Man and environment in the Palaeolithic
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Environment and Upper Palaeolithic adaptations in Moravia

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Abstract
Recently, environmental studies in Moravia concentrate on the Dolní Věstonice-Pavlov project, and the related period of 30,000 - 20,000 B.P. The sites of Dolní Věstonice, Předmostí, and the peat-bog at Bulhary were continuously studied by methods of palynology (E. Rybníčková, H. Svobodová), palaeopedology (L. Smolíková), and malacozoology (V. Lozek, J. Kovanda). The cultural layers developed in an unstable period of climatic oscillations between the relatively temperate Würmian Interpleniglacial, and the Upper Pleniglacial maximum.
Archaeology reflects changing behavioural patterns: an intensive land-use in the Aurignacien, resulting in a network of sites, and preference of marginal highlands, where deposition of the last loess cover was limited. The Gravettian, partly contemporary, is usually found in extended side-clusters under loess deposits near river valleys. By the end of the Gravettian, a horizon of sites with eastern-reminiscent artifactual elements, emerges on strategic points along the passage from the Danube valley to the North European Plain. After 20,000 B.P., the Epigravettian constitutes a thin network of small sites, mostly in sheltered valley locations. Further inter-cultural differences are observed in strategies of subsistence, raw material exploitation, and transport.

Key words: Aurignacian, Gravettian, environment, raw materials, subsistence, adaptation

Introduction

Several recent archaeological studies stressed geomorphological characters of the Moravian territory. It is considered as a system of narrow passages connecting the plains: in the north, the Moravian Gate with important Aurignacian and Gravettian settlement; in the center, the Vyškov Gate and the Napajedla Gate. In the relatively open southern plains, isolated chain of the Pavlovské Hills emerges as a marked orientation point. As a whole, the territory forms a natural corridor between the Bohemian Massiv and the Carpathians, allowing migrations from the Danube valley in the SW to the North European Plain in the NE. This function is reflected both in palaeontological record (Ložek 1991a) and in archaeological record.

This paper focuses on environment and adaptation of two Upper Palaeolithic cultures: the Aurignacian and the Gravettian. Traditionally, the Aurignacian is considered as an Early Upper Palaeolithic (EUP) culture, and the Gravettian as a Middle Upper Palaeolithic (MUP) one. However recent evidence suggest that the two cultures were partly contemporary.

Stratigraphically, the period concerned in this paper is principally correlated with soil formation representing the upper member of the soil complex PK I (Middle Aurignacian, with ^{14}C datings between 32,500 - 29,000 B.P.; Haesaerts 1990a,b; Svoboda 1991a, in press) and the deposition of the overlying loess (Upper Aurignacian and Gravettian), until the Last Glacial Maximum (20,000 - 18,000 B.P.).

During the time of coexistence of the two cultures, Moravia possibly was a territory of intergroup competition. This paper summarizes the actual knowledge of the environmental conditions (sedimentology, pedology, palaeobotany and malacozoology), and the various behavioural reactions (settlement pattern, raw material economy, and subsistence).

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Sedimentology and pedology

At Stránská skála, micromorphological investigation shows that the basal soil ranges typologically between the pararendzines and chernozems. The soil developed within a short time-span, under repeated eolian sedimentation, redeposition and sedimentation. In the subsoil, we observed horizontal movements of sediments (gelifluction) and horizontal and vertical movements of stones (formation of sorted circles), both prior to the soil formation (Czudek et al. 1991).

At Dolní Věstonice II, a stratigraphically identical soil has been classified as a weakly developed paraendzine, mixed with relics of earlier chernozem soils. Again it evolved during a short time-span, under cold and relatively dry climate. Following moister oscillations were responsible for its pseudogleyfication. At the nearby site of Milovice, on a different substrate, this soil corresponds to a weakly developed pseudogley (Smolíková 1991).

The overlying loess cover was studied in detail by Klíma (1958, 1969; Klíma et al. 1962) at Dolní Věstonice II and by Haesaerts (1990a,b) at Willendorf. Both authors observed several pseudogley horizons, eolian sand and solifluction layers within the loess. Further excavations at Dolní Věstonice repeatedly reveal further pseudogley horizons (Smolíková 1991), obviously representing periods of increased humidity rather than of increased temperature.

The Gravettian cultural layer at the Moravian sites developed during a period of limited loess deposition. It originates from anthropogenic activities, and, as shown by Smolíková, the matrix also includes soil particles. Horizontal movements (solifluction) and other deformation of this layer are visible, but archaeological features such as hearths, pits or human skeletons are little or not affected by these deformations.

