characteristics only reflect the indirect effect of a certain knapping procedure. Considering that various factors influence its formation, it is necessary to accumulate experimental studies controlling for complex variables. In this paper, I attempt to focus on the microscopic manufacturing traces produced by the direct consequences of contact between the hammers and the stone artefacts. The purpose of this paper is to examine what kind of difference can be found in microscopic manufacturing traces not only in obsidian samples but also in hard shale and chert samples depending on the materials of hammers and the percussion modes. The results of experimental analysis show that the differences in the degree and type of polish spot, percussion circle and striations are more reliable indications of the materials the hammers were made of and the percussion modes. The results of this study will provide useful criteria for the identification of knapping techniques of blades and microblades in the microblade assemblages of Northeast and East Asia.

Keywords: lithic production technology; microscopic manufacturing trace; experimental; knapping technique
FISH PROCESSING ALONG THE NILE. A SHELL TOOL FROM THE MIDDLE KINGDOM OF ELEPHANTINE ISLAND

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Abstract

Fish processing along the Nile. A shell tool from the Middle Kingdom of Elephantine Island. Shells have always been used for multiple purposes, with the animal being used as protein food since Paleolithic times, and the shell used as decoration for jewelry and clothes or as tool to make impressions on uncooked pottery. Grinded shell was also used as degreaser in the manufacturing of pottery from Neolithic time. Besides this very common uses, shells are also frequently used as multifunctional tool to accomplish different activities, the main one of which is scraping. In the Middle Kingdom of Elephantine Island, fresh water fishes from the Nile (Tilapia, Bagrus, Synodontis), were a very important resource. A shell of Aspatharia showed bare-eye signs of use on the longest margin and a dark-greasy residue on the main scars. Use-wear and residues analysis, verified through a targeted experimental activity, suggested that the shell was used to scrape the skin of a fish to eliminate the scales. Ancient contamination of the tool also revealed the presence of cereal starch granules from different species. This paper aims to open a window on the everyday activities carried out in the Middle Kingdom of Elephantine Island.

Keywords: Aspatharia; Clarias; shell; Middle Kingdom; Aswan
TRACEOLOGICAL AND TAPHONOMIC ANALYSIS OF DHOLAVIRA BONE POINTS

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Abstract

Harappan Civilization site of Dholavira in western India has unearthed a rich repertoire of worked bone and ivory artefacts. Unlike their inorganic counterparts, they have not been subjected adequately to in-depth studies, merely being described numerically or typologically in the site’s excavation report. A pilot detailed traceological study was therefore carried out on 8 bone points recovered in varying states of integrity from the castle, bailey, middle and lower town areas of the site. The primary objective was to document and interpret the nature, frequency, location and association of various marks present on them. The literature review at the outset aided in creating an exemplar on existing definitions and descriptions of such marks and whether those of manufacturing can be distinguished from use-wear. Under microscopes (stereo and SEM), 3 points clearly displayed morphology of pre-depositional manufacturing marks like profuse longitudinal scraping and polishing on the curved surfaces attributed to blank preparation either on fresh or semi-fresh bones. Same points also evidenced use-wear such as oblique grinding marks, numerous and closely situated, but on the flattened apical parts. Concentric circles, short and broad gouging marks below the tip and a deep chop mark were also noted. Other marks documented on majority of the points included black staining in patches due to manganese oxide in the surrounding matrix, cortical surface exfoliation, porosity due to waterlogging and recent breakage with chipped edges mimicking micro flake scars, all of which attested to active post-depositional taphonomic agents and their impacts. Encrustation was heavy in 2 points while in the rest, sediments had contributed to obliterating manufacturing or use-wear marks. After integrating the results, no patterns or correlation could be drawn between the tool type, the marks discerned on them and the artefacts’ provenance and context suggesting similar further studies on the rest of the repertoire.

Keywords: Harappan Civilization; Dholavira; bone points; manufacturing marks; use-wear
NEW EXPERIMENTAL INSIGHTS FOR THE TRACEOLOGICAL STUDY OF AMBRONA AND TORRALBA ARCHAELOGICAL SITES

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Abstract

During the last years, one of the most frequently debated issues focuses on the functionality Lower and Middle Paleolithic archaeological sites. The archaeological sites of Ambrona and Torralba are involved in these discussions, based on the data obtained from the lithic and faunal record of the lower and middle levels. From the study of the lithic industry, traceology is once again presented as a line of research that would contribute relevant information to this debate. The sources of the raw materials have not been located so far, which has made it difficult to make a comparative reference collection for the analysis of use-wear traces. Currently, it is possible to carry out an experimental programme to generate a reference collection for the archaeological lithic material analysis. In response to these advances in research, from the traceological studies, it has been possible to organise an experimental programme adapted to the needs of the sites under study. Based on the raw materials identified in the archaeological record (three types of flint and quartzite), a series of activities have been planned in a sequential monitoring. In this poster we present the first results obtained from this experimental programme, configured on the requirements identified in both archaeological records (wood processing, grass, and animal carcasses). We expose the data concerning the formation and development of macro and microscopic use-wear traces, documented by the binocular and the metallographic microscope. The approach and development of this experimentation includes a variety of individualised movements such as cutting, sawing and scraping, but also tools with dual use (sawingscraping, cutting-scraping). Based on these data, it is possible to discuss new flint types not yet included in the bibliography, as well as to continue generating interpretative markers through the introduction of new quartzite varieties.

Keywords: Ambrona; Torralba; use-wear; experimental protocol; reference collection
EXPLORING THE FUNCTION AND THE IMPACT OF POST-DEPOSITIONAL SURFACE MODIFICATIONS (PDSM) ON CHÂTELPERRONIAN END SCRAPERS FROM QUINÇAY CAVE, FRANCE

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Abstract

The Châtelperronian industry (44 to 40 ka cal BP), has provided a variety of material evidence including lithic and bone tools, ornaments and human remains associated with the Late Neandertals and with the arrival of the early anatomically modern humans (AMH) in western Europe (Hublin 2015, 201). This research focuses on exploring the usage of one of the most predominant tool types: end scrapers. Our main research questions concern the function of end scrapers within their archaeological context, as well as the degree of impact that post-depositional surface modifications (hereafter, PDSM) have on the observable use-wear patterns and within the different layers of the stratigraphic sequence. We applied use-wear analysis on 40 selected end scrapers from two different Châtelperronian layers of Quinçay Cave, France. We first estimated the impact of PDSM on both flint and jasper artefacts. Both low and high power approaches were used with a specific cleaning protocol. The interpretation of use-wear was made through a comparison with the experimental collection available in Leiden University. The results showed that PDSM highly affected six artefacts thus; their in-depth interpretation could not be addressed, which was also due to the composition of the different raw materials. Despite the post-depositional alterations, we were able to interpret 17 artefacts as used for scraping bone but mostly hide, while the rest displayed traces which are not that clear and could be a result from PDSM and possible use. As a final remark for this type of analysis, we point out the differences among the layers and raw materials, flint versus jasper. We also emphasize on the necessity of exploring the Châtelperronian assemblage following this method to reconstruct not only the intra-site activities in the Châtelperronian but also to investigate the potential interconnectivity, an aspect that is still under investigation.

Keywords: Châtelperronian industry; use-wear analysis; post-depositional surface modifications (PDSM); end scrapers; Quinçay Cave

References
THE ROLE OF THE HUSKING TRAYS: FOOD PRACTICES AND SOCIAL BEHAVIORS IN THE LATE NEOLITHIC NEAR EAST

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Abstract

The so-called ‘husking tray’, a late Neolithic pottery shape from the Near East, was the aim of a recent PhD research. The ambitious goal of the research was to grasp the values that the past communities attributed to this ceramic form and all the possible repercussions that could shed new light on ancient societies. To achieve this objective, the artefact has been studied from several points of view: from the accurate collection of archaeological data to ethnographic comparisons, from stylistic to experimental analysis. The research fulcrum was the traces analysis of a husking tray sample from northern Syria and south-eastern Turkey; it provided a better understanding of the technological choices made by the potters who shaped the husking trays and their actual function. All these data together allowed us to speculate on the role of these vessels, on the food practices and social behaviors of the ancient communities in which they were in use.

Keywords: pottery; technological traces; use-alterations; food practices; social behaviors
IDENTIFYING THE STONE TOOLKIT OF COPPER AND BRONZE AGE METALLURGISTS: NEW CONTRIBUTION OF USE-WEAR AND XRF ANALYSIS ON EXPERIMENTAL TESTS

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Abstract

Use-wear analysis of stone tools implied in metallurgical processes is a recent field of investigation within functional analysis. In order to consolidate the methodological framework of these researches, experiments have been conducted on the production of copper and bronze objects. Several steps of production have been tested, on the basis of archaeological questions applied to sites dated from the 3rd and the 2nd millennium BC in north-western Europe. Copper ore crushing has been tested to compare use-wear traces produced by three distinct actions: block breakage, fragmentation in small pieces and grinding into powder. Hammering was also undertaken for shaping various parts of copper and tin bronze axeheads and daggers: deburring and regularization of their sides, as well as thinning the cutting edges immediately after casting or at a later stage. Finally, abrasion and polishing of the sides and edges of copper and bronze axeheads were also performed. The combination of use-wear and XRF analysis of the tools implied in this experimental sequence, consolidate the methodological background of stone tool functional analysis. They allow better discrimination of use-wear traces produced by ore processing within hard mineral matters. They also raise questions on the preservation of metal residues on stone tool surfaces depending on the separate actions performed. Finally, the discrimination between copper and bronze objects is discussed. Examples of application on various metallurgist’s stone tools from the Early Bronze of north-western Europe will support the demonstration.

