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Life history of a large flake biface

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ABSTRACT

Bifaces, primarily handaxes and cleavers, are the hallmark of the Acheulian techno-complex lithic industry. They spread across Africa and Eurasia during the Early to Middle Pleistocene. While many attempts have been made to define and describe the typology and technology of these tools, most focus on a single stage in their manufacture and usage, from quarry to discard. These attempts are fragmented, primarily due to the fact that at no single site are all stages of biface manufacture and use represented. An additional factor that appears to impede attempts to present the full "life cycle" of bifaces is the view of all Acheulian assemblages as belonging to a single cultural entity. While all assemblages belong to the same techno-complex, distinct stages and phases should be recognized, each different in typology, technology, and probably also in chronology. This research focuses on the large flake stage of the Acheulian. Data accumulated over many years of research from different regions are analyzed together in an attempt to present a holistic view of the life cycle of a biface. The study of particular Acheulian sites from the Levant and Western Europe enables us to reconstruct all stages of the biface, from raw material exploitation to final discard. The result is a model more comprehensive and precise than those suggested previously for understanding the Large Flake Acheulian.

1. Introduction

Acheulian bifaces have been studied by prehistorians since their discovery in Europe where handaxes were first identified as prehistoric stone tools. The earliest identification of such tools from Hoxne, Suffolk by John Frere in 1797 and later by Boucher-de-Perthes (Boucher-de-Perthes, 1864) from Somme River terraces, were supported by finds from the Manzanares River (Madrid) in San Isidro (De Prado, 1864; Wernert and Pérez de Barradas, 1925) and from the Thames Valley (Evans, 1872, 1897). Over the years, researchers have defined, described, and attempted to understand the 'biface enigma' (after Wynn, 1995). Some researchers focused on the manufacturing technology of bifaces and others on the typological definition of the tools and their significance. Many described different assemblages or collections; others suggested a regional or a holistic view of the Acheulian techno-complex. However, the full "life cycle" of a bifacial tool, from the selection and extraction of raw material at the outcrop to final discard, has been less frequently discussed (Bárez del Cueto et al., 2016; Goren-Inbar and Sharon, 2006a; Méndez-Quintas et al., 2018; Paddayya et al., 2006; Petraglia et al., 1999).

This is particularly true for the later stages in the "life" of a tool, primarily because such stages are harder to observe and identify in ancient Acheulian sites. Raw material selection strategies and acquisition have been identified and studied (e.g. Barkai and Gopher, 2009; McPherron, 2006; Sharon, 2008). The technology of biface production can be reconstructed by the tools and waste excavated at sites, with substantial support from experimental studies. However, the later stages in the life of a biface, its storage, usage, and discard are harder to reconstruct. After decades of study, we cannot even confirm the purpose for which bifaces were used. Common knowledge suggests their use in the consumption of large game (e.g. Kleindienst and Keller, 1976; Machin et al., 2007; Viallet, 2016), hence the term "Large Cutting Tools" (see discussion and references in Sharon, 2007). Beyond their actual use, bifaces are poorly understood in other aspects as well. The understanding and interpretation of the "extremely rich assemblages" are highly debatable (Wynn, 1995), as is the role of re-sharpening in biface final usage and shape (e.g. Goren-Inbar and Sharon, 2006a; McPherron, 1999, 2006). The discard of these tools is enigmatic, as most tools show almost no visible evidence of use. They seem to have been left behind when still fully usable and for no obvious reason (to our modern eyes).

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An additional issue hampering the discussion of the life cycle of bifacial tools is the tendency to look at the Acheulian techno-complex as a single entity. While all bifacial dominated early assemblages are defined as Acheulian, much variability can be identified within them. The variability is expressed in typology and technology that bear chronological and even climatic significance (e.g. Bordes, 1961; Leakey and Roe, 1994; Malinsky-Buller, 2016; Moncel et al., 2015; Roe, 1981, 2001; Sharon, 2007). The Acheulian reduction sequence can, and should, be divided into different stages or phases. The study of each stage separately will, we believe, enable a better understanding of the life history of bifacial tools and the socio-spatial organization of the human activities in each stage. In this paper we focus on the large flake phase of the Acheulian techno-complex (Sharon, 2009, 2010; Sharon and Barsky, 2015). The existence of large flake based biface assemblages signifies the presence in this Acheulian stage of complex and structured reduction processes including sophisticated raw material catchment strategies, primary production of flakes (initial *débitage*), and the application of particular shaping methods later adapted to large flake manufacture (*façonage*) processes. In order to understand the complexity of one of the most representative Acheulian expressions, we will limit and focus our analysis to these techno-cultural strategies. Such focus will allow us to propose a reconstruction of the entire life cycle of a large flake handaxe or cleaver from raw material outcrop to discard.

The definition and identification of large flake assemblages also enables us to compare sites from different regions and of different natures (quarry, workshop, home base etc.), each contributing details to a holistic view of the biface "life cycle." In this paper we compare and discuss Large Flake Acheulian (LFA) sites from two regions remote from each other, the Levant and the Iberian Peninsula. To date, the only LFA in the Levant is the assemblage from Gesher Benot Ya'aqov (GBY). The GBY assemblage comprises a long sequence of intensive occupations at the shore of the Paleo-Hula Lake in the Early Middle Pleistocene (Goren-Inbar, 2011; Goren-Inbar et al., 2000, 2018; Sharon et al., 2011). In contrast, the Iberian Peninsula has numerous LFA assemblages; unfortunately, many of them originated in disturbed contexts such as river terraces (e.g. Blain et al., 2014; Santonja and Pérez-González, 2010; Santonja et al., 2016; Santonja and Villa, 2006; Sharon and Barsky, 2015). In recent years, new excavations and studies at the Madrid Basin exposed a series of undisturbed LFA sites, many of which have been reconstructed as quarries or workshops. The comparison of data from the Levantine and Iberian LFA sites can complete the puzzle of the biface life cycle.

