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Why this revolution? Explaining the major technical shift in Southwestern Europe during the 7th millennium cal. BC

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ABSTRACT

During the course of the 7th millennium cal. BC, a major change occurred in stone-working techniques and tool types among the lithic industries of Mesolithic hunter-gatherers in North Africa and Western Europe. These mutations not only affected the function and shape of certain tools, but also modified volume management and the techniques used for blade removal. This article proposes a new exploration of this shift, which is the most important during the Mesolithic in Europe, based on the interrogation of a database of 570 sites, using very strict ordering criteria. The examination of the first occurrences of these industries region by region reveals a diffusionist process that seems to begin in North Africa (Tunisia) at the end of the 8th or the very beginning of the 7th millennium cal. BC, before spreading progressively towards the Atlantic Ocean. The data are not yet reliable enough to understand the process beyond the north of the Loire River (Northern France). It then underwent a regional stylistic diversification everywhere. This technical mutation has not been recorded for bone tools or personal ornaments. It was not accompanied by a transformation in social organization, such as for cemeteries during the Early Mesolithic. An analysis of the available data also calls into question all the economic changes sometimes evoked for these periods. Climatic change does not have a direct impact on this phenomenon. Apart from Portugal, which is on the geographic fringe of this shift, the 6200 cal. BC climatic crisis clearly occurred after this diffusion and had no direct effect on its development. On the other hand, the geographic modifications induced by the Holocene warming clearly affected the extension of this phenomenon to Western Europe, with the marine transgression.

1. Introduction

During the course of the 7th millennium cal. BC, a major shift occurred in Mesolithic hunter-gatherer stone-working techniques and tool types. It affected Northern Africa (Camps, 1975; Rahmani, 2003) and the whole European continent (Kozlowski, 1976, 2009, p. 205–210 and 526) about 1000 years before Neolithization. It mainly concerns lithic methods and techniques of production, but also affects tool types as well as certain functions.

As early as the 1920s, French archaeologists perceived a dichotomy in Mesolithic industries, between the Sauveterrian during the first phase, and the Tardenoisian during the second (Octobon, 1921; Coulonges, 1935). This chronological and cultural bipartition was then widely and very mechanically exported on the continent by European researchers, in such a way that it was no longer appropriate (Barrière, 1956, for instance). The spatial extension of the concept of Tardenoisian encompasses then too many different realities to be relevant. This was followed in the 1970s by much more regional perspectives (Fortéa Pérez, 1973; Rozoy, 1978). The Mesolithic bipartition into two successive technocomplexes remains operational within a geographic area restricted to France, Italy, and Switzerland, with a first Mesolithic (Early Mesolithic), and a second Mesolithic (Late Mesolithic), corresponding to the blade industries and trapezes discussed in this article (Perrin et al., 2009; Marchand, 2014a, b).

From 1920 to 1940, this second phase was interpreted as the manifestation of the arrival of human populations from Northern Africa, which some authors perceived as bearing animal and plant domestication, while others did not (Octobon, 1921, 1926; Vignard, 1934; Childe, 1949, p. 29). Later, J.G.D. Clark linked this mutation to the advance of the Neolithic in Europe, as it appeared to precede the latter in much the same way as some sort of poorly-defined

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signal (Clark, 1958). Other researchers suggested origins in southwest France (Barrière, 1956), in Belgium (Rozoy, 1978), in Crimea (Biagi and Kiosak, 2010), or in the Near East (Gehlen, 2010). Strong climatic impacts were assumed to be involved, in particular the 8200 cal. BP climatic event (Gronenborn, 2007; Biagi and Kiosak, 2010; Bicho et al., 2010). In spite of different causal interpretations, these works converged in defining a problem of continental amplitude, probably issued from diffusionist processes, which may or may not have been spread by population flows, and which may or may not have been generated by climatic impacts.

This article proposes a new approach to this phenomenon, which represents the most important event in the Mesolithic of Europe, based on the interrogation of a database of 570 sites, using very strict ordering criteria (Perrin et al., 2009). This approach enables us to define the contours of this shift on a very large scale, not only spatially, but also in terms of its changing dynamics during the course of two millennia. This technical rupture has been perceived for decades and mainly concerns the stone tools, which represent the most widely used material in enquiries in the field of prehistory. The investigation of other archaeological remains enables us to complete the social and economic perspectives on this "revolution". Only after that is it possible to examine the link between climatic variations and social, technical or economic domains with a sufficient degree of precision.