Keywords: copper and bronze metallurgy; stone tools; experiments; use-wear analysis; XRF analysis
“WHETSTONES” ON THE CUTTING EDGE. UNDERSTANDING THE CULTURAL BIOGRAPHY OF ROMAN AND MEDIEVAL MACROLITHIC TOOLS THROUGH THE APPLICATION OF USE-WEAR ANALYSIS. FROM DOMESTIC AND AGRICULTURAL ACTIVITIES TO SPECIALIZED CRAFT PRODUCTIONS

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Abstract

The material culture study of historic macrolithic tools has been ignored for a long time. Traditionally, lithic studies have mainly been restricted to the investigation of pre- and proto-historic artefacts, as if stone implements are an anachronism in younger periods. Nevertheless, they hold a lot of potential to gain new insights in ancient technology, trade networks, agricultural and domestic activities and craft specialization of historical periods. With the introduction of metallurgy from proto-history onwards and later during the Roman period, certain stone implements for cutting activities were replaced by metal ones, for example knifes, axes and adzes. However, for a very wide range of non-cutting activities like grinding, abrading and polishing, stone implements kept in vogue, even until very recent historic times. Whereas the last decades typomorphological studies and provenance studies have been developed, systematic functional studies are currently completely lacking. In this project we will focus on tools that are generically determined as “whetstone”, referring to the sharpening function for the cutting edge of metal implements. However, we believe that their specific function is much more diverse then is generally assumed. As such they can contribute to the wider socioeconomic debate on domestic, agricultural and (specialized) craft activities. They could have been used in different stages of processing animal, vegetal and mineral resources like example metalworking, working bone, antler, amber, wood, stone and nuts. We aim to evaluate this hypothesis and as such to contribute to the debate on historical craft (specialization) by applying systematic usewear studies on “whetstones”. An approach that has proved its merits in prehistoric archaeology, but which is highly innovative within historical archaeology. In this paper we want to present the preliminary results of our experimental program and the first use-wear analyses on a selection of Gallo-Roman archaeological assemblages from Flanders (Belgium).

Keywords: Gallo-Roman/medieval period; whetstone; abrading tool; polishing tool
SWORD-FIGHTING IN BRONZE AGE EUROPE: ASSESSING THE USE OF BRONZE SWORDS FROM BOHEMIA AND MORAVIA

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Abstract

This poster presents the defined individual categories of combat marks on Bronze Age swords from Bohemia and Moravia and explores their function to grasp their practical use and significance. How the bronze swords were used is still a valid question in European traceology. We find various types of traces of use of which many are related to their functionality as weapons. As a distinctive category of artefact, the first swords appear during the Bronze Age, and this could suggest the change of the nature of violent conflict. Nevertheless, for a long time, there persisted an opinion that rebutted this interpretation and questioned the functionality of bronze swords, describing them rather as ceremonial objects. I have amassed the collection of more than 40 swords from different contexts, which were analyzed with the combination of various use-wear methods. I have identified and classified categories of combat marks, which are often found on Bronze Age swords. Based on the combat marks on ancient weapons and experimental reference marks from my experiments, I was able to identify the precise nature of various types of combat damage. Analyses of the combat marks revealed a multitude of clusters and patterns and main concentration on the one segment of the blade, so-called “pivot point”. What is important is that traces that are most frequently identified are usually related to blade repairs. This could influence the way we interpret the sword-fighting techniques as well as how we should understand their evolution.

Keywords: swords; combat; use-wear analysis; Bronze Age Europe
PRELIMINARY TECHNO-TYPOLOGICAL STUDY OF STONE AND OSTRICH EGGSHELL BEADS AT MAHAL TEGLINOS, EASTERN SUDAN. LOCAL MANUFACTURING OR IMPORTED PERSONAL ORNAMENTS?

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Abstract

Body ornaments are one of the most common archaeological findings. Although they give us information about the access, distribution of natural resources and trading relationship among different human groups, they are poorly studied in Nubian archaeology. We present the results of a preliminary techno-typological study focused on a set of selected semiprecious stones and ostrich eggshell beads coming from the Gash Group settlement and funerary areas (middle III - early II millennium BC) at the site of Mahal Teglinos (K1), located in the Kassala region, Eastern Sudan. The aim of the research is to identify whether the stone drills detected in the Gash Group’s lithic assemblage were involved in local stone and ostrich eggshell beads manufacturing, and to possibly reconstruct their chaîne opératoire. The traceology analyses include a multipurpose microscopic study combining stereo, metallographic, 3D digital and scanning electron microscopes. The comparison of the macro and micro technical traces present on the archaeological artefacts with the experimental replicas, and the possible residues will allow us to confirm whether these personal ornaments were manufactured by the inhabitants of Mahal Teglinos using local or imported semiprecious stones and ostrich eggshell, or if they were traded by human groups occupying the Nile Valley or the Northern Horn of Africa.

Keywords: beads; stone drills; traceology; experimental manufacturing; Sudan
UPPER PALAEOLITHIC OSSEOUS ARTIFACTS FROM THE MAMUTOWA CAVE IN POLAND. FIRST RESULTS OF THE TRACEOLOGICAL STUDIES

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Abstract

The study’s main objective is to present the first results of the traceological analyses concerning osseous artifacts found in the site Mamutowa Cave in Poland. Most of the bone artifacts found on the site are connected with the Aurignacian and Gravettian cultures. The inventory of the Cave includes, among others: projectile weapons represented by more than twenty Mladeč-type points (40,000–35,000 cal BP), baguettes, demi-ronde and personal ornaments in the form of various pendants. They are made mostly from mammoth tusk and bone. During the traceological analysis of the mentioned artifacts, a broad spectrum of technological traces was identified, allowing to reconstruct chaîne opératoire of their production process. For the project, morphological, technological, and functional data about similar finds from Europe was also collected and confronted with obtained results.

The project is financed by the National Science Centre, Poland (project no. 2019/32/C/HS3/00615).

Keywords: Poland, Technology, Upper Palaeolithic, Mamutowa Cave, Osseous industries
Abstract

The Late Glacial/ Early Holocene period in Fennoscandia is framed by the Weichselian ice age. Hunter-gatherers first (re)settled this part of Europe as it was liberated from the ice cover at the end of the last ice age beginning c. 15,000 years ago. Due to bad preconditions for preservation of organic materials, the evidence is mainly lithic assemblages. The data so far speaks in favor of an early southwestern, and an eastern route into Scandinavia in the early Holocene. This was followed by a migration of eastern groups into most part of Scandinavia in the Middle Mesolithic moving south through Northern Sweden and along the Norwegian coast area in the west. Settling the new land, the hunter gatherers left areas with lots of good quality flint. In the area freed from the ice cover they encountered local raw materials such as quartzites and cherts, porphyrites, tuffites and brecciated quartz. This offers archaeologist a possibility to investigate a number of questions relating to adaptive responses of hunter gatherers. Seen through the lens of lithic technology it is possible to highlight organizational aspects related to access, reliability, efficiency and maintainability balanced against the impact of cultural traditions. The project “Lithic Raw Material Economy in Mesolithic Scandinavia” work in a selected research area in central Sweden with a number of differently distributed raw-material sources and a large number of excavated sites. In a series of experiments and analyses including use wear analyses we look at the difference in efficiency and durability of flint edges compared to tools and weapons made out of local raw materials. In this poster we present and illustrate a recent experiment investigating efficiency and durability and penetration damage on 20 slotted bone points with microblade insets of five different lithic raw materials compared distance to raw-material sources.

Keywords: Penetration experiments; slotted bone points; efficiency; durability; impact damage
SHOULD WE STAY IN TOUCH? NEW INSIGHTS INTO CONTACTS BETWEEN FIRST FAMER COMMUNITIES IN CENTRAL EUROPE, BASED ON MACROLITHIC STONE TOOLS ANALYSIS

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Abstract

The appearance of first framer societies associated with the Linear Pottery culture (LBK) in Central Europe took place between 5500-4900 BC. The dynamic nature of the spread of the LBK is the subject of many research. Although it is considered that some local Mesolithic societies were involved in the process of the Neolithization, it is proved that primary centres were located in the south of Carpathian Mountains. The goal of this study was to determine the nature of contacts between southern cultural centres and further north expansions. Were the contacts still maintained after the communities completed the initial phase in the newly inhabited zones? Did the local production of the necessary tool kit based on the recognition of the local deposits of raw material fulfil their needs? We were hoping to answer this question by focusing our research on the group of the macrolithic stone tools, which were essential for Neolithic people for food preparation and other agricultural, construction and craft activities. The artefacts for our project was chosen from two well excavated LBK sites from Lower Silesia (SW Poland): site no 16 in Strzelin and site no 1 in Skoroszowice. The site in Strzelin represents a long term settlement where traces of occupation of three LBK culture phases were recorded. Collection of 43 ground stone tools from Strzelin 16 included adzes/hoes, querns, grinding stones, handstones, tool preforms and tool fragments. The site in Skoroszowice was occupied during the third phase of LBK culture. Collection of 18 ground stone tools from Skoroszowice included: adzes/hoes; querns; handstones and 2 tool fragments. By studying raw material provenance, technological and use wear traces on tools, it became evident, that despite the passage of the time contacts were maintained.