2. Characterizations of the Iberian and Levantine Acheulian

2.1. The Acheulian of the Iberian Peninsula

The Acheulian of the Iberian Peninsula seems to represent different lithic traditions that overlap and coexist over long periods (Bárez del Cueto et al., 2016; Falguères et al., 2006; Méndez-Quintas et al., 2018; Santonja et al., 2016; Santonja and Villa, 2006). Non-Acheulian Lower Paleolithic flake industries are found in sites like Cuesta de la Bajada (Santonja et al., 2016) and Bolomor (Blasco et al., 2008; Fernández Peris, 2007). Such assemblages are considered by some scholars as "pre-Acheulian", but the dating is debatable and the presence of non-biface assemblages in Acheulian sites such as in Notarchirico, Italy (Cassoli et al., 1999; Pereira et al., 2015; Piperno et al., 1998; Piperno and Tagliacozzo, 2001) suggests a more complex scenario. Early Acheulian sites, potentially similar to Early Acheulian sites in other regions such as 'Ubeiydia (Bar-Yosef and Goren-Inbar, 1993) or even the Early Acheulian African sites (Asfaw et al., 1992; Beyene et al., 2013), can be identified at Bois-de-Riquet in France (Bourguignon et al., 2016) and La Boella in Spain (Mosquera et al., 2016). A local evolution of pre-Acheulian industries into the Western European Early Acheulian indicated by factors such as the presence or absence of large flakes, the absence of cleavers, and the presence of larger-sized tools has been suggested (Mosquera et al., 2016; Sharon and Barsky, 2015).

Subsequent to these early stages, the Iberian Acheulian contains abundant assemblages with numerous bifacial tools. Many of these assemblages are from the fluvial contexts of river terraces, which limits the integrity of the data retrieved both in techno-typological and chronological aspects (Santonja et al., 2016; Santonja and Villa, 2006). Nevertheless, the recent excavation of several sites in primary context makes it possible to draw a general picture of the Iberian Acheulian (Santonja and Pérez-González, 2010; Santonja et al., 2016, 2017; Sharon and Barsky, 2015). The Iberian Acheulian presents variability of tool production strategies and typological expressions. It varies from classic biface assemblages with symmetric handaxes, cleavers, and organized core flaking to assemblages showing the simplest bifacial types such as pics, trifacials, and chopping tools accompanied by polyhedric core reduction (Dennell et al., 2011; Martínez and Garcia Garriga, 2016; Ollé et al., 2016; Santonja et al., 2016). Examples include Ambrona (Santonja et al., 2017), Galería y Gran Dolina (Ollé et al., 2016), La Solana (Jiménez-Arenas et al., 2011), Transfesa-Tafesa (Baena et al., 2010), Pinedo and Las Cien Fanegas (López Recio et al., 2015), Cerro (Monteiro-Rodrigues and Cunha-Ribeiro, 2014), and many others (Lhomme et al., 1998). Generally, the following observations can be suggested for the Iberian Acheulian: (1) frequent use of non-flint, coarse-grained raw material for the production of bifacial tools; (2) good representation of cleavers; and (3) presence of the LFA in the majority of its assemblages (e.g. Moloney et al., 1996; Santonja, 1996; Santonja and Villa, 2006; Sharon and Barsky, 2015).

2.1.1. The lower paleolithic of the Madrid Basin

The Acheulian of central Iberia is traditionally defined by assemblages characterized by the presence or absence of bifacial tools and Levallois technology. However, the use of typological elements to assign techno-cultural tradition must be done cautiously. Many of the assemblages come from quarrying and alluvial contexts and indicate a high degree of variability. Among other reasons, this is best explained due to raw material constraints (Baena et al., 2000).

In recent years, new Acheulian sites were discovered and excavated between the Manzanares and Jarama Rivers in the regions of El Cañaveral, Los Berrocales, and Los Ahijones (Bárez and Pérez-González, 2006). In these regions different chrono-cultural traditions can be recognized. Some sites have been reconstructed as representing short occupation occurrences, while others comprised of palimpsests and re-occupation are indicative of a more intensive occupation history. All sites in this region share a great abundance of knapping waste in a context of rich flint outcrops of Tertiary age. This richness of lithic resources is related to the wide range of knapping strategies observed at the sites. (For details on the sites' stratigraphy and chronology see the supplementary material.)

2.2. The Large Flake Acheulian of the Levant

The large flake stage of the Acheulian techno-complex was suggested by one of us (Sharon, 2007, 2010) with GBY defined as the type site of this stage. The criteria defining a site as LFA were published elsewhere (Sharon, 2007). Here we focus on other aspects of the GBY lithic assemblage, in particular those indicating the use, reuse, and discard patterns of LFA bifaces. The numerous occupation events represented within the documented 34 meter stratigraphy of GBY, which accumulated over tens of thousands of