2. Corpus and study methods

2.1. Modifications of the Mesolithic lithic industry

The nature of the technical changes involved provides a first guide for understanding this shift. The most obvious changes observed by the first prehistorians are related to arrowheads, tools used for hunting or wars. Due to the geometric forms of these stone elements inserted into wooden arrow shafts, they are known as geometrics. Both truncations are secant in the Early Mesolithic triangles and non-secant for the trapezes of the Late Mesolithic (Fig. 1). This very marked dichotomy between these two types of points is the emblematic illustration of a much more profound change than a simple variation in shape. These two types of points were obtained using very different operative sequences and very distinct techniques. This also induces different functions: triangles were used to arm shafts as barbs and points (Philibert, 2002; Larsson and Sjöström, 2010; Chesnaux, 2013) whereas trapezes were generally hafted to the end of the shaft, in some cases as a transverse arrowhead (Nuzhnyj, 1989; Marchand, 1999). The difference in size and weight between these two groups probably entailed a difference in the shafts themselves and consequently, a probable evolution of the types and strength of the bows.

In the rest of the toolkit, the development of laterally notched blades has also been observed for decades in France (Rozoy, 1978), but also in Northern Italy (Broglio, 1975), in Spain (Fortéa Pérez, 1973), Portugal (Roche, 1972; Marchand, 2001) and in the Upper Capsian in Algeria (Camps, 1974; Camps-Fabrer, 1975). Recent use wear studies of these characteristic final Mesolithic tools have shown that they were not used as saws working in a horizontal direction. The notches are not due to use, but are the result of intentional retouch by flexion or percussion. They were used for scraping, mainly for plant materials (Gassin et al., 2013; Guéret et al., 2014). The rest of the toolkit is not very standardized and therefore not suitable for comparative studies of the two Mesolithic phases.

These clear changes in the function and shape of some tools necessitated changes in the management of knapped volumes and in the techniques applied to blade removal. During the very early Mesolithic, stone hammers, often sandstone, quartz or quartzite pebbles, or more rarely discarded flint cores, were used for knapping. During the Late Mesolithic, two new techniques emerged on the European continent, pressure (with a compressor used with a chest crutch or a shoulder crutch) and indirect percussion (with a punch). The spatial distribution of these two techniques is a little different. Pressure flaking (with no prior thermal preparation) spread along the Mediterranean shores at the same time as indirect percussion (Perrin et al., 2009; Binder et al., 2012), whereas indirect percussion developed by itself further north (Séara et al., 2002; Allard, 2007; Allard et al., in press) and along the Atlantic seaboard, from Brittany to Portugal (Marchand, 1999, 2001). As of yet, we have no explanation for this absence of pressure flaking outside the Mediterranean Basin, but this dichotomy undoubtedly points to very significant wide scale cultural divergences in Western Europe. Blade pressure flaking also developed around the Baltic Sea, but in a different context of cultural dynamics and at an earlier stage during the 9th millennium (Sørensen et al., 2013).

In any case, the products obtained by these two techniques are more regular and wider than those of the Early Mesolithic, flaked with a hammerstone. The thinner products were destined for the fabrication of arrow armatures by truncation, and the thicker products were used to make knives or notched blades.

When precise technological studies have been done, the debitage methods we can observe on cores are also new, with a predilection for the use of a narrow and flat flaking surface instead of core periphery methods (Marchand, 1999, 2009, 2014a; Séara et al., 2002). This change in technical norms towards more regular products has no unequivocal effect on acquisition economies. The use of the best quality, fine-grained flints with ample volume is relatively widespread, but is by no means a general rule. However, in some regions, such as Italy during the first diffusion stages of wide blades and trapezes, we observe a preferential selection of small flint pebbles (Briois et al., in press). In Brittany (Western France), in a geological context without flint and where its acquisition thus required long itineraries and exchanges, knappers reduced their acquisition territories and adapted their knapping systems to less suitable rocks (Marchand and Tsobgou Ahoupe, 2009). However, this research domain is subject to disparities on a continental scale; in some cases due to a lack of accurate characterization studies, and in others on account of the uniformity of the geological formations over vast surfaces (for example in the Parisian Basin). This absence of causal links between regular blade production and raw material acquisition is not paradoxical, but can be explained by the small dimensions of the intended products, which means that they can be adapted to different volumes. Flexibility was allowed by the use of a punch or a compressor.

This technical shift in the mid-Mesolithic thus involves a wide range of lithic industries, with implications for learning and *savoir-faire*, as far as the shapes and functions of certain tools are concerned. On the other hand, on a European scale, this mutation does not directly concern raw material acquisition economies, or some of the everyday tools, such as end scrapers.

2.2. Ordering of archaeological information

The investigation presented in this article concerns the sites of Southern Europe (Portugal, Spain, France, Italy) dating from the 7th and 6th millennia cal. BC. Sites in Germany, Switzerland, Belgium and the Netherlands also show this phenomenon, but beyond the Seine River, the scarcity of radiocarbon dates precludes correctly judging the possible dissemination of trapeze industries. For our technological survey, the lithic descriptors used were the trapezes, notched blades, as well as certain technical debitage aspects (indirect percussion, pressure, cores with narrow platforms). The 570 listed sites were ordered into three groups. The first comprises 5% of the corpus and includes the Mesolithic sites with a coherent stratigraphic