Keywords: Neolithic; Linear Pottery culture; macrolithic stone tools; use wear
THE NEOLITHIC POLISHED STONE TOOL AS A BRONZE AGE FUNERARY GIFT

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Abstract

The Vlaardingen Culture (3400-2500 BC) is a regional Neolithic group in the western Netherlands and Vlaardingen sites are located in different ecological zones. It is generally assumed that the sites which are located on the coastal dunes consist of permanent settlements while those in the wetlands consist mainly of temporary specialized extraction camps, focused on the extraction of wild resources. The author wrote an MSc Thesis on use-wear analysis for part of the flint scraper assemblage from Den Haag Steynhof. This site belongs to the Vlaardingen Culture and is located on a coastal dune that is characterized as permanently settled. The working hypothesis suggests that due to residential mobility the inter-site variability will be reflected on the use-wear traces between scrapers used in temporary and permanent settlements. Hence, traces of the initial stages of hide working such as fresh hide scraping are expected on both the temporary camps and permanent settlements while more advanced stages of hide-working are mostly expected in permanent settlements. To test this hypothesis an experimental program was set up to gain insight into the variability in use-wear traces resulting from different stages of hide-working. Thus, both fresh-hide scraping and dehairing experiments were conducted and finally, their results were juxtaposed with the traces on the archaeological assemblage. Dehairing was chosen as a representative of a more advanced stage of hide-processing. Except for its understudied character, dehairing was chosen as it is a time-consuming activity which would more likely have taken place in a permanent settlement and because it is ethnographically documented as such. As part of the ‘Putting Life Into Neolithic Houses’ project, this study contributed to the understanding of the intra- and inter-site relationship between the different activities in space regarding the Vlaardingen Culture settlements.

Keywords: Neolithic; Bronze Age; shoe-last adze; grave goods
Abstract

As part of the archaeological excavation project of the medieval town of Cencelle (Tarquinia, RM, Italy), by the Sapienza University of Rome, the need for the analysis of the large number of ceramic finds has become apparent, focusing on aspects concerning the social significance of the containers used in everyday life in the late Middle Ages. The aim to combine a canonical typological approach to the study of potteries with methodologies of experimental archaeology, traceology, and residue analysis, led to the elaboration of a first study that took into consideration the domestic ceramic defined “testello”. It is a flat container with edges only a few centimeters high, possibly used to produce bread and focaccia bread. To disclose the actual function of this category of ceramic, widespread in Cencelle town, the integrated approach was applied. In this regard, the use of residue analysis, although still at a preliminary stage, has already provided information on the diet and possible reuse of the analyzed artefact. Furthermore, the application of techniques and methodologies of experimental archaeology and traceology, still little used for the study of medieval pottery in Italy, is offering numerous new inputs to the study of the material culture of Cencelle, leading us to think about new modalities of domestic tool production and dynamics of social organization within a medieval town.

Keywords: Medieval pottery; traceology; residue analysis; social dynamics; experimental archaeology
FIRST GLIMPSES ON THE TECHNOLOGICAL AND FUNCTIONAL STUDY OF THE EARLY NEOLITHIC LITHIC INDUSTRY OF LA MARMOTTA (LATIUM, ITALY)

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Abstract

The archaeological site of La Marmotta in the lake of Bracciano (Anguillara Sabazia, Roma, Italy) is an underwater early neolithic village dated between 5700 and 5300 cal BC, excavated between 1989 and 2009 under the direction of M.A. Fuggazzola Delpino (Sopr. Arch. L. Pigorini). The site is famous for the preservation of organic materials, for instance dug-out pirogues, complete sickles and so on. It has also yielded an abundant lithic industry made of different raw materials (flints, obsidians) associated with different chaînes opératoires. The technological study aims to characterize each chaîne opératoire to understand raw material procurement, knapping techniques and methods, typological choices, and their implications in terms of social organisation and cultural relations.

The usewear analysis benefits from the exceptional preservation of several wooden handles. Beyond the already published sickles, the goal of our study will be to characterize the modes of utilisation with or without handles of the tools. The current study concerns the house number 7, which belongs to the oldest phase of occupancy. The first results of our preliminary study show a variety of knapping technics (pressure, indirect percussion, direct percussion) in an industry dominated by blade productions. Retouched tools are very abundant: truncations, geometrics, borers, etc. So far, we proceeded to the usewear analysis on a limited sample of flint artefacts. Sickle blades are abundant, woodworking is present, geometrics are used at least partly as projectiles.

Keywords: Neolithic; lithic industry; underwater village; lithic technology; usewear analysis
REFLECTIONS ON HIDE-WORKING. DEHAIRING EXPERIMENTS AND USE-WEAR ANALYSIS ON VLAARDINGEN CULTURE (3400-2500 BC) SCRAPPERS FROM DEN HAAG STEYNHOF

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Abstract

The Vlaardingen Culture (3400-2500 BC) is a regional Neolithic group in the western Netherlands and Vlaardingen sites are located in different ecological zones. It is generally assumed that the sites which are located on the coastal dunes consist of permanent settlements while those in the wetlands consist mainly of temporary specialized extraction camps, focused on the extraction of wild resources. The author wrote an MSc Thesis on use-wear analysis for part of the flint scraper assemblage from Den Haag Steynhof. This site belongs to the Vlaardingen Culture and is located on a coastal dune that is characterized as permanently settled. The working hypothesis suggests that due to residential mobility the inter-site variability will be reflected on the use-wear traces between scrapers used in temporary and permanent settlements. Hence, traces of the initial stages of hide working such as fresh hide scraping are expected on both the temporary camps and permanent settlements while more advanced stages of hide-working are mostly expected in permanent settlements. To test this hypothesis an experimental program was set up to gain insight into the variability in use-wear traces resulting from different stages of hide-working. Thus, both fresh-hide scraping and dehairing experiments were conducted and finally, their results were juxtaposed with the traces on the archaeological assemblage. Dehairing was chosen as a representative of a more advanced stage of hide-processing. Except for its understudied character, dehairing was chosen as it is a time-consuming activity which would more likely have taken place in a permanent settlement and because it is ethnographically documented as such. As part of the ‘Putting Life Into Neolithic Houses’ project, this study contributed to the understanding of the intra- and inter-site relationship between the different activities in space regarding the Vlaardingen Culture settlements.

Keywords: micro-wear analysis; experimental archaeology; hide working, dehairing; residential mobility
PRELIMINARY RESULTS FROM THE TRACEOLOGICAL ANALYSIS OF THE LATE NEOLITHIC AND BRONZE AGE STONE TOOL ASSEMBLAGES FROM RA’S AL-JINZ 3 (OMAN)

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Abstract

The south eastern Arabian coast line with its diverse habitats and high levels of bio productivity is characterized by a abundance of archaeological sites dating from the Neolithic to Islamic periods. Since the beginning of the Holocene populations of hunter, fisher, herder and gatherers have developed cultural and behavioural knowledge that allowed them to flourish and endure the climatic oscillations that acted upon the environs along the Arabian Sea shore. The archaeological remains of these resilient populations are the subjects of considerable archaeological research since the beginning of the exploration of the Peninsula. Yet, save for some rare exceptions, traceological/functional analysis have been seldom incorporated into the research agenda of archaeological projects exploring the Holocene human occupation of the Arabian coastal environments. Here we present the preliminary results from the traceological analysis undertaken on a sample of lithic artefacts dating to the Late Neolithic and Bronze Age from the multi occupational site of Ras al Jinz 3 (RJ-3), Oman. Located only a few meters from the shore, RJ-3 is part of a larger prehistoric settlement and likely represents a specialized area where different productive activities took place. In order to crystallize what kind of activities have been performed with the stone tools traceological analysis was undertaken and the results will be presented. The Late Neolithic assemblage from the site is characterized by a series of large tabular scrapers made on massive cortical chert flakes, cutting implements, piercers and microlithic lunates. Two different cultures are identified in the Bronze age sequence of the site, Early Bronze Age Hafit Period and the later Umm an Nar tradition. Lithics from the Haft occupation show an ad-hoc character and present a high amount of postdepositional alterations making the identification of the worked material challenging. The Umm an Nar lithics, most of which can be classified as bifacial becs and drills show traces congruent with mineral processing activities, possibly the manufacturing of Conus shell rings.

Keywords: Coastal human occupation; Holocene; Oman; Traceology; Lithic technology
FIRST ATTEMPTS AT SAMPLING AND ANALYSING RESIDUES FROM MACRO-LITHIC TOOLS IN EASTERN SUDAN

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Abstract

During the two 2019 investigations of the Italian Archaeological Expedition to the Eastern Sudan (IAEES), a selected number of macro-lithic tools were sampled to proceed with residue analysis for the first time. The samples came from two different sites, labelled UA 53 and Mahal Teglinos (K1), respectively located in the Upper Atbara and close to the modern city of Kassala, under Jebel Taka. The first site is characterised by Malawiya Group contexts (4th mill. BCE), associated with a hunter-gatherer economy. The second is distinguished for its settlements and funerary areas belonging to the Gash Group (2700 to 1800 BCE) and the Jebel Mokram Group (1800 to 500 BCE) periods, corresponding to the main agropastoral phase of the area. Two diversified methodologies have been used to sample the residues from the tools, providing interesting preliminary results, including methodological evaluations.

Among the residues, there are phytoliths not identifiable at the level of species but generically indicative of herbaceous elements of cereals. The abundant presence of C4 plants is consistent with the typical Sudanese vegetation, which, nowadays, represents about 60% of the entire flora. These percentages were probably lower in the ancient and middle Holocene; however, Poaceae were strongly represented then. Identifiable starch granules may be mainly associated with the Paniceae tribe (millets) and sorghum. A few damaged globular granules cannot be identified but show mechanical alterations consistent with grinding activities. This paper aims to show these preliminary results, focusing on the relationship between starch granules and types of tools, the contexts of provenance, and the distinct socioeconomic cultures characterising the sites. The analysis of use-wear traces on the stone artefacts from LRC can help to clarify the activities carried out on the site and therefore to determine its function, an essential step to better define the subsistence strategies and symbolic behavior of Neanderthals in the region and beyond.

