Journal of Archaeological Science: Reports 19 (2018) 301–311

Contents lists available at ScienceDirect

Journal of Archaeological Science: Reports

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

Linear Pottery Culture sandstone supply strategies in north-western Europe: The example of macrolithic tool production in the Aisne Valley, France (late 6th millennium BCE)

Caroline Hamon[a,*], Gilles Fronteau[b]

[a] CNRS, UMR 8215 Trajectoires, Maison de l'archéologie, 21 allée de l'Université, 92023 Nanterre cedex, France
[b] EA3795 GEGENAA, Université de Reims Champagne-Ardenne (URCA), 2 Esplanade Roland Garros, 51100 Reims, France

ARTICLE INFO

Keywords:
Neolithic
Linear Pottery Culture (LBK)
Quartzitic sandstones
Petrography
Mechanical properties
Macro-tools
Supply strategies

ABSTRACT

Among the new technologies that emerged in the Neolithic, the development of macrolithic implements was a key technological shift which accompanied the development of food processing (querns) and craft activities (e.g. polishers). Throughout the Early Neolithic of continental Europe (Linear Pottery Culture [LBK] contexts, 5500–4900 BCE), it has been observed that sandstones (sedimentary rocks) were virtually the only resource used for the production of macrolithic blanks. Our study focuses on a particularly well documented area of the Paris Basin, located along an 80 km stretch of the Aisne valley, which was intensively occupied by LBK populations. By combining regional and local approaches (based on geological maps and field surveys) to sedimentary sandstone sources and diversity on the one hand, and a technological analysis of macrolithic production on six LBK sites on the other, we have been able to correlate accessibility and quality of sandstones with specific raw material supply and management strategies developed by LBK populations. The high resolution model of mineral resource exploitation highlights how the dependence of Neolithic people on certain specific rocks led them to develop quite complex strategies for the production of macrolithic tools, even at a local scale.

1. Introduction

The emergence of the Neolithic in the middle of the 6th millennium BCE in continental Europe was characterized by major economic and technological changes, such as the introduction of a production way of life including sedentism and farming, and major technical innovations such as ceramic production. The complete renewal of lithic technologies ("neo-lithic") constitutes one of these fundamental technological shifts that include the development of macrolithic implements used for food processing (e.g. querns) and craft activities (e.g. polishers).

Throughout the Early Neolithic of continental Europe, sedimentary sandstone was virtually the only resource used for the production of macrolithic domestic implements (Pavlu, 2000, Zimmermann, 1988, Hamon, 2006, Van Gijn and Verbaas, 2009): resources used for other categories of tools (e.g. flaked tools, adzes and maceheads) include flint, basalt, amphibolith and jadeite. Though used occasionally by Paleolithic and Mesolithic populations for the production of grinding and polishing tools, the increased attractivity of quartzitic sandstone at the beginning of the Neolithic in continental Europe (Linear Pottery Culture [LBK] contexts, 5500–4900 BCE) implied truly intensive exploitation strategies, involving the gathering of blocks from secondary alluvial sources and open-air extraction sites.

In the sedimentary plains where the first farming populations of Western Europe settled, the ubiquity and abundance of such sedimentary sandstones offered a very wide range of rocks (quartzitic sandstones, calcareous sandstones, ferruginous sandstones), with diverse mechanical properties, suitable for a wide range of activities and technical actions (grinding, abrading, and percussion). Hence, our goal is to propose a territorial view of the exploitation of sedimentary sandstone resources using a multiscale perspective, ranging from the site to the local and regional areas, balancing the weight of natural constraints and cultural choices in the circulation and "economy" of the first farming societies of continental Europe (Binder et al., 1990). In this context, our paper aims to explore strategies of sedimentary sandstone exploitation through the example of a small, archeologically well-documented region for the LBK: the Aisne Valley in the Paris Basin (France). This important area of LBK settlement in Western Europe has the benefit of a solid corpus of data regarding its internal chronological, economic and social characteristics which may have influenced the composition of domestic toolkits and technical behavior (Hachem and Hamon, 2014; Gomart et al., 2015). Furthermore, the Aisne Valley

* Corresponding author.
E-mail addresses: caroline.hamon@mae.cnrs.fr (C. Hamon), gilles.fronteau@univ-reims.fr (G. Fronteau).

https://doi.org/10.1016/j.jasrep.2018.02.049
Received 7 November 2017; Received in revised form 2 February 2018; Accepted 27 February 2018

offers high quality sandstone resources in Tertiary (Cenozoïc) sandstone levels. This region, which marks a clear geological boundary with the edge of the calcareous plateau in its eastern part, allows us to examine the consequences of limited access to sandstone resources.

Combining a geological and archeological approach, it has been possible to explore the relationship between the site locations, accessibility of the different qualities of sandstone and technical behavior of LBK populations. In this respect, our goal has been to describe the diversity of behaviors behind the apparent technical uniformity of sandstone macrolithic tool management, with reference to the "Diversity in Uniformity" concept of Moddermann (1988). Several questions have been addressed: (1) how can we express the local variety and distribution of tertiary sandstones, which sometimes present specific features? (2) How were the exploitation of raw materials and the management of stone supplies organized? (3) What kinds of strategies were developed by LBK populations in response to the stone supply constraints? (4) Were strategies and management of blanks and raw material circulation impacted by sandstone availability (5) Are there boundaries or interface areas with specific technical behaviors? And finally, (6) were these features linked to the exploitation of other mineral resources, such as flints or claystones, during the LBK?

