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Did prehistoric foragers behave in an economically irrational manner? Raw material availability and technological organisation at the early Gravettian site of Willendorf II (Austria)

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ABSTRACT

Willendorf II provides the longest and best-studied MIS 3 sequence in the Middle Danube region, and represents one of the key reference sequences for this time period in Central Europe. The assemblage chosen for analysis derives from archaeological horizon (AH) 5, attributed to the period of the first Gravettian between 30 and 27 ka uncal. BP. Previous analyses were all based on a selected inventory (mainly tools and cores) derived from the 1908/1909 excavations. The discovery of labelled wooden boxes containing numerous additional artefacts from the 1908/1909 excavations at the end of the 1990s in the cellar of the Natural History Museum in Vienna considerably raises the total number of finds for all archaeological horizons, and opens new perspectives for investigating Upper Palaeolithic behavioural variability in the Middle Danube region. For the first time, all artefacts have been assigned to a raw material source area, thus providing a picture of the geographic extent of the foraging territory, and allowing for quantified observations on raw material economy and technological variability in the early Gravettian of the Middle Danube region. Willendorf II provides an excellent basis for the study of Gravettian lithic assemblage variability due to the wide array of local and nonlocal lithic resources available at varying distances from the settlement. Source provenance information and patterns of raw material use offer complementary measures of mobility. We discuss the results in the light of the concepts of “technological provisioning” developed by S.L. Kuhn. Distance to source alone is not suitable to predict and explain raw material frequencies and the character of transported technologies on nonlocal material at Willendorf II-AH5. We argue that other factors such as the degree of anticipation of foreseeable activities and occupation span might account for the observed economic patterns. Our results clearly have broader relevance for understanding assemblage variability in the Gravettian of Central Europe and further afield.

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1. Introduction

In European Upper Palaeolithic research, issues of culture history – questions of chrono-cultural grouping and technological lineages – are preeminent. Accordingly, variability in assemblage composition is typically seen as having cultural and/or chronological significance (see Clark, 2009). The formal variability of Gravettian industries is a case where variation in lithic

technological systems is considered to reflect cultural traditions to a far greater degree than it reflects trade-offs to be assessed through economic models.

In studies of Gravettian lithic variability, culture-historical causes have received considerable attention (e.g. Djindjian and Bosselin, 1994; Klaric, 2007; Otte and Noiret, 2007; Svoboda, 2007; Moreau, 2010, 2011; Pesesse, 2010; Anghelinu et al., 2012; Ríos-Garaizar et al., 2012; Djindjian, 2013; Wierer, 2013; Marreiros et al., 2015; Polanská and Hromadová, 2015). This is partly imputable to the definition and routine practice of the *chaîne opératoire* as an analytical tool (Pelegrin et al., 1988), and related with it, the underlying claim of reading the enculturated minds of

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prehistoric knappers (Audouze, 1999; Bar-Yosef and Van Peer, 2009). Quantitatively underpinned economic explanations for observed patterns in Gravettian technological variation have been less systematically examined (e.g. Montet-White, 1988; Svoboda, 1994; Arrizabalaga et al., 2014; Lengyel, 2015). However, it is easier to attempt demonstrating the inadequacy of economic models first, than to demonstrate *a priori* that historically contingent cultural constructions and biases are not the driving motivations for past behaviours (Kuhn, 2004a: 563).

In an effort to overcome some of the shortcomings in the way variability of Gravettian industries has been approached, we use lithic artifacts from archaeological horizon (AH) 5 at Willendorf II, Austria, to investigate the interaction between raw material availability and technological organisation in the early Gravettian of the Middle Danube region. Willendorf II provides an excellent basis for the study of Gravettian lithic assemblage variability due to the wide array of local and nonlocal lithic resources available at varying distances from the settlement.

By addressing the issue of raw material economy at the onset of the Gravettian this paper examines the influences of differential raw material availability on raw material frequencies, patterns of blank selection, and lithic transport. Particularly, we address lithic assemblage characteristics in the light of the following questions:

- What are the frequencies of local vs. nonlocal raw materials in the early Gravettian assemblage?
- In which stage of manufacture (reduction) were specific raw materials introduced into the site?
- Are there differences in terms of core and tool reduction intensity between raw materials from local sources compared to those from further away?

We discuss the results in the light of the concepts of “technological provisioning” developed by Kuhn (1992). We argue that distance to source alone is not suitable to predict and explain raw material frequencies and the character of transported technologies on nonlocal material at Willendorf II-AH5. Instead of concluding that early Gravettian foragers behaved in an economically irrational manner we argue that other factors such as anticipation of foreseeable activities and occupation span might account for the observed economic patterns.