Palaeobotany and malacozoology

On the basis of pollen analysis of the Stránská skála soil (Middle Aurignacian), Svobodová (1987a,b) reconstructed grass- and herbaceous steppe vegetation, where the species of Asteraceae, Chenopodiaceae and Poaceae were probably the leading plant types. Isolated islands of trees were present (AP = 16.6: *Betula, Pinus, Salix, Alnus*). At the base of the overlying loess (Upper Aurignacian) the mean AP values are roughly the same, but we may note the appearance of *Picea* and species that may indicate an increased humidity. Change to tall forb communities is observed as well (*Filipendula*, Ranunculaceae, *Polygonum bistorta, Valeriana officinalis*).

At Dolní Věstonice II, pollen analysis of the pararendzine horizon indicates a temperate climate (Svobodová 1991a). The overlying loess, including the Gravettian layer, yielded indicators of increased humidity and of a temperate environment. The AP reaches 30-70 % in the individual samples, with the dominance of conifers (*Pinus, Picea, Juniperus, Larix*), and the presence of oak, hazel, beech and others (Svobodová 1991a,b). Beech is also confirmed by charcoal samples (Kneblová 1954). Recently, an analysis of charcoal by Mason & Hather (1993) suggests even the presence of yew as an indicator of oceanic or suboceanic climate. Samples from loess overlying the Gravettian layer show that the arboreal pollen (especially pine) retains importance.

Data from the loess samples are confirmed by pollen analysis of peat samples from a core bored at Bulhary, about 6 km east of Dolní Věstonice (Rybníčková & Rybníček 1992). The section documents gradual formation of almost forested landscape shortly after 25,675 B.P. Composition of the tree species corresponds to the loess samples.

Pollen data for the Gravettian occupation at Předmostí (Svoboda et al. in press) are quite comparable to the evidence from Dolní Věstonice, even if the site is located further to the north. Share of the arboreal pollen in the Gravettian layer reaches 31 %, and decreases to 16 % in the overlying loess. It indicates the complex of grassland steppe vegetation. Altogether, the palaeobotanical data indicate a relatively temperate and humid environment during the Gravettian.

Malacozoological analysis of the Stránská skála soil (Ložek 1991b), with a loess society of the *Striata* fauna, suggests a steppe with continental, relatively cold climate. Analysis of the same soil at Dolní Věstonice II (Klíma et al. 1962; Kovanda 1991) yielded both the cold steppic societies and the climatically non-pretendous or less expressive species.

The definitely cold *Columella* fauna appears in the overlying loess with the Gravettian. In the view of malacozoology, therefore, the climate during the Gravettian seems more severe and the landscape more open.

The analysed layer developed during a longer time-span (29,000 - 25,000 B.P. after the Groningen data; 29,000 - 21,000 B.P. after data from various laboratories). We expect that this was an unstable period of smaller climatic oscillations. Furthermore, the Dolní Věstonice site is located at the limit of various altitudinal zones of the Pavlovské Hills area.

Settlement pattern and geography

The Moravian caves, intensively settled during the Middle Palaeolithic and the Magdalenian (Valoch et al. 1988), received only scarce and episodic visits by the Aurignacians and the Gravettians.

Since the EUP, the settlement pattern demonstrates an intensive land-use throughout the territory, and creation of network of sites in open landscape (Oliva 1987; Svoboda 1983; Svoboda et al. 1991). Marginal highlands at 300 - 400 m a.s.l. were prefered, enabling exploitation of a variety of altitudinal zones and environments. At favourable sites we observe superimposed reoccupations (Stránská skála). The loess deposition, however, was limited in such exposed areas and, in consequence, much of the evidence is found on the surface.

In the Gravettian, the strategy in selecting a microregion or a site differs. The Gravettian is usually found in extended sites under loess deposits near river valleys, at 200 - 300 m a.s.l. These sites are less numerous, and are aranged axially, along the main route connecting the Danube valley and the North European Plain (Willendorf, Pavlov, Dolní Věstonice, Předmostí - Svoboda et al. 1991, fig. 47). The Gravettian/Aurignacian superpositions (Willendorf, Milovice) are rather exceptions. Recent research projects, including internal analyses of the sites demonstrate that they are, in fact, horizontal clusters of separate, non-contemporary settlement units, expanded over fairly large areas. At Dolní Věstonice I and II, the occupations start downslope, closer to the rivershore (29,000 - 28,000 B.P.), and continues higher (after 28,000 B.P.).