2. Material and methods

An 80 km portion of the Aisne Valley (Paris Basin), stretching from Menneville to Soissons, was selected for the combined geological and archeological analysis. A project carried out during the 1980s and 1990s (Lithic Raw Material and Protohistoric Societies in the North of France, funded by the French Ministry of Culture, ATP project) had already identified the variety of superficial and geological formations in this area, focusing on flint, chert and sandstone resources (Blanchet et al., 1989). Later, this work was extended by local sampling carried out by archeologists from Soissons who focused on recording lithic-, soil- and claystone-resources (Pommepuy, 1999; Constantin, 1994; Allard, 2005). More recently, further sampling was carried out within the framework of studies of macrolithic tools (Hamon, 2006) and stone quarries (Devos et al., 2010; Turmel et al., 2016). These successive studies highlight the high lateral and vertical variability of the various geological formations and lithic sources, and the particular characteristics of some very small outcrops and deposits.

All grinding, polishing and percussion implements found on LBK sites in the Aisne valley are made out of sedimentary sandstones (calcareous, ferruginous and quartzitic), as are most of the macrolithic tools dated to the early Neolithic in the Paris Basin. They include querns and grinders, mainly used for the processing of cereals and pigments, hammerstones and anvils used for flint debitage, flat-, hand- and grooved polishers used in the manufacture of bone tools and ornaments, as well as handstones and burnishers used in the treatment of hides and ceramics (Hamon, 2006; Monchablon, 1999; Pommepuy, 1995).

In order to determine if the variable characteristics of the available local raw materials played a role in shaping the composition and technical characteristics of the sandstone toolkit, the macrolithic implements from 6 sites (49 domestic units) were studied, namely (from west to east) Le Culot (Missy-sur-Aisne), Le Grand Horle (Chassemy), Les Fontinettes (Cuiry-les-Chaudardes), Le Port aux Marbres (Pontavert), Le Vieux Tordoir (Berry-au-Bac), Derrière le Village (Menneville) (Fig. 1). These sites span the entire sequence of LBK occupation in the Aisne valley (5100–4900 BCE), as defined by ceramic seriation: 6 domestic units for the earliest stage, 16 units for the middle stage and 23 units for the final stage (Ilett and Hachem, 2001, Blouet et al., 2013).

The sandstone implements have been studied from petrographical, technological and functional perspectives, taking into account all stages of the tool's lifecycle, from the collection/extraction of the stone blocks to the disposal of the tools. A petrographic analysis of the raw material characteristics has been conducted in order to assess how representative the stone types are within each broad category of tools (Fig. 2). It aimed to evaluate the degree of relationship between the cohesion, porosity and granulometry of the different rock qualities, with regard to raw material management strategies and their functional destination. In this perspective, all processing stages of the shaping *chaîne opératoire* have been studied for each category of tool: the morphology and dimensions of the collected or extracted blocks, the techniques and stages of roughout manufacture (including the study of flakes), and the preparation of the working surfaces. Finally, the function and cycles of use and re-use of the tools have been examined, focusing on the degree of reshaping and re-use of the blanks.

3. Results

3.1. Sandstone resources in the alluvial valleys near the border of the Ile-de-France cuesta: the Aisne Valley example

3.1.1. Geological setting

The various sandstones existing in the Paris Basin have been the focus of intense study from the 19th century onwards. Analysis carried out by Cayeux (1906) was widely used as a reference until modern characterizations involving geochemical analysis and complete petrographic descriptions (Demars et al., 1996; Thiry, 1999; Haddad et al., 2006; Baele et al., 2012; Thiry and Milnes, 2017). These studies were linked to stratigraphical analyses of the Paris Basin and have allowed the geological formations containing sandstones to be listed and mapped at a local scale.

The study area is characterized by the transition from cretaceous chalky substrates to tertiary substrates where erosion creates an incision in the plateaus immediately to the east of Berry-au-Bac (site n°5, Fig. 1). Sandstones are not observed in massive banks or thick formations but rather as isolated masses within uncemented sands. Only sandy limestones and limestones from the Lutetian stage (Eocene) form cohesive and continuous banks that constitute a durable layer on the plateau summits. In the other geological formations, and more especially in the various sand layers, recent crystallizations punctually cement the sand: iron oxides give rise to ferruginous sandstones, whereas siliceous cements give rise to various kinds of quartzitic sandstones. These crystallizations tend to be very localized, varying from only one or two meters to a few hundred meters in length, and occur on paleosurfaces (paleosols or paleo-erosions) or near localized water courses that emerged temporarily during the Cenozoic and Quaternary Periods. According to previous authors, some of these quartzitic sandstones result from diagenetic cementation associated with the circulation of acidic water, and their facies may display paleopedological features (Baele et al., 2012; Thiry and Milnes, 2017). Similarly, ferruginous sandstones observed in the study area seem to be the result of post-depositional crystallization, often linked to the alteration of glauconite (glauconite is a mineral frequently found in marine sands).

These post-depositional evolutions of the geological sand deposits during the Tertiary and Quaternary periods are particularly significant in the context of our study because the various diagenetic processes, or more precisely telogenetics processes (Choquette and Pray, 1970), led to the development of very small deposits of sandstones, scattered in loose sand formations. We have chosen to refer to these kinds of deposits as micro-deposits, to differentiate them from the usual geological formations. These micro-deposits are very sensitive to recent erosional processes and to the impact of vegetation cover, which may result in their being exposed and made available for exploitation. Conversely, the same processes may bury or erode the micro-deposits while the geological sand layer remains untouched.

Furthermore, because our deposits are located near the extreme limit of their geological distribution, in an erosional context, it is also very common for Thanetian sandstones to occur in residual positions. They can be found over a wide area on the cretaceous chalky substrate, whereas the sand layer is totally eroded. And, in the Aisne Valley, large