Keywords: macro-lithic tools; residue analysis; Eastern Sudan; hunting-gathering; agropastoralism
This research is addressed to highlight the traits of the agricultural practice in Sardinia during the 5th millennium BCE, starting from the analysis of a set of lithic harvesting inserts found in the Middle Neolithic B household settlement of Su Mulinu Mannu, Terralba (Central-West Sardinia). This open-air site (4500-4100 cal. BCE) includes different structures: we focus our investigation on one of these, whose last function was interpreted as a waste pit. The archaeobotanical evidence shows, for this site, an agricultural system based on the cultivation of cereals and bears evidence of the cultivation of free-threshing wheat, together with naked and hulled barley (Ucchesu et al. 2017). The sickle inserts of Su Mulinu Mannu, made on blade(lets) and flake blanks, were almost exclusively on obsidian from the Monte Arci sources (around 10 km E-SE). The working edges of these implements were frequently retouched and often shaped by abrupt retouch, at one or both ends, to facilitate its insertion into the haft. After a first assessment through a stereoscopic microscope (5× to 80× magnification), these elements have been observed through a reflected-light microscope (50× to 200× magnification), in order to highlight the characteristics of the polish, striations and rounding. The traces observed on such inserts seem the result of cutting silica-rich vegetal material, most likely cereals. The techno-functional analysis of the sickle elements of Su Mulinu Mannu provides relevant information on agricultural practices and on the increase of the productive economy in Sardinia during the Middle Neolithic; further investigation may help us to better understand this phenomenon either in a broadened geographical and temporal perspective.

Keywords: Sardinia; Middle Neolithic; Harvesting; sickle inserts; obsidian

References
TRACES ANALYSIS ON MUD FIGURINES: MAKERS, TECHNIQUES AND SOCIAL DYNAMICS FROM MIDDLE BRONZE AGE EGYPT (1800-1700 BC)

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Abstract

This contribution presents the results of a traceological study applied to Egyptian Middle Bronze Age mud figurines (specifically the late Middle Kingdom, c. 1800-1700 BC). The analysed corpus consists in a hundred of mud figurines unearthed from the ancient town of Hetep-Senusret (modern Lahun), ca. 100 km south of Cairo. Mud figurines have been selected because of their archaeological and social contexts, since they are associated with domestic areas and more modest levels of society, a shadow cone still at the margins of the historical reconstruction in Egyptological tradition. In addition, the debate on the significance of these figurines is still open. Scholars, indeed, proposed diverse hypotheses sustaining the interpretation of these artefacts as symbolic and religious objects or even toys. Manufacturing traces analysis, which integrate the study of technological features and fingerprints analysis, suggests a high variability of the shaping sequences at the base of the creative process. Moreover, traces analysis confirmed that the number of shaping steps performed seems to be related with the accuracy of the final artefact. Such a variability was interpreted in the light of fingerprints analysis aiming at identifying the age of producers and assessing the possible connection of these objects with religious purposes or other kind of activities such as children playing. The results of our study reveal that most of the mud figurines from Lahun were made by late adolescents/adults, while the contribution of children/early adolescents or only adults seems to be considered marginal. These data allow us to propose specific hypotheses regarding the context and the social dynamics underpinning the production and the use of these artefacts.

Keywords: figurines; technological traces; ceramic; bronze age; Egypt
EXPLORING PREHISPANIC WOODWORKING TECHNOLOGIES IN THE ISOLATED CONTEXT OF THE CANARY ISLANDS

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Abstract

The Canary Islands are one of the richest geographical regions presenting desiccated wooden artefacts. These artefacts, preserved at several islands of the archipelago, were manufactured by North African agropastoral populations that settled the archipelago around the Era. These first settlers had to adapt to the local raw material availability, which lacked metal ores, and thus developed volcanic lithic technologies and woodcraft in an insular environment. In this poster we present the WoodTRACES project recently started (H2020-MSCA-IF-2020) which seeks to test the hypothesis that the study of woodworking technology can shed light on the human adaptation process in an isolated context such as the Canary Islands. This is the first time that an interdisciplinary approach based on archaeobotany (wood analysis), experimental archaeology and tool-mark and wear analyses is applied to study the process of production and usage of wooden artefacts by the aboriginal groups from the Canarian archipelago. The outstanding preservation of desiccated wooden remains from the Prehispanic period (5th – 15th centuries CE) offers an excellent opportunity to approach past indigenous woodworking using volcanic stone tools. This varied wooden assemblage, including domestic and funerary contexts, is revealing meaningful data regarding wood acquisition and woodworking technologies at different islands, involving a deep knowledge of plant availability and the physical and mechanical characteristics of taxa.

Keywords: Prehispanic; Canary Islands; Wood, Traceology
DETERMINING THE FUNCTION OF ARCHAEOLOGICAL ARTIFACTS ASSOCIATED WITH A LACUSTRINE WAY OF LIFE DURING THE ARCHAIC IN THE BASIN OF MEXICO

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Abstract

The site of San Gregorio, Atlapulco, is an islet in the center of Lake Xochimilco, occupied during the Archaic, a phase considered to be of transition towards the development of the first settlements (6000-3500 BCE), has revealed a rich archaeological registry that has allowed us to elucidate the strategies of subsistence of complex hunter-gatherer groups in the south of the Basin of Mexico. Recovered remains from aquatic fauna (turtle, Kinosternon sp.; axolotl, Ambystoma mexicanum; and charal (Chirostoma sp.), alongside mammals including white tail venison (Odocoileus virginianus), peccary (Pecari tajacu) and badger (Taxidea taxus) suggest that these first early occupations had access to wildlife resources associated to the lake, complemented by foothill resources (Blancas, 2017). Besides the gathering of lacustrine resources, a variety of domesticated or in the process of domestication plants were incorporated, such as maize (Zea maize ssp. maize), sweet potato (Ipomoea batatas), beans (Phaseolus sp.) and chili (Capsicum sp.) (McClung & Acosta 2015; Martínez 2017, Rodríguez 2017, Rivera 2019, Vera 2019, Toscano 2019). For the microscopic analysis of the flaked stone tools, we used the methodology of Álvarez (2003) and Pérez (2017), using an Olympus BX52 microscope with a reflected light module to register micropolish at 100x and 200x. To take the panoramic microphotography, we used the program Helicon Focus that allows us to create images with depth of field by merging photographs with different focus points. For the ground stone tools siloxane polyvinyl (PVS) samples were taken to be microscopically observed at 200x, parallel to this analysis starch observation and identification was conducted.

The results indicate that among the processed plants were bean (Phaseolus sp.), chili (Capsicum sp.), yam (Dioscorea sp.) and the papa de agua (Sagittaria sp.) in addition to different wild species of grasses not yet identified.

Keywords: use-wear; micro-residues; lake stones; ground stones; Basin of México
SEA MAMMAL BUTCHERING IN JOMON RITUAL CONTEXTS: USEWEAR ANALYSIS OF LITHICS FROM HAMANAKA 2 SITE, JAPAN, REBUN ISLAND

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Abstract

The northern coast of Rebun Island (Japan, Hokkaido prefecture) yields a number of open-air coastal sites containing assemblages related to symbolic and domestic activity from Jomon culture. This paper presents a functional analysis of lithics from the ritual complex of the Late Jomon culture (Layer VIII, 1050 BCE-350 CE) at the Hamanaka 2 site. The ritual complex consisted of the skulls of sea mammals situated in a row surrounded by bones, pottery fragments, and lithics. The aim of this use-wear analysis is to determine the functions of the tools from the ritual complex of the VIII layer, and their related symbolic activities. The results of this study have identified butchering traces on two bifaces, a biface resharpening spall, retouched flakes, and blades. These results illuminate the specific role of bifaces in sea mammal worshiping rituals. Two bifaces with use-wear from this assemblage were made of imported raw material and have ritual item features. One biface is of specific imported raw material and initial breakage. The second biface has an exaggerated size and proportions. Other evidence of the specific role of the bifaces is the trimming spall from the edge of the biface with use-wear. This artifact can be interpreted as the result of biface resharpening. The microstratigraphical and spatial positioning data of the items, their raw material, the presence of use-wear and technological features of lithics attest to the ritual nature of this complex From this analysis, we can interpret butchering as a symbolic activity, as well as define the specific role of usage and breakage of bifaces in these practices.

Keywords: Jomon culture; Ritual Practices; Sea mammals; Butchering; Japanese Neolithic
FISH PROCESSING IN THE MESOLITHIC. FIRST DATA FROM ROMAGNANO LOC III ROCK SHELTER (SOUTH-EASTERN ALPS, ITALY)

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Abstract

The traceological analysis of a sample of lithic artefacts coming from the Early Mesolithic series of Romagnano Loc III in the South-Eastern Alps (layers AF-AE and AC6-5) allowed bringing to light consistent evidence concerning the processing of fish resources. Romagnano Loc III is a rock shelter located along the Adige valley whose Mesolithic sequence was excavated in the 1970’ies and, up to present, stands as a reference for the Early Holocene in the entire region. From a palaeo-environmental point of view, the presence of low-energy running waters and/or marshy areas in the surrounding of the site is reported and confirmed by the identification of some fish remains at the site, whose study is currently ongoing. The lithic tools that yielded use-wear referable to fish processing, present consistent morphological features. In some cases, a thin cutting edge was used with a preferentially longitudinal motion that could be interpreted as filleting. Tougher edges are generally associated to a transversal action (scaling). Frequently, both these activities are attested on the same tool, exploiting two opposite edges.

Keywords: Early Mesolithic; Southern Alps; fish processing; lithics
TRACEOLOGICAL ANALYSES OF THE JKSH P52 SITE LITHIC ASSEMBLAGES FROM OCCUPATIONAL LAYERS, JIBAL AL-KHASHABIYEH, JORDAN: IMPLICATIONS ON OUR UNDERSTANDING OF THE DESERT KITES USERS DURING THE LATE PPNB

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Abstract

Recently, the South-Eastern Badia Archaeological Project (SEBAP) has identified the oldest desert kites (archaeological structures made of long stone lines converging towards an enclosure and pit-traps, and used as mega-traps) in the Jibal al-Khashabiyeh region, and dated around 7000 BC. Used for the mass-hunt of wild animals, they are among the most spectacular prehistoric installations in Southwest Asia. Eight dwelling sites are directly associated with these huge traps. The excavation of JKSH F15, F19 and P52 campsites revealed stratified occupation layers within drystone settlements, and yielded very specific and homogenous lithic assemblages. In a context extremely rich in flint, the newly defined “Ghassanian” techno-complex is dominated by a laminar production, as well as a distinctive bifacial component and a large variety of small arrowhead types.