2. Background

In Europe, the period between 36,000 and 30,000 calendar years ago witnessed a deep socio-economic change in human evolutionary history, which roughly coincides with the cultural change from the Aurignacian to the Gravettian technocomplex. Important new features of the period are the earliest unambiguous Upper Palaeolithic burials in Europe and the appearance of vast, intensively used open-air sites attesting patterns of increased residential stability (Soffer, 1989; Svoboda et al., 1996, 2000). It is generally agreed that the presence of such sites, interpreted as semi-permanent residential camps, is critical for the differentiation between Aurignacian and Gravettian land use strategies (Soffer, 1989; Svoboda et al., 1996, 2000). At the same time, Gravettian human remains reflect habitual burden-carrying and high levels of mobility, as is indicated by lower limb skeletal hypertrophy and proportionally long limbs relative to trunk length compared to recent (and more sedentary) Holocene human populations (Holt, 2003). Thus, Gravettian foragers seem to have adopted a behaviour combining high levels of mobility and seasonal semi-sedentism (Trinkaus, 2005). The alleged high degree of mobility in the Gravettian has been interpreted as the result of climatic fluctuations and deterioration leading towards the Last Glacial

Maximum, which may have triggered greater mobility and more extended social networks than among previous hunter–gatherer societies and hominin populations (Gamble, 1999; Svoboda et al., 2000). However, given the lack of post-cranial human remains for the previous Aurignacian (Bailey et al., 2009), the question as to what degree Gravettian foragers were actually more mobile than their Aurignacian counterparts remains difficult to assess from a physical anthropological perspective.

A significant behavioural shift occurring within this time period concerns the organization of lithic raw material economies in concert with variable blank production objectives and modalities (Floss, 1994; Féblot-Augustins, 1997, 2009; Miller and Straus, 2001; Moreau, 2009, 2010, 2012). While Late Pleistocene hunter–gatherers of both the Aurignacian and the Gravettian deployed provisioning strategies according to anticipated future needs, it is generally taken for granted that the lithic technology of the Gravettian placed higher constraints on the quality of raw materials, thus justifying higher costs of obtaining lithic raw materials when the local stone proved unsatisfactory (Svoboda et al., 1996; Féblot-Augustins, 1997, 2009).

3. Materials and methods

3.1. Site and dataset

In Central Europe, assemblages attributed to the (late) Aurignacian and (early) Gravettian based on a secure chronostratigraphical context are scarce. Willendorf II represents one of the rare suitable sites with a series of stratified archaeological horizons from both techno-complexes. The Willendorf site cluster (eight sites: Willendorf I, Willendorf I-Nord, Willendorf II to VII) is located approximately 80 km west of Vienna in the so-called Wachau, a ca. 30 km long, narrow part of the Danube valley cut deep into the geological formation of the Bohemian Massif (Fig. 1). Willendorf II (48° 19' 23.50" N, 15° 24' 15.20" E) is the only systematically excavated site of the Willendorf site cluster. It represents an open-air site situated on the western side of the valley about 15 m above the river (230 m a.s.l.). J. Szombathy, H. Obermaier, and J. Bayer from the Natural History Museum in Vienna conducted initial excavations between 1908 and 1926. The hallmark of these excavations is the discovery of the famous Gravettian Venus figurine from below AH 9 (Antl-Weiser, 2008). In 1955, F. Felgenhauer further excavated the northern part of the site (Felgenhauer, 1956–1959). In 1981, 1993, P. Haesaerts, F. Damblon and colleagues conducted geological and chronostratigraphic research on a newly opened section (Haesaerts, 1990; Haesaerts et al., 1996; see also; Nigst and Haesaerts, 2012; Nigst, 2012). From 2005 to 2011, excavations led by P. Nigst, B. Viola and G. Trnka aimed at providing new data on the timing and nature of the Middle to Upper Palaeolithic replacement in the Middle Danube region (Nigst et al., 2008, 2014).

Willendorf II provides the longest and best-studied MIS 3 sequence in the Middle Danube region, and represents one of the key reference sequences for this time period in Central Europe (Haesaerts et al., 2007; Nigst and Haesaerts, 2012; Nigst et al., 2014). The deposits at Willendorf II cover a timespan of 45 to 23 ka uncal. BP, with a long sequence of occupation phases related respectively to the Szeletian, Aurignacian, and Gravettian (Felgenhauer, 1956–1959; Moreau, 2012; Nigst, 2012). In detail, the archaeological sequence contains 11 archaeological horizons (AH) (*Kulturschichten*): from bottom to top one AH (AH 1) without specified techno-typological attribution due to the low number of finds, one Szeletian AH (AH 2), two early (AH 3, 3ab) and two evolved Aurignacian AHs (AH 4, 4a), and six Gravettian AHs (AH 5–8, 8a and 9) (Nigst et al., 2014). The lithic assemblage studied here derives from AH 5, which has been attributed to the early Gravettian based

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