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The Big Puzzle 30 Years After: A Shared, Multidisciplinary, Palaeolithic Perspective – International Workshop, Tarragona (Spain), May 9–11, 2017.

In 1987 Erwin Czesla, Sabine Eickhoff, Nico Arts, and Doris Winter organised at the Monrepos Archaeological Research Centre and Museum in Neuwied (Germany) the first International Symposium on stone tool refitting. The symposium was a reference in Prehistoric studies, highlighting the significance of refitting to understand past human behaviours (Czesla *et al.* 1990). Even though the refitting of lithic artefacts have been commonly used in stone tool analysis since the end of XIX century, it was at the end of XX century that the growing emphasis on technological and spatial issues lead to an increased and systematic application of refits in Prehistoric studies. The Monrepos symposium clearly acknowledged this method as a privileged way to understand and interpret past human behaviours and to look at settlements as dynamic entities where several human-human and human-things interactions were defining functional and social spaces. In the last 30 years, several studies have shown that the refitting of archaeological remains, including bones, is very fruitful for reconstructing site formation processes and identify technical and social events (Villa 1982, Hofman, Enloe 1992, Morrow 1996, McCall 2010, Vaquero *et al.* 2015). The enlarging of the perception of spatial and temporal relations between human activities has significantly improved behavioural archaeology (Schiffer 1975), the knowledge on how ancient hominins moved into the landscape, built economic strategies, used flexible technical systems, and organised the social space of their campsites (Schurmans, De Bie 2007, McCall 2014, Romagnoli, Vaquero 2016). Furthermore, the recent development of GIS applications and computer modelling in refitting studies is opening a new perspective on demographic and cultural long-term processes (e.g., Klyne, Boyd 2010, Kobayashi, Aoki 2012, Kuhn 2013).

The international workshop "The Big Puzzle 30 Years After", organised by Francesca Romagnoli and Manuel Vaquero, was held at the Universitat Rovira i Virgili and at the IPHES – Institut Català de Paleoecologia Humana i Evolució Social on May 9–11, 2017. The idea of the workshop arose from the need to reflect on the current state of refitting studies, to evaluate whether the expectations raised 30 years ago have been met, and to discuss new, shared pathways to manage and share the huge amount of data produced during the last three decades. It brought together researchers currently investigating human behaviours through refitting studies. They are specialists in Palaeolithic and team members of research groups with a long trajectory of studies. The workshop enabled them to present data of their ongoing researches, to share their experience, and to discuss problems and perspectives in refitting analysis. Furthermore, during discussion the participants could look at archaeological and experimental materials. Discussion focused on three main issues:

- 1) how to infer time in archaeological contexts using refit analysis,
- 2) how to optimise time in refitting,
- 3) how to generate comparable data to enhance our understanding of each specific context and to use these data to identify general trends and propose models to look at human technological, economic, and social behaviours from an evolutionary perspective.

Olaf Jöris, from the MONREPOS (Germany) presented how the meeting organised in 1987 had a crucial impact for the implementation of refitting studies in Palaeolithic contexts through theoretical reflections and practical protocols. However, the lack of standardised procedures limits in many cases the interpretation of contemporaneity and diachrony in intra-site analysis. Case studies from extensive excavations and analysis in Niederbeber and Gönnersdorf sites clearly showed the informative potential of systematic refits to interpret site formation processes and to approach the problem of time resolution in Palaeolithic contexts.



FIGURE 1: The closing discussion organised by Francesca Romagnoli and Manuel Vaquero at Institut Català de Paleoeologia Humana i Evolució Social.

Alfredo Maximiano Castillejo (Universidad de Cantabria, Spain), Adrian Evans (University of Bradford, UK), and Davide Delpiano (Università di Ferrara, Italy) discussed new methods in automating refits. Maximiano presented theoretical approaches to implement 3D stochastic computational analysis to provide an automatic or semi-automatic efficient tool. Delpiano showed how the application of 3D scanning to refitted Middle and Upper Palaeolithic cores from Grotta di Fumane and Piovesello di Cassimoreno sites (Italy) enabled to improve quantitative morpho-metrical study of the archaeological materials to investigate technological features and levels of knapper expertise. Evans presented the implemented algorithms that his research team has developed in the "Fragmented Heritage" project to process digital models of stone artefacts looking for automated refits. Their computational method has been applied to the middle-Pleistocene site of Boxgrove and to the Epipalaeolithic site of Kharaneh IV in Jordan.