In this poster, we present the results of the traceological analysis conducted on selected tools, coming from the JKSH P52 occupation soil layers. Despite frequent alterations to the tools, obtained results allowed to present the range of activities carried out at the site and to discuss relevant issues linked to the massive exploitation and processing of animal resources during the Late Pre-Pottery Neolithic B in the southern Levant.

Keywords: Use-Wear; Lithic tools; Pre-Pottery Neolithic; Desert Kites; Camp sites
DECIPHERING THE ROLE OF WILD PLANT FOODS AT THE DAWN OF AGRICULTURE IN THE LEVANT

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Abstract

To date, research on the origin of plant domestication in the Near East has primarily focused on identifying specific plant morphological traits. Little attention has been given to explore how the long-lasting human/wild plants interaction changed with the introduction of domesticated species. The proposed contribution presents the results from the integration of functional study on ground stone tools (GSTs) and dental calculus from the project “Deciphering the role of wild plant foods at the dawn of agriculture in the Levant”, funded by the Irene Sala CARE Foundation. Focusing on three main contexts, Nahal Yarmuth, Eynan and Nativ Hagdud, we provide preliminary results about wild and domestic plant technology and consumption from the Natufian to the Pre Pottery Neolithic B. Use-wear and residue analyses on GSTs allowed us to reconstruct plant food processing strategies, isolating, and identifying elements of continuity or discontinuity in the technological know-how associated with plant foods exploitation. Specifically, analysing micro-wear and residues on GSTs we provide evidence about the technological know-how related to the treatment of plant foods. Dental calculus permitted us to investigate possible shifts in dietary habits, with compelling direct evidence about the species of consumed plant foods. Our results allow us to understand how the introduction of domesticated plant foods affected established food technologies associated with wild plant consumption and their role at the onset of agriculture in the Levant.

Keywords: plant; use wear; residue; dental calculus; Near East
THE ECONOMY OF THE NEOLITHIC COMMUNITIES OF THE CENTRAL BALKANS ACCORDING TO THE MACRO-LITHIC ARTEFACTS

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Abstract

Regionalisation of the Late Neolithic Vinča culture has been observed primarily based on the pottery analysis several decades ago. Despite a long research tradition, this process has never been discussed and explained. The previous research of Bronze Age macro-lithic tools of the Copper and Bronze Age in southern Iberia showed territorial division produced by diversities economic activities. Based on this experience and methodology we have analysed 2174 macro-lithic tools from the 12 Neolithic settlements (c. 5900 - 4650/4600 BC cal) from the Central Balkans. Our aim was to answer several questions concerns the Neolithic economy of the Central Balkans such as detection of economic changes through time and space, to define and confirm regional economic differences during the Late Neolithic, identifying distance exchange patterns, identification of standardization of the macro-lithic objects, and defining if the Vinča culture had highly organized production and society. Thus we applied a complex methodological system that includes petrographic analysis, analysis of morphometric characteristics, functional analysis, and an experimental examination.

Keywords: macro-lithic tools; functional analysis; economy; Vinča culture; Central Balkans
BRONZE AGE GRINDING STONES REVEALED: A COMPREHENSIVE STUDY OF THE FINDS FROM CENTRAL-WESTERN TURKEY

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Abstract

Hundreds of grinding stones were found at many Bronze Age sites in western Anatolia, but so far, they have not received enough attention. These artifacts are one of the archaeological finds that bring us information about common daily activities, so they form an important part of life on the settlement. The grinding stones found at the Bronze Age settlement of Kaymakçı, located in central-western Anatolia near lake Marmara, are introduced in this case-study. Up to now just 36 of 300 found grinding stones were studied more in detail. Those finds were produced from multiple raw material sources, in which volcanic rocks predominated - mainly rhyolite and andesite. This study presents use-wear patterns related to various tool functions analyzed on this specific raw material. It comprises experiments with replicas, morphological and use-wear analyses based on different scales of observations (low and high magnification).

Keywords: grinding stones; Kaymakçı; central western Anatolia; use-wear analysis
ETHNOTRACEOLOGICAL ANALYSIS OF STONE KNIVES OF THE EKVEN CEMETERY

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Abstract

This investigation focuses on preliminary results of ethnotraceological studies of stone knives – one of many categories of funerary equipment of the Ekven cemetery, which are stored in the depositories of Peter the Great Museum of Anthropology and Ethnography (the Kunstkamera) (St. Petersburg, Russia) and the State Museum of Oriental Art (Moscow, Russia). The cemetery is one of the few widely excavated sites of the Neo-Eskimo culture of Chukotka (I millennium BC). The uniqueness of these artifacts results from the persistence of their authentic forms caused by the millennia-old tradition, practically unchanged ecosystem of the region and especially their exceptional practicality and comparative ease of manufacture. Thanks to such a “living” ethnography and experimental-traceological analysis, it became possible to comprehensively reconstruct the ways of using these objects among the ancient Eskimos. Experimental and traceological studies of ethnographic materials provided an additional information source and allowed us to verify the archaeological and ethnographic data, making comparisons more correct.

Keywords: Chukotka, Ekven cemetery, Neo-Eskimo culture, stone knives, ethnotraceological analysis
TESTING BACKED LITHIC POINTS AS PERFORATORS TO CREATE ORNAMENTS. EXPERIMENTATION RESULTS AND NEW POSSIBLE USE FROM RIPARO VILLABRUNA (BELLUNO – ITALY)

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Abstract

Riparo Villabruna (Belluno – Italy) is a small shelter at 500 m a.s.l. with Recent Epigravettian lithic industry, located in the Dolomites of Veneto region and excavated in the 1988-89. The Palaeolithic sequence starts with the level 17 where a burial (radiocarbon dated 14,400 – 13,800 cal. BP) was found and exposed during roadworks that cut the lower limbs at the level of distal femoral shafts. The buried individual was an adult male of 25 years old and 170cm tall, recognized as a hunter-gatherer for the presence of funerary goods. The dentition of this individual also documents the earliest evidence of dental caries intervention on a Late Upper Palaeolithic modern human specimen (Oxilia et al., 2015). The Epigravettian lithic industry is mostly characterized by backed points, backed bladelets, microgravettes, geometric elements, truncations and scrapers (Aimar et al., 1992). In addition, there were also found four perforated atrophic canines of red deer (Cervus elaphus). These objects look like shiny pearl and tears profile, with an undoubtable beauty. Macro-fracture analysis on backed lithic points has been performed in order to eventually evaluate the presence of projectile points as to understand the function of the archaeological site. Some backed points proved to show a differing wear pattern and experiments were performed in combination with use-wear analysis whether these traces could correspond be caused by using these points like perforators to create decorative objects. Hereby, we present the results of a new experiment and use-wear analysis of lithic backed points on atrophic canines of red deer to create ornaments. The goal is trying to define the use of the Epigravettian backed points in order to have more information about the behaviour of the hunter-gatherers at Riparo Villabruna.

Keywords: Upper Palaeolithic; Dolomites; backed point ; ornament; animal tooth
THE LEGEND OF POROSPHAERA GLOBULARIS BEADS AND THEIR
RELATIONSHIP WITH THE EMERGENCE OF SYMBOLIC THINKING
IN HUMAN PREHISTORY. A MYTH DEBUNKED

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Abstract

Because of their inherent symbolic significance, personal ornaments gained a key role in the scientific debate regarding the emergence and evolution of symbolic behavior, the presumed Acheulean beads discovered in the 19th century in northern Europe’s sites are considered crucial evidence of this. The fossils of the sponge Porosphaera globularis, because of their morphological characteristics, have been interpreted by some archaeologists as the starting point of this evolutionary path.

In this work the largest collection of Porosphaera globularis specimens is analyzed, after remaining unpublished to this day. This was originally found in the French site of Saint-Acheul and preserved at the Civic Museums of Modena. Use-wear, morphometric, geologic and cultural studies were performed, as to understand whether these fossils were actually used as beads by any pre-sapiens hominid. These integrated analysis was carried out to the results revealed that they were actually not used as ornaments. This suggests the importance of finding strong arguments and evidence to support theories about the development of cognitive abilities in the genus Homo.

Keywords: evolution of symbolic behavior; Lower Paleolithic; ornaments; symbolism; use-wear analysis; Acheulean
MIDDLE MAGDALENIAN FLINT TOOLKITS TO ENGRAVE AND SCULPT THE STONE

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Abstract

The Middle Magdalenian (19-16 ka cal. BP) is marked by a considerable increase and diversification of the art production in comparison to the Badegoulian and the Lower Magdalenian periods. The richest assemblages of portable and cave art are found in west-central France, Dordogne and the Pyrenees regions where the sites yield a diversified bestiary, human figures, and abstract representations. These artistic works can take different forms: sculpted cave walls at the Roc-aux-Sorciers, engraved portable art at La Marche, engraved and painted cave walls at the Tastet cave, and engraved portable art associated with engraved and painted cave walls at the Blanchard cave. Through the functional analysis of large and varied lithic assemblages that include over 1800 flint pieces from these four sites, we question the specialisation and the status of stone tools dedicated to the realisation of the different artistic productions. In each site, a wide range of tool types and edge shapes were used to work different mineral materials (e.g., blade fragments, burins, beaks, endscrapers), showing no functional specialisation of certain tool types in the engraving or the sculpting activities. This suggests that the technical and symbolic values were not placed in the flint tools but in the result of the art work. The wall-carving tools are frequent at the Roc-aux-Sorciers, suggesting that the realisation of the sculpted frieze had a structuring role in the status of this site. The tools used to work mineral materials are much scarcer at La Marche, the Blanchard cave, and the Tastet cave. These data allow to rethink the status of Magdalenian sites rich with cave or portable art and to replace these productions in domestic contexts where the activities related to the exploitation of the animal resources dominate.