End of the Gravettian coincides with maximal glacial advance in North Europe. A horizon of several sites with artifactual elements reminiscent of East Europe (female figurines, shouldered points) emerges on strategic places along the passage from the Danube valley to the North European Plain (Willendorf II, layer 9; Předmostí, hypothetical younger occupation; Petřkovice). Recently, the Petrkovice site was dated to 20,790 $\pm$ 270 B.P. (GrN 19540). This age corresponds to comparable sites in eastern Central Europe and East Europe. The relationships observed in the cultural inventories over fairly large areas suggest an increased mobility, possibly as an adaptive response to the climatic deterioration.

After 20,000 B.P., the Epigravettian constitutes a sparse distribution of smaller sites (Svoboda 1991a; Svoboda et al. 1991, fig. 61). These sites occupied the same microregions as in the EUP (Brno Basin, Vyškov Gate, Prostějov area), but prefered more sheltered locations. Again, most of them emerge on the surface.

Lithic raw material exploitation and use

Decrease in importance of Moravian lithic materials and increase of foreign rocks is a regular trend observed during the interval between late Middle Palaeolithic and the Gravettian (Svoboda 1983; Přichystal 1989; Kozlowski 1987). Aurignacians still occupied and exploited important local chert sources such as Stránská skála and Krumlovský Les. Imports played a certain role in areas deprived of local supply. In the Gravettian, this pattern becomes more systematic. About 60 - 90 % of raw materials originate from the flint outcrops in the Silesian glacial sediments or in the Cracovie-Czestochowa Jurassic of South Poland, and 10-30 % from the radiolarite outcrops, either in the Slovakian/Moravian borderland or in the Austrian Danube valley. It has been suggested that this pattern is due to a higher mobility and regularity of the movements along the SW-NE route. Later in the Epigravettian, imports continued to be used, but selection of the sources is less systematic.

We believe that the message reflected in these changing behavioural patterns is important. Geochemical analyses are in course in order to locate the network of lithic imports as precisely as possible.

Subsistence

Unfavourable conditions of bone preservation at most of the EUP sites in Moravia caused the actual lack of evidence on hunting during this pe-

riod. Most of the determined bones belong to horse and mammoth.

On the contrary, a huge amount of faunal material is being excavated at Dolní Věstonice, Pavlov, Předmostí and Milovice, but we lack modern analyses. Basing on the last published studies by Musil (1959a,b), the dominating species are fox, hare, reindeer, wolf and horse. New faunal research has recently been initiated by Soffer (1993).

Along the settlements, large deposits of mammoth bones were excavated (Dolní Věstonice I - Klíma 1969; Dolní Věstonice II - Svoboda 1991b; Milovice - Oliva 1989). A discussion exists whether these bones accumulated through human hunting activities, or whether they represent natural mammoth cemeteries, exploited by man for organic materials. A direct relationship between man and mammoth, in any case, is demonstrated by the terrain situations and by the contemporaneity of the settlements with the adjacent bone deposits. It is equally clear that the mammoth bone deposits disappear by the end of the Gravettian. For the Epigravettian, the site Stránská skála IV brought evidence of specialized horse hunting (Svoboda 1991a).

The question of plant exploitation receives attention as well (Klíma 1955), especially with the new evidence from recent excavations and with the newly applied methods (Mason & Hather 1993).

Concluding remarks

Changing climatical conditions and the changing modes of adaptive responses by various Palaeolithic populations represent the topic of long-term research projects. New excavations (Stránská skála, Vedrovice, Dolní Věstonice, Předmostí, Milovice) and their multidisciplinary evaluations are actually at various stages of progress. This short article points to some of the observed trends, and it refers to the data base presented in special publications and manuscripts.

Most of the available analyses reconstruct the Aurignacian and Gravettian period as a relatively temperate part of the Last Glaciation. More pretendous tree species existed during warmer oscillations and in favourable areas. The Last Glacial Maximum appeared quickly, and its direct impact in our territory is less precisely understood.

Strategies in land-use and in settlement pattern differ in the Aurignacian, Gravettian and Epigravettian. Equally variable are the ways of raw material exploitation and transport. The Gravettian model of long-distance transport is the most labour-expensive and most systematic one. Comparison of the subsistence strategies still suffer from limited data-base, especially for the Aurignacian. Even if the Gravettian model of man-mammoth relationship is unsufficiently understood, it demonstrates an intensive system of animal exploitation.

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