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Quaternary International

journal homepage: www.elsevier.com/locate/quaint

Editorial

New contributions to the functional analysis of prehistoric tools



Half a century after the publication of Sergej Semenov's fundamental work "Prehistoric Technology" (1964), traceology or microscopic use-wear analysis continues to be the major method for the identification of prehistoric tool use and function. The recognition of macroscopic and microscopic wear traces as well as use-related residues contributes to various important aspects of archaeological research. Among them are relevant questions on site functions and activities carried out in prehistoric settlements or the reconstruction of archaeologically invisible components of complex tool technology, for example hafting and composite tool design. Traceology has significantly contributed to the debate on human behavioural complexity and cultural and cognitive advancement as well as other aspects of the evolution of the human cognitive capacity.

Since the establishment of the International Scientific Commission A17 on "Functional studies of prehistoric artefacts and their socio-economic influence on past societies", and particularly since the Liège Congress in 2001, its main activity has been devoted to the complex and manifold role of artefacts in human palaeoecology and the reconstruction of ancient economic systems. This implies that the reconstruction of production and use of artefacts in the past is not just the reenactment of processing of different raw materials, human activities or prehistoric technologies but a matter of understanding the evolution and adaptation of production techniques and their consequences for the people that produced and used the artefacts in a socioeconomic context. The Commission ensures that the greatest possible efforts are made to promote methodological advancement and support cutting-edge research that is aimed at widening the informative capacity of use-wear analysis, as well as establishing new data recording and relational database systems.

This volume is the result of the Commission's activities during the XVIIth UISPP World Congress from 1 to 7 September 2014 in Burgos, Spain, which included the organisation of three sessions dedicated to traceology. The first session was titled "Recent trends and aspects of use-wear analysis and their contribution to the modernization of archaeology", and was oriented on the theoretical and archaeological reasoning from which a traceological study should stem from. As well it welcomed the discussion on recent innovations aiming to overcome specific problems of the basic methodological procedures of the discipline. They included technological enhancements to improve the microscopic observations, as well as combined methodological procedures aimed to face especially difficult archaeological issues. The second session was titled "Traceological work research and experimental work",

and was the one with the highest number of contributions. The presentations focussed on the importance of the experimental works for the study of the prehistoric tool uses, complemented by ethnographic observations and technical knowledge. Here archaeologists who work in the field of microwear and residue analysis and related experimental framework presented their current research in order to contribute to methodological debate and the exchange of ideas in the discipline. The third session, entitled "Microscopic determination of hafting technology: use-wear and residues" was specifically devoted to the issue of prehistoric hafted tools, which can be identified through examples of preserved hafts (resulting from very specific sedimentary contexts or because the handle has been produced in less perishable materials such as bone and antler), through use-wear studies describing microwear produced by the haft itself or related to the use of a hafted tool, or after identification of residues used to adhere the tools to the haft. From the overall 63 oral presentations and posters presented during the congress, 21 studies were finally included as articles in the current volume.

A first group of papers specifically focused on the experimental procedures, which from the very beginning of the discipline were recognised as of fundamental importance for its development. [Skakun and Terekhina \(2017\)](#) are opening the volume debating on the significance of experimental works in research of the function of ancient tools, and present a comprehensive case study of the experimental-traceological method based on the assemblage from the site of Bodaky.

Chabot and colleagues are discussing the concept that functional studies require experimental referential according to the specific context of the sites to be investigated. Therefore, they propose a complete and specialised database based on high magnification use-wear analysis. Such a database is intended to assist the understanding of subsistence activities and to highlight lifeways, social relations and the complexity of the occupation sequence of the Northeast portion of the American continent ([Chabot et al., 2017](#)).

[Pedernana and Ollé \(2017\)](#) are discussing the study of use-wear on quartzite by means of an experimental programme based on the sequential monitoring of the process. This has the double aim of constructing a wide reference collection to serve for future interpretation of archaeological quartzite tools, and, at the same time, to improve the comprehension of the mechanical behaviour of such a particular raw material. Methodological issues regarding the combined use of optical microscopes and SEM are also evaluated.

Alvarez Soncini and Mansur (2017) introduce us to the world of polished and pecked artefacts. This is done through the highly promising preliminary results of an experimental program devoted to distinguish technological polishing and use wear traces from a series of modifications produced by different actions on volcanic rocks used by the hunter-gatherer societies of the Southern cone (Patagonia).

Galimova and Sitdikov (2017) are closing this first group of papers by presenting the experimental results on the traceological distinction between prehistoric flint scrapers and gun-lock flints. Macro- and micro-wear features, involving striking and hafted edge damage, have been used to establish criteria to distinguish actual gunflints from prehistoric flint scrapers.

Keeping the interest on the experimental works, a second group of papers deals with the residues adhered on the tools' surfaces as a source of information to investigate the activities conducted with those artefacts in order to reconstruct past human behaviours.

Xhaufclair and colleagues are presenting a method to determine the relationship between the identified residues on stone tools and the tools' actual function. Hereby, the spatial relationship between the use-wear and use-related plant residues is in detail studied on experimental tools, and also the problem of modern contamination as a possible cause of misinterpreting residues on artefact surfaces is assessed (Xhaufclair et al., 2017).