Keywords: Middle Magdalenian; Palaeolithic art; stone tools; west-central France; Pyrenees
DRILLING DOWN THE DETAILS: FURTHERING THE INVESTIGATION ON THE PERFORATIONS OF THE NEOLITHIC STONE BEADS AND DRILLING TOOLS

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Abstract

One of the most challenging stages of the technical chaîne opératoire of stone beads is the drilling process. According to ethnoarchaeological and experimental studies, the creation of deep perforations requires fast drilling techniques, namely those involving mechanical devices such as pomp or bow drills. Stone beads with deep perforations occur since the Early instances of the Neolithic in the Near East. However, little is known about the tools used to create them. From which materials they were made, according to which sizes and morphologies? Based on the variabilities of the sections, the dimensions and the topographies of the walls of the perforations, a large range of tool types must have been employed. To go beyond the morphometric characteristics, we conducted experiments that document simultaneously the evolution of use-wear on both tools and stones during the process of drilling. The tools were flit tips, and the stones represent common varieties, of different physical proprieties, used for beads in the Neolithic Levant (serpentine, amazonite and carnelian). The results of the microscopic optical analyses conducted on the experimental collection were presented in the last AWRANA congress in Nice. In this poster, we address the second part of our analytical protocol: the characterization of the micro-textures of the experimental collection, as well as those of sampled Neolithic beads and flint drilling tools, applying confocal microscopy and metrology software. The aim is to understand how the micro-topography evolves during the drilling process on both the perforations and the flint tools despite the differences in the nature of the raw materials.

Keywords: stone beads; Neolithic; drilling tools; experimentation; confocal microscopy
THE OBSIDIAN MIRRORS A REFLECTION OF THE PAST

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Abstract

In Anatolia obsidian has been used since the 8th millennium for the production of non-utilitarian artefacts such as ornaments and mirrors. Mirrors are circular objects slightly convex with a highly reflective surface. They are rare as only 56 obsidian mirrors were found in the Near East, in five sites in Central Anatolia: Tepecik, Çatalhöyük-Est, Kayırlı Değirmenyolu, Güvercinkayası, Domuztepe and Akarçay Tepe occupied between the 8th and the beginning of the 5th millennium and one mirror has been found in the Levant at Tel Kabri. Mirrors are found in various contexts: inside graves and middens, in the infill of buildings after their abandonment, in caches, or on the surface. The study of the typology, the technology and the use-wear of the finished mirrors and preforms discovered at Tepecik allow us to reconstruct the production and diffusion of these specialized artefacts. Three different types of mirrors have been recognized. We make the hypothesis of a production of one type of mirror (the one without handle) in Tepecik, from the end of the aceramic Neolithic to the early Chalcolithic, with a regional distribution to Kayırlı Değirmenyolu and Çatalhöyük, and possibly- an extra-regional diffusion towards Akarçay Tepe. The function of the mirrors was also investigated as it remains obscure. Indeed, their surface is reflective enough to actually be used as mirror in order to deflect light, to signal, or to see oneself. Mirrors could also have been employed as burnishers for pottery or for the processing of pigments.

Keywords: Chalcolithic; obsidian mirror; Near East
PRESTIGIOUS BUT STRONGLY WORN. ANTLER COMBS IN ROMAN PERIOD

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Abstract

Antler or bone composed combs represent one of the most attractive and prestigious non-metal artefacts in grave goods of male and female graves in the Barbaricum during the Roman and Migration Period in central Europe. Despite the cremation burial ritual, they are usually sufficiently preserved to wear analyses. They proceed from rich equipped graves but also from ordinary graves. Well documented findings proceed from settlements too, including preforms and production waste, which allow an analysis of production traces and toolkits. Although archaeological context testifies they formed part of elite inventory, the majority of them show intensive and functionally specific wear. The 60-hour combing experiment proved that such use-wear corresponds with life-long use. The long-time care about, the strong relation to individual ownership, and the deposition in elite graves form coherent information about narrative importance of antler combs in Germanian society.

Keywords: prestigious artefacts; antler and bone; long life use-wear; combing experiment; Roman period
CRUSHING OCHRE IN ETHIOPIA

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Abstract

Ochre is generally found abundant in Middle Stone Age and some Late Stone Age archaeological contexts throughout the Horn of Africa and southern Africa, with evidence that the exploitation of red ochre became increasingly widespread after 100 ka. In South Omo valley, in Ethiopia, the Hamar, both men and women, still use ochre as a corporal cosmetic substance; a practice which is imbued with symbolism. Detailed reconstructions of ochre processing techniques are rare, and mostly associated with the grinding and scrapping a range of ferruginous rocks, containing iron oxide such as hematite, or hydrated iron oxyhydroxides such as goethite. This research distinguished and recorded the different extraction techniques, transformation processes and uses of several types of ochre by the Hamar. A detailed examination of the chaîne opératoire reveals that ochre use is more complex than previously thought. The different colours of ochre, the tools used, and the transformation processes differ between the two sexes and offer insights in the Hamar social construct. A functional analysis, incorporating design theory and usewear analysis, offers a better understanding of ochre use in general, applicable also in archaeological contexts.

Keywords: ethnoarchaeology; ochre; chaîne opératoire; design theory; usewear
STONE TOOLS AND THEIR ROLES IN MESOLITHIC FUNERARY RITES: THE STONE DEAD PROJECT

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Abstract

This poster introduces the AHRC-funded Stone Dead Project. The aim of this research is to explore why stone tools - artefacts often associated with utilitarian activities - were so often placed with the dead during prehistory. Stone Dead will bring a critical and new understanding of the roles stone tools played in the mortuary rites and rituals of European hunting and gathering societies by reconstructing their biographies from raw material source, manufacture and use, through to deposition. To do this, patterns of wear are being studied using tools from key burial sites.

Keywords: Lithic grave goods, hunter-gatherer, biography
A MICROSCOPE TOUR: EXPLORING DIFFERENT MICROSCOPIC APPROACHES TO DENTAL MICROWEAR ANALYSIS ON HUMAN POPULATIONS

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Abstract

Dietary reconstruction allows to make inferences about the subsistence strategies of ancient human populations, but it may also serve as a proxy to characterize diverse technological and cultural attributes of populations. Through dental microwear we can approach the physical properties of the foods consumed, or the degree of processing prior to consumption. Dental microwear analysis has a long history of use for paleodietary reconstruction. Naturally, substantial changes in the methodologies and technologies used to observe and quantify microwear have occurred. Earliest studies on human teeth were done with optical microscopy (OM) and later were replaced by scanning electron microscopy (SEM) due to some technical limitations. A more recent advance, with automatic quantification, came from the use of white light confocal microscopy together with scale-sensitive fractal analysis for dental microwear texture analysis (DMTA). From a methodological perspective, we aim to evaluate the applicability and the procedures of the three microscopes for reconstructing the diet from different Holocene populations focused on the buccal surface of the teeth.

With this in mind, we test OM against established SEM procedures applying technological improvements to OM in order to create a consistent and user-friendly method that provides good image resolution, solving the technical limitations why it was discarded. Lastly, we explore the utility of DMTA applied to buccal surfaces, a novel approach since most of the studies with DMTA have focused just on occlusal surfaces.

Keywords: Microscopy; dental microwear; DMTA; teeth; diet
INTER-TOOTH AND INTER-MAXILLA BUCCAL MICROTEXTURE VARIABILITY IN PAPIONINI PRIMATES

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Abstract

Dental microwear and 3D surface texture analyses are techniques widely used for dietary discrimination in extant mammals and reconstruction in fossil specimens. Recent studies in extant primates (Romero et al., in press) suggest that the adult’s diet is not fully achieved until the second molars is erupted and close to be in functional occlusion. This result has implications for microwear and microtexture analyses that use different teeth to infer the diet of extinct populations, that are poorly represented in the fossil register. For this reason, it is important to characterize the microtexture pattern of each tooth and to test if there are differences between maxilla (upper and lower) and teeth (premolars and molars). To do so, we have analysed 8 microtexture parameters on the buccal surface of premolars and molars, both from maxilla and mandible, from 8 known diet primate species (Theropithecus gelada, Macaca sylvanus, Papio hamadryas, Papio ursinus, Lophocebus albigena, Papio cynocephalus and Cercocebus atys). Multifactorial analyses were applied to test if there were significant differences between species, tooth and maxilla. Preliminary results indicate that while the buccal microtexture pattern can discriminate between diets, there were not major statically differences between teeth and maxilla. These results suggest that the second premolar and the first and second molars have similar microtexture patterns and would show the same dietary information in these species.