Ignacio de la Torre (University College London, UK) summarised experimental and archaeological

results from studies in East Africa at Olduvai Gorge and Mieso, in Early Stone Age assemblages. The research showed the relevance of refits for understanding site formation processes in relation with flaking directionality, clustering of remains, and post-depositional disturbances.

Javier Baena (Universidad Autónoma de Madrid, Spain) applied refitting analysis to Middle Pleistocene workshop sites in Madrid region showing the relevance of this method for understanding post-depositional disturbances, variability of knapping systems, and production aims in Levallois reduction sequences.

The relevance of refitting analysis for a taphonomic understanding of an archaeological site has been also discussed by Esther López-Ortega (Universitat Rovira i Virgili – URV, Spain) applying fabric analysis of refitted elements at Atapuerca Gran Dolina site.

Jorge Machado (Universidad de La Laguna, Spain) presented results of researches at Abric del Pastor Middle Palaeolithic site. Applying stone tool refits with a spatial approach, was possible to discuss indicators to understand behavioural variability in settlement short-term occupations.



FIGURE 2: The participants in the international workshop.

Jordi Rosell (URV and IPHES, Spain) presented faunal refits at Abric Romaní discussing social interaction in food processing and sharing. Furthermore, the comparison of results along the stratigraphic sequence at the site showed different occupational patterns related with variable intensity and duration of occupation at the site.

Francesca Romagnoli (IPHES, Spain) addressed technological issues related with technical import and export events in Middle Palaeolithic. Interdisciplinary refitting and spatial analysis of stone tools allowed identifying personal toolkit transported by Neanderthals at Abric Romaní, recognising single intra-site technical events and their temporal relationship, and reconstructing variability within each knapping method. Results allowed understanding socio-economic strategies and looking at Middle Palaeolithic behavioural variability in relation with mobility and settlement patterns.

Manuel Vaquero (URV and IPHES, Spain) examined intentional intra-site mobility of lithic artefacts at Abric Romaní showing how the study of long-distance refits and the analysis of their directionality allowed discussing refuse disposal strategies, spatial and temporal functional complementarity between

activity areas, intra-site social relations, and tool recycling in Middle Palaeolithic.

Jorge Martínez-Moreno (Universitat Autònoma de Barcelona, Spain) presented Upper Palaeolithic assemblage from Cova Gran de Santa Linya. Through refitting analysis, it was possible to recognise as different products (flake, blade and bladelet) were extracted during the same reduction sequence. Results contributed to increase our knowledge of variability in Early Upper Palaeolithic blade technology.

Guido Bataille (Universität Tübingen, Germany) presented data from the Aurignacian of the Swabian Jura and characterised technical and symbolic behaviour through refitting analysis of lithic artefacts and organic remains.

Petr Neruda and Zdeňka Nerudová (Moravian Museum, Czech Republic) showed manufacturing processes of Szeletian leaf points at Moravský Krumlov IV in Moravia. Looking at refits it was possible to reconstruct the production method and define a specific Moravian early Szeletian in terms of operative schemes and searched outputs.

Claudine Karlin discussed social dynamics at the Magdalenian campsite of Pincevent. Ethnographic

studies and refitting analysis of archaeological both lithic and faunal remains led to the identification of young and inexperienced individuals in the archaeological record, to infer the duration of occupation at the site and demographic data, and to reconstruct social relationships between familiar units at this hunting site.

Finally, Xavier Roda Gilabert (Universitat Autònoma de Madrid, Spain) showed intra-site settlement patterns in Mesolithic Font del Ros site. The spatial analysis of refitted ground stone tools allowed inferring functional activity areas and social organisation of tasks.

Participants agreed that refitting analysis is a highly informative method for understanding past behaviours still today. Refits allow enlarging our understanding of economical choices and modalities of human adaptation to the environment, approaching the high degree of variability within past technical systems, identifying economical patterns, and discussing social relationships in the spatial organisation of activity. It is a privileged way to look at past communities because refits allow introducing time in Prehistory to identify phenomena at short time-scale and to study long-term dynamics including demographic aspects and cultural changes. Future perspectives in this research line must include database standardisation and accessibility to go beyond the analysis of the specific contexts and reconstruct global models based on strong empirical data.

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