Borgia and colleagues developed a method for the detection of poisonous substances on ancient hunting weapons. Starting from current information on toxic molecules present on modern plants, and working backwards to ethnographic and historical weapons, they are subsequently looking into the analysis of archaeological materials and succeeded in identifying traces of toxic molecules with non-invasive methods as mass spectrometry and hyphenated chromatographic techniques (Borgia et al., 2017).

A third group of papers emphasizes on the lithic use-wear analysis of archaeological assemblages, sometimes combined with residue studies, from Middle Palaeolithic to later Neolithic contexts and from Aboriginal people of Australia.

Pawlik and Thissen (2017) are reporting on the activities carried out at the Middle Palaeolithic open air sites of Inden-Altendorf, in Germany, by means of use-wear, residues and spatial data. They focus their interest on selected artefacts, from which activity zones devoted to complex technologies like hafting and composite tool making have been reconstructed. These include uses like the production of synthetic adhesive (birch bark pitch), as other unusual tool uses for this period such as the processing of phytolith-rich grasses, the working of mineral materials and use of hafted projectile points.

Winiarska-Kabacińska and Kabacinski (2017) dare presenting the functional results of the Early Mesolithic site of Krzyż Wielkopolski, in Poland. There, an exceptional direct on-the-spot confrontation of traces has been recorded on bone and antler tools but also on lithic production debris in the assemblage that served for their specialised manufacturing. Among the actions identified on the flint artefacts were mainly scraping, cutting, reaming, grooving, chiselling and drilling, which correspond to the different stages of production of those organic tools.

Pichon's contribution gives way to the works devoted to the Neolithic sites. The author is presenting here the detailed functional results on the traceological analysis of sickle blades from the Syrian village of Dja'de-el-Mughara, in order to shed light on the technical and economic changes related to the first attempts of introducing agriculture in the region (Pichon, 2017).

Mateva (2017) continues with a similar subject of study, presenting the results on a analysis of a large collection of flint tools that was found during excavations of a Thracian fortress in the archaeological reserve of Sbornyanovo, Bulgaria. The Late Neolithic tools

exhibit distinctive techniques of treatment and preparation, while the observed use-wear traces indicated trends in tool production and dedicated specific uses typical for the Neolithic in this region.

In another traceological research on Neolithic contexts, Masclans and colleagues are reporting on the results of the functional study of the polished adzes and axes from the Neolithic open air site of Bòbila Madurell-Can Gambús-1-2 in Spain. With the support of experimental and ethnographic informations, traceological data are used to succeed in the interpretation of the technical and productive processes conducted at the site, as well as to shed light on symbolic and social issues in relation to the funerary contexts (Masclans et al., 2017).

The last work of this group is the one by Fullagar and colleagues, who are presenting the case study of a site in the Pilbara region, Australia, which produced an assemblage dominated by grinding and pounding tools. The results of use-wear and residue analysis show a predominance of seed-grinding, accompanied by other plant and animal processing. The authors propose a new open site type, the grinding grounds, to improve our knowledge on past settlement, subsistence and resource-use (Fullagar et al., 2017).

A fourth set of papers specifically focus on the hafting technology, from an experimental perspective and also as seen on Palaeolithic and Neolithic archaeological examples. Chen and colleagues open the section with the results of an experimental program devoted to assess the potential of a low-power approach for identifying hafting wear in quartzite tools, especially in the distinguishing between hafting and binding wear and use wear (Chen et al., 2017).

Jardón and colleagues reason that accurate use-wear analyses based on systematic experimental programs and framed in real contexts of use are needed to make progress in the identification of archaeological lithic arrowheads. In their essentially methodological work, they present a detailed set of experimental results involving copies of Mesolithic and Azilian arrows from French sites (Jardón Giner, 2017).

Clemente-Conte and colleagues are discussing the hafting issue in the archaeological quartz tools from Sierra de Capivara, Brazil. Here, hafting arrangement is identified, as well as microscopic features are considered to be hafting wear, and distinctively different from the use-wear identified on the functionally active edges of the same tools (Clemente-Conte et al., 2017).

Gibaja and colleagues are presenting a study of the exceptional assemblage of Neolithic reaping knives from the site of Egozvil 3. Techno-typological and use-wear data reveal that a two-stage reaping method was applied at the site, and the authors propose to use the harvesting techniques as a proxy to follow population movements and cultural filiations of the first European farming groups (Gibaja et al., 2017).

A final group of papers is devoted to the use-wear analysis on bone artefacts. This section begins with a contribution by Akhmetgaleeva (2017), who is presenting an analysis of bone tools, for instance needles, awls and other pointed objects from the Byki sites, Russia, where hide polish has been identified and proposed to reflect seasonality.

Still in the region of Russia but moving on to the Mesolithic, a paper by Zhilin (2017) is focusing on the bone arrowheads from the site of Ivanovskoye 7 site. The author provides a very detailed and illustrated description of the process of manufacture of bone arrowheads used for hunting, as well as the use-wear traces recorded after the microscopic analysis.

Mărgărit (2015) focuses her interest on two bone tool types common in Neolithic and Chalcolithic assemblages north of the Danube: Spatulas made on rib fragments and abraded astragali. After an experimental program devoted to test their possible use

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