Keywords: Papionini; microtexture variability; primates; diet

References
PALAEOECOLOGICAL RECONSTRUCTION FROM THE PLIO-PLEISTOCENE SITE GUEFAÏT-4.2 (JERADA, EASTERN MOROCCO) BASED ON DENTAL WEAR ANALYSIS OF FOSSIL UNGULATES

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Abstract

The origin of Plio-Pleistocene hominin populations in North Africa has long been a conundrum. The recent findings in this territory, especially in Morocco and Algeria, are essential to understand and take part in the debate about the dispersal and ecological context of the first hominins population in this area. By contrast, the palaeoecological studies carried out in this chronology are mainly focused on eastern and southern Africa. The aim of this work is to reconstruct the palaeoecology of the large mammal species identified in the fossil locality Guefaït-4.2, characterizing the diet and habitat of the communities of herbivores through dental wear analysis and to integrate these data to understand the palaeoecological context of the first hominins in the Magreb. Dental remains of large herbivores, including the families Anancidae, Equidae, Rhinocerotidae, Suidae, Hippopotamidae and Bovidae, were studied through mesowear and microwear analyses. The two techniques provide dietary information on two different timescales: mesowear averages the diet over months or even years, while microwear reveals the diet in the last days/weeks of an animal’s life. A total of 193 molars were selected, moulded and screened under a stereomicroscope at 35× magnification. Final results were based on 110 and 56 teeth for microwear and mesowear analysis, respectively. All the ungulates from Guefait-4.2 show a wide spectrum of diets, ranging from browse-dominated and mixed feeders to pure grazers. One the one hand, the mesowear indicates low levels of abrasion for the Bovidae, an intermediate abrasion for Equidae and a relatively high
dominated mixed feeding dietary traits for Equidae and Bovidae, a grass-dominated mixed feeding for Hippopotamidae, Rhinocerotidae and Suidae and also a pure grass-feeding pattern for Anancidae. In conclusion, the results highlight niche partitioning among the large herbivores recovered at Guefait-4.2 and the availability of a wide range of resources and habitats available in the surroundings of the site.

**Keywords:** microwear; mesowear; North Africa
MICROWEAR TEXTURE METRICS ON BUCCAL ENAMEL SURFACES OF HOMININI TEETH SHOW SIGNIFICANT ASSOCIATIONS WITH DENTAL CROWN CUSP TOPOGRAPHY AND FEATURE DENSITY AND LENGTH

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Abstract

Paired correlations of molar topography parameters (MorphoTester) of occlusal crown curvature (DNE), complexity (OPCR) and relief (RFI), and 3D ISO/FDIS 25178 microtextural features on buccal enamel surfaces were analyzed on a sample of African Plio-Pleistocene hominin taxa to test for associations between the two types of 3D metrics in relation to dietary habits and biomechanics of food processing. The microtextural parameters were measured as the median of four independent observations on buccal enamel surface. Data were Log-transformed to fit normal distributions, while Log[1+parameter] was used to prevent log-transformation of negative values of textural parameters. A stepwise Linear Discriminant Analysis (LDA) of the textural variables showed that Sda, Vm, and Sal significantly discriminated between hominin species. Spearman correlation coefficients between the six selected variables (N=33) showed paired significant association for DNE-OPCR (ρ=0.463, P=0.007) and DNE-RFI (ρ=0.750, P<0.001), which is consistent with previous studies, as well as for Sal-Sda (ρ=0.722, P<0.001) and Sda-OPCR (ρ=-0.402, P=0.020), though not for Sal-OPCR (ρ=-0.305, P=0.084). High Sda values are indicative of enamel surfaces where valleys have large cross sections areas, and high Sal values represent large overlap among textural features. OPCR, a measure of occlusal crown complexity that decreases in worn-out cusps, is negatively correlated with both textural metrics which increase in worn dental crowns. These associations are consistent with larger Sda values in less complex (i.e. worn) cusps, which might be indicative of processing small, hard food particles, as in species consuming substantial amounts of abrasive plants, as small hard particles do not fracture enamel and result in smaller and shallower features. The expected association of these roughness and topographic variables with enamel microwear feature density and length, direct indications of phytoliths content in chewed foods, are also analysed.

Keywords: paleodiet; microtexture; dental topography; hominin; correlation
ON SAMPLE SIZE AND BUCCAL ENAMEL PRESERVATION IN DENTAL MICROWEAR

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Abstract

Buccal dental microwear is a dietary proxy used either in paleoanthropology and bioarchaeology. One of the main concerns in microwear studies is taphonomic alterations, that limits and reduces the size of the original sample, which in itself is usually limited. In this study, we have screened all buccal microwear studies published so far and selected only those that gave detailed information of the original dental sample and the final sample once taphonomically altered teeth have been discarded. Studies have been subdivided into three broad categories: extant primates (n=374 teeth corresponding to 11 different species), fossil hominins (n=2695 teeth corresponding to 13 different fossils species), and archaeological populations (n=438 teeth from 10 different archaeological sites spanning from the Neolithic to Medieval Age). The percentage of well-preserved teeth in extant Primates ranges from 8.8% in Colobus abyssinicus to 49% in Pongo p. pygmaeus, with an average of 33.15% for the whole Primate sample. In the case of fossil hominins (and hominids), it is observed that the percentage of preservation of buccal enamel are slightly lower, ranging between 6.4% for P. boisei and 57% for H. heidelbergensis, with an average of 23.75% for the whole hominin fossil sample. Lower fossil preservation values are to be expected given the taphonomic conditions to which they have been subjected.

In the case of archaeological populations, only two Bronze Age articles (Plaça de la Gardunya, n=442 teeth; and Mar i Muntaya; n=25 teeth) incorporate data on the initial and final dental sample. In the case of the bronze site in La Plaça de la Gardunya, 31.67% of the teeth displayed good buccal enamel. On the other hand, the evolution of the mean of the variables of the buccal microwear pattern (with special emphasis on NT) as a function of the number of teeth considered has also been analyzed. Thus, the mobile average for the NT has been calculated by adding the data one by one, to detect when the NT value stabilizes. Results indicate that, in fossil hominins, a sample of at least 15 individuals is required to have adequate NT representativeness. A similar situation is observed in Bronze Age populations. These novel results provide more information on the minimum sample size that should be considered in buccal microwear studies, emphasizing the difficulty of establishing effective paleodietary conclusions in studies with small sample sizes.

Keywords: Sample size; taphonomic alteration; buccal microwear; hominin
NEANDERTHAL BONE TOOLS FROM INSIDE, AT JONZAC, QUINA LEVEL, FRANCE

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Abstract

Although pioneering studies a century ago revealed the existence of Mousterian bone tools of various morphologies, they were forgotten and only the retouchers present in many assemblages were finally retained as (pseudo) bone tools, but seen by prehistorians to be the result of opportunistic pickings in food wastes, despite their essential role in the functioning of lithic tools. This apparent lack of a Mousterian bone industry, according to current typological standards, was interpreted as a cognitive inability of Neanderthal to perceive the specificities of the bone material and the technical opportunities it offered. This led to the point that blunt ends of herbivore ribs shaped by scraping or abrasion from two late Middle Palaeolithic assemblages were quite recently regarded as the first standardised and specialised bone tools of humankind, that predicted the coming Upper Palaeolithic. However, mentions of bone tools of this kind exist at a low level in the scientific literature, most often in the form of isolated finds, but sometimes also in sets. The recent discovery at the Chagyrskaya site in western Siberia of an undeniable Middle Palaeolithic bone industry, with a variety of tools on ribs and on blanks produced by fracturing, adjusted by retouch and scraping or abrasion, suggests that there is a part of the Mousterian technical system which has not been sufficiently explored. However, the identification of such artefacts is based on technological and traceological criteria that are difficult to understand outside a narrow community of specialists, while several decades of taphonomic research have warned against natural convergences in form. We shall see, with examples from the Quina bone industry of Chez Pinaud site at Jonzac, how X-ray microtomography can provide complementary clues to characterise the technically significant parts of the objects.

Keywords: bone industry; Neanderthal; Quina; traceology; microtomography
WEAR TRACES OF BASALT TOOLS - AN EXPERIMENTAL CASE FOR ARCHAEOLOGICAL INTERPRETATION (BATEX): A NEW PROJECT ON MICRO-WEAR STUDIES OF BASALT TOOLS

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Abstract

Basalt is one of the most common raw materials used for tool manufacture in many prehistoric sites. The widespread importance of this raw material is emphasized by its spatiotemporal ubiquity across many archaeological sites, but researchers still lack a unified methodology for assessing uses of basalt by hominins in prehistory. This is especially true for the sites of older chronologies where basalt is often the most important and sometimes the only source of information about the life and behaviour of early hominins. BaTEx aims to fill in this existing void by providing the necessary methodological framework using multiple macro- and microscopic techniques and experimentation to permit the functional analysis of basalt tools. We prevent the first results of this project and specifically focus on the experimental component. Thanks to sequential experimentation and analysis with a comprehensive functional approach combining optical and scanning electron microscopes, we are able to provide the first insights in terms of use-wear formation on basalt. We discuss the minimal use duration required for diagnostic wear to form, the characteristics of edge damage, polish, and other wear and discuss how basalt differs from other raw materials. We elaborate on the potential of BaTEx for future investigations of archaeological material. The expected impact of the project is that it will provide functional data on basalt tools allowing, for the first time, to fully study and interpret human activities at key archaeological sites including those of older chronologies, and to properly address technological issues, subsistence patterns and even behavioural and cognitive aspects of basalt assemblages, which cannot yet be faced in the current stage of research.

Keywords: Basalt; stone tool micro-wear; microscopy; experimental archaeology; Pleistocene
STONE TOOLS IN THE SUN: THE EFFECT OF UV LIGHT ON THE PRESERVATION FLINT SURFACES AND ADHESIVES

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Abstract

Functional interpretation of prehistoric stone tools is sometimes compromised by post-depositional alterations that may hinder wear and residue observations, which may complicate a reliable reconstruction of past human activities. Indeed, once discarded, stone tools are exposed to a broad range of degrading agents (before and after burial) and these may impact the preservation of use-wear and residues on their surfaces. UV light is one of the first agents potentially altering functional evidence on stone tools. Even though UV light is assumed to potentially affect stone tool surfaces, its effect on use wear and residues has never been systematically tested by archaeologists. In this poster, we present the results of an experiment in which we used a UV chamber to expose experimental tools with and without organic adhesives to UV radiation equivalent to one year of daylight and we discuss the changes observed. The results of the experiment show that flint tools and adhesives are modified due to UV light and that these changes need to be taken into account when examining and interpreting archaeological material with the help of experimental reference collections.

