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Exploring Neanderthal skills and lithic economy. The implication of a refitted Discoid reduction sequence reconstructed using 3D virtual analysis

Exploration des aptitudes et de l'économie lithique de l'homme de Néandertal. Implication d'une reconstitution de la séquence de réduction discoïde par utilisation de l'analyse virtuelle 3D

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ABSTRACT

Lithic refitting studies have consistently contributed to address two specific research aims: the intra-site mobility and identification of preferential areas or latent structures, and the in-depth analysis of the knapping technologies and core reduction strategies. Multiple refits, in particular, can produce highly detailed data on knapped stone technology. Elucidating human skills and lithic economy, a potential still rarely evaluated for Discoid technology: a stone knapping method largely spread across the Middle Paleolithic of Europe. The opportunity to explore Neanderthal knapping behavior is provided from the remarkable discovery of a primary lithic waste concentration in the Mousterian Discoid level of the Grotta di Fumane, Italy, dated to at least 47.6 ky cal BP. With a combined approach that included the 3D virtual interaction, we were able to reproduce a complete reduction sequence that supports the technological analysis conducted on the lithic assemblage. Results lead to a better comprehension of the knapper's technological and technical behavior, including the detection and quantification of economic objectives and productivity.

Mots clés :
Pierre taillée
Technologie visuelle 3D
Reconstitution
Technologie discoïde
Néandertal
Paléolithique moyen

RÉSUMÉ

Les études de reconstitution lithique ont considérablement contribué à la poursuite de deux objectifs de recherche: la mobilité intrasite et l'identification d'aires préférentielles ou de structures cachées et l'analyse en profondeur des techniques de taille et des stratégies de réduction de nucléus. Des reconstitutions multiples, en particulier, peuvent fournir des données très détaillées sur les techniques de taille des pierres. L'élucidation des aptitudes humaines et de l'économie lithique est un potentiel de ces méthodes encore rarement évalué dans la technologie discoïde: une méthode de façonnement de la pierre

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largement répandue au cours du Paléolithique moyen en Europe. L'opportunité d'explorer le comportement de taille de la pierre chez l'homme de Néandertal est fournie par la remarquable découverte d'une concentration de débris lithiques primaires dans le niveau discoïde moustérien de la grotte de Fumante, datant au moins de 47,6 ka cal BP. Une approche combinée incluant l'interaction virtuelle 3D nous a permis de reproduire une séquence compète de réduction, qui corrobore l'analyse technologique réalisée sur l'assemblage lithique. Les résultats obtenus conduisent à une meilleure compréhension du comportement technique et technologique du « tailleur de pierre », avec la détection et la quantification des objectifs économiques et de la productivité.

1. Introduction. Technological and behavioral contribution of lithic refitting; perspectives in the Middle Paleolithic of western Eurasia

Lithic tools and assemblages (the most common and preservable finds along the Paleolithic) have always been used to define culturally hunter-gatherer human groups and species. Within the Middle Paleolithic, in particular, the contrast between the apparent technical stability and the wide variety of tool sets and knapping methods attracted contributions from several scholars, each one with different analytical paths. Only in the last decades, the technological approach allowed us to investigate and understand in detail the behavioral strategies in terms of human adaptation (Bamforth and Bleed, 1997; Inizan et al., 1999; Nelson, 1991; Odell, 2001), especially when studies on knapped stones have been integrated with sourcing studies, refittings, use-wear traces, microresidue analysis, and taphonomy.

Refits in particular can produce highly detailed data on technological evolution, human skills, natural and cultural formation processes, lithic economy and human land use (Cziela et al., 1990; Delagnes & Ropars, 1996; Roebroeks, 1988; Skar & Coulson, 1986; Vaquero et al., 2007). In more recent years, the discovery of multiple refits in the European Middle Palaeolithic archaeological record has provided opportunities for direct comparison with analytic theories, also serving as a "control test" for the technological approach to the study of lithic assemblages. In this case, the use of mental refitting has thus made a fundamental contribution to the understanding of the technical gestures aiming to explore further their variability. Mental refittings should thus be confirmed if possible through real refittings, when extensive and complete, although this evidence rarely occurs and relates to specific events. Refittings may be equally useful in coming to an understanding of the more conceptual stages of flaking, such as, for example, the predetermination of flaking products. Thanks to these discoveries, it is also possible to ascertain the ramifications of the core reduction strategies, which in some cases intertwine with the exploitation of flake supports.

While, most of the refitting evidence concerns assemblages created using the Levallois method (Delagnes and Ropars, 1996; Roebroeks, 1988), a range of knapping methods were used by Neanderthals in Western Eurasia; one of the most intriguing is Discoid technology, which covers a wide range of cultural contexts (see Delagnes and Rendu, 2011; Peresani, 2003). Examples of multiple refits are rare within Discoid lithic assemblages (Carbonnel ed., 2012; Deschamps et al., 2016; Faivre, 2011; Locht & Swinnen, 1994), probably due to the spatial and temporal fragmentation that characterizes the operating chains of these industries (Turq et al., 2013), which in turn correlates to the economic behaviors that are expected of human groups with an elevated level of mobility (Delagnes and Rendu, 2011). Consistent with that observed for the Levallois, and even for the Discoid core itself, the technology provides a consistent source of first-choice products, which could be part of the toolkit of hunters aiming to maximize the potential utility-to-weight ratio.

The meaning of the word "discoid" has had a long metamorphosis from the tool to the core to the knapping method. The definition has been impacted by methodological and critical trends in lithic studies, from the typological to the technological approach, and finally experimental comparisons. In this manner, following the determination of some morpho-technical features of the cores, an elaboration of a series of technical criteria adhering to a flaking method has been determined (Boëda, 1993; Gouëdo, 1990). The new approach has made use of the analyses of noted archaeological collections, turning to the so-called mental refitting in order to reconstruct the volumetric design and architecture of core reduction. New light was shed on the method over the course the '90s and 2000. The variability of the technical criteria was better defined, leading to a more complete understanding of the complex dynamics that led to the formation of the archaeological lithic sets (Peresani (Ed.), 2003). An opportunity to explore this particular knapping technology is provided here from the remarkable discovery of a primary lithic waste concentration in the Mousterian Discoid assemblage of the Grotta di Fumane.

2. Materials and methods

2.1. The archeological context and the finding of the lithic concentration

Fumane cave is a south Alpine site well known for its Middle and Early Upper Palaeolithic sequence with Mousterian (units A11 to A5), Uluzzian (A4, A3) and Aurignacian levels (A2 to D1c) (Broglio et al., 2006; Obradović et al., 2015; Peresani, 2012; Peresani et al., 2008, 2016). Within the late Mousterian sequence, the unit A9, explored extensively in the last years, is an ensemble of thin levels and

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