Keywords: Taphonomy; lithic use-wear; adhesives; UV light
COMPARATIVE STUDY OF SILICONE MOULDING MATERIALS IN ARCHAEOLOGY AND THE FORENSIC SCIENCES

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Abstract

Moulding using malleable polymerising materials such as silicone rubbers is a non-destructive, low-cost and quick method for documenting and replicating the form and/or surface topography of objects. Consequently, a range of specifically formulated silicones with varying properties such as curing time, polymerisation reaction, chemical stability, colour, hardness, pliability, rheology (e.g. fluid mechanics, viscosity, thixotropy), resolution, accuracy, or degree of shrinkage is available to professional users. This project addresses the question how replication of objects with widely used silicones and acquisition of the moulds affects the qualitative and quantitative analysis of surface topography. Joining forces with the forensic sciences as another discipline relying heavily on moulding, we compared five industrially certified metal roughness standards of different nominal roughness values to provide a reference. This permits both visual comparison of impressions under a light microscope and a quantitative comparison of surface topography via the nominal surface roughness (Ra). For the computation of Ra values, 3D measurements were acquired with a laser-scanning confocal microscope. By assessing the difference in Ra between standards and moulds (ΔRa), a performance gradient is observed between products, perhaps best described as varying accuracy and resolution under the given conditions. However, the material with the lowest ΔRa (and therefore the most suitable for laser-scanning confocal microscopy) performs far less favourably during examination using incident light microscopy, possibly due to its colour or specific contrast under the applied light source. In conclusion, the choice of the moulding material should not only consider commonly reported chemical or physical properties but also the compatibility with substrate, casting media or any other contact material, as well as the requirements for any subsequent analytical procedure to be carried out.

Keywords: Moulding; Silicone Rubber; Quantitative Analysis; Qualitative Analysis; Confocal Microscopy
QUANTIFYING USE-WEAR POLISH THROUGH 3D IMAGING SOFTWARE: FIRST RESULTS FROM A PRELIMINARY STUDY CALCULATING USAGE TIME OF NEOLITHIC SICKLES

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Abstract

Since its international development in the second half of the last century, use-wear studies have become an indispensable analytical method staple of archaeological research. The technique has often been criticized for basing results on subjective observations made by the researcher. The study presented in this paper uses the image analysis software Mountainsmap to study the development of use-wear polish on flint tools. The initial case-study uses the software to measure polish development on experimental flint blades. Based on the results from this initial study a concluding case-study is conducted to calculate usage time of archaeological flint sickles. The preliminary study shows that it is possible to gather quantitative data regarding use-wear polish using Mountainsmap and photographs taken with a camera mounted inverted metallograph microscope with a magnification of 200x. Results from case study 1 also shows that the development of use-wear polish relates to time used. In proving this, case study 1 also provides a way of calculating relative usage time of flint sickles. Results gathered in case study 2 also shows that development of polish correlates to the amount of gloss accrued from the flint sickles.

Keywords: sickle gloss; texture analysis; gloss quantification; image analysis; bifacial sickles
COPPER AGE MARBLE BEADS: AN INTERDISCIPLINARY APPROACH

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Abstract

We present the interdisciplinary approach used by “MARMO/MARBLE” research project to study the pre-protohistoric marble ornamental artefacts from Tuscany, through techno-typological, functional, petrographic and archaeometric analyses, integrated with experimental activity for the reconstruction of the production gestures and the operational sequence.

Keywords: Calcolithic; Beads; Marble; Use Wear; Tuscany
MAKE IT CLEAN: CRITICAL ASSESSMENT OF THE IMPACT OF CLEANING METHODS IN OSSEOUS ARCHAEOLOGICAL REMAINS

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Abstract

Cleaning of archaeological remains is a key step to be able to extract any information from those objects. The information we use to make assumptions about past human groups and ways of living is usually blocked behind layers of dirt, mud, concretions and similar artefacts of burial. Cleaning as a process requires a thoughtful approach in order to preserve original features while eliminating potentially damaging agents to those materials. However, there are some instances where this has not been the case, and cleaning procedures have not been sufficiently reflected upon. This is of utmost importance when trying to infer valid hypotheses from archaeological remains, since damaging the materials during cleaning could hinder our ability to extract important information to sustain any given hypotheses.

In this poster we will look specifically at the state of the art of cleaning procedures on osseous materials. To do this, we will do an overview of the different cleaning methods that are common to appear in the literature. Also, we present a brief study of how these methods have been developing over the years, and which ones are over or under represented in literature. Finally, we reflect upon the importance of conducting experimental research to truly assess which of the cleaning methods are less damaging, and how failing to do this could come at the cost of unreliability of both archaeological and taphonomic studies.

Keywords: cleaning; bones; archaeology; taphonomy; methodology
CREATING A PROTOCOL FOR NON-DESTRUCTIVE ANALYSIS OF ANCIENT ADHESIVES

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Abstract

The identification of ancient adhesive residues, is a challenging task, given the scarcity and degradation of the surviving materials. Correct identification is imperative as adhesives play an important role in reconstructing trade networks and the current debate on technological and cognitive complexity in Neandertals. The determination of biomarkers through GC-MS is the most suitable method for identifying organic residues. Since the method is destructive, it is not always appropriate for archaeological materials. Characterisation using non destructive methods is another possibility, but generally a wide range of methods is used unsystematically and it is unclear how applicable they are for adhesives (but see Monnier, Frahm, Luo, & Missal, 2017 and Prinsloo, Wadley, & Lombard, 2014), the range of techniques used varies and generally it has not been part of a systematic analysis. We are therefore attempting to create a protocol for identifying ancient adhesives non-destructively, focusing on tars. In this protocol we tested a range of methods (SEM-EDX, micro-FTIR, micro-Raman and XRD), as it is likely that a complex mixture like tar required multiple characterisation techniques. We studied three types of adhesive samples. Firstly, an experimental birch bark tar sample that was in pristine non-degraded state. Secondly, we analysed birch tar in a weathered state, resulting from a three-year-long burial experiment. Finally, we examined seven Mesolithic bone points from the Dutch North Sea (Doggerland) that contained residues, possibly tar-based. The experimental samples from the baseline from which we can interpret the results of the archaeological samples. They also assist in understanding the effect of decay and post-depositional materials on the quality of the spectra and the reliability of the identification. The analysis of archaeological materials allowed us to test our protocol. In this poster, we present the most appropriate configuration and settings for each of the methods, identifying their effectiveness in the identification of birch bark tar. Among the methods tested, we will look for complementary or redundant ones to define the optimum combination and order. The results will contribute in creating a protocol for non-destructive analysis of birch bark tar.

Keywords: residues; birch bark tar; non-destructive analysis; spectroscopy; decay
INTRODUCTION TO TRACEBOOK: AN IT SOLUTION FOR COLLECTION AND STUDY OF THE EXPERIMENTAL TRACES ON DIFFERENT MATERIALS

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Abstract

The necessity for an open-access insight into diverse experimental programmes and procedures, represented in various laboratories for use-wear and residue analysis of archaeological artefacts all over the world, was highlighted in many occasions, in conferences, workshops and in everyday correspondence between the researchers. In order to address this need, in 2019 within the collaboration between the Sapienza University of Rome and Paris 1 Panthéon Sorbonne University, and CNRS - UMR 8215 Trajectoires the idea of TRACEBOOK - a software for experimentally produced traces was born. A unique database, available to all the researchers from the field online, where the experimental protocols, traces and results would be available could serve as an important meeting point and a neutral place for fruitful discussion and exchange of both opinions and data. The focus of our project was to determine the objectives, needs and aims of such programme, to eventually find the means for its creation and finally to establish it. The work, so far, covered the first two phases, while the process of creation is still ongoing. The aim of the presentation of TRACEBOOK project is to highlight the procedure that was undertaken in the process. The most important element are the variables that are equalized, so far, for chipped stone tools, pottery, and mobile art, as three important groups of cultural remains of prehistoric societies. These variables are of utmost importance because they can represent a common language between researchers working on both technology and function of material culture of different origin. This can also be considered as an invitation to expand the list of materials in the future since the work was specifically focused on the possibility to engage different type of materials and objects.

Keywords: software; experimental archaeology; technological analysis; use-wear analysis; residue analysis
**ROBO(?)CHOP – A PURPOSE-BUILT RIG FOR CONTROLLED USEWEAR EXPERIMENTS WITH BRONZE AXE REPLICA**

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**Abstract**

Besides the expansion of a still near-exclusively low-power tool-kit, closer enquiry into use-wear formation has been identified as a key challenge for the sustained methodological development of traceological research on metal and specifically copper-based artefacts, with a particular focus on the impact of alloy composition, metallurgical structure and post-depositional transformations including corrosion and conservation. This will require some conceptual departures from recent metal-wear research, which has often – and often quite successfully – focused on offensive weaponry. While, e.g., recent experimental studies of Bronze Age combat have struck a delicate and closely- reflected balance between actualism and control (which well befits such a complex and distinctly human act as trying to kill another member of one’s species), a study of, e.g., the influence of tin content on use-wear accrual is a typical example of an enquiry into a single parameter that presupposes, by necessity, strict control of all other parameters; this will hold true for many studies of foundational aspects of use-wear formation on metal. Hence, we present, in this poster, a mechanical testing rig for replica bronze axes that has been purpose-built for addressing research questions that require strong experimental control. Based on the mechanism of a hammer mill, with each stroke triggered by the release of a weighted lever, the rig can be actuated manually or incorporated into a mechanized or automated set-up. With the axe blade swung on an arc and a contact sample mount that replicates, by swiveling on two axes and sliding back and forth on a third, the alternating strokes to a widening notch that are typical of, e.g., tree-felling or log-bucking, the rig offers an approximation of actual(istic) use not possible on general-purpose drop-towers, while the parallel development of a ‘machine-friendly’ axe replica and a counterpart for manual use permits contextualization of results through comparative experiments.

**Keywords:** use-wear experiment; experimental control; mechanical rig; bronze axes; replicability