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RAW MATERIAL SOURCES IN EARLY UPPER PALEOLITHIC MORAVIA. THE CONCEPT OF LITHIC EXPLOITATION AREAS

ABSTRACT. — Lithic exploitation area is defined as a geographical region in the vicinity of several km from localized raw material source, or in places of concentration of non-localized raw materials, where usually numerous stone industries made prevailingly of local materials occure. Four such territories in Moravia, occupied during the Early Upper Paleolithic (EUP) period, are studied and compared from the points of view of settlement pattern, raw material economy, technology and typology. Each of the areas has at least one large main site and a structure of several smaller sites. In two of the areas (Ondratice, Stránská skála) the technology is based on the prepared flat core technique, and on the evolved Upper Paleolithic technique, while in the other two (Bořitov, Krumlov areas) the blade production from less prepared prismatic cores is more frequent. The extensively worked material from Ondratice allows detailed technological reconstructions, while the localized Stránská skála source is important for studies of intentional raw material distribution. Leaf-points are present in all four exploitation areas, Jerzmanowice-points occure in two of the main sites only and the Aurignacian elements are distributed in the main sites and in some of the smaller sites. Analogy to the stratified site of Bohunice and data from neighbouring countries allow to date the EUP settlement into the periods around the first Würmian Pleniglacial maximum (industries of the Bohunice-type), and especially into the following Interpleniglacial (Jerzmanowician elements, Aurignacian).

KEY WORDS: Lithic exploitation area — Lithic distribution area — Early Upper Paleolithic — Moravia.

INTRODUCTION

One of the possibilities of approaching the behaviour of early man is provided by the studies of stone-working technologies. The comparison of assemblages from different periods helps us to trace some of the evolutionary trends, regularities and discontinuities in this process, and reactions to environmental pressures and changes. Comparisons on one chronological level, on the other hand, may throw some light on the raw material exploitation, distribution and selection of artifacts. Patterns of early organisation of labour can also be supposed (Kozlowski, 1966).

This paper is based on the definition of the lithic exploitation area as a geographical region in the vicinity of several km from localized raw material source, or in places of concentration of non-localized raw materials, where numerous stone industries made mainly of local material usually occure. The distribution area, on the other hand, may be understood as the whole territory where a raw material of certain origin is to be found. The stone industries in the exploitation areas should be studied from the points of view of settlement pattern, raw material economy, technology and typology. In Moravia, the Early Upper Paleolithic (EUP) materials offer a unique opportunity for such studies.

Populations of this period exploited the local sources more intensively than any other Paleolithic populations. Thus the EUP occupation presents one of the most important archaeological levels preserved in the exploitation areas (the Neolithic/Eneolithic exploitation is actually under study).

In this paper we shall concentrate on four important raw material sources: the Drahany quartzites (silicified sandstones), Jurassic hornstones of Stránská skála, Cretaceous hornstones of the Boskovice furrow and hornstones from secondary position in Tertiary sedimentary rocks in the Krumlovský les Upland. Further materials, such as the Jurassic hornstones of Cretaceous (so-called Rudice type) sedimentary rocks in the Moravian Karst, menilite schists, radiolarite and rock crystal were also used, but an EUP exploitation of their sources is less known. Various rocks have been collected from secondary deposits in the glacial sediments of Northern Moravia and in the fluvial accumulations of Moravian rivers. Finally, there are some imports from other regions, but they were less important than in the later periods of the Upper Paleolithic (cf. Štelcl—Malina 1972; Valoch, 1975a; Přichystal, 1979).

Until recently, only non-representative parts of material in the lithic exploitation areas have been stratified and most of these extremely rich collections, reaching up to tens of thousands of artifacts, have been assembled on the surface. With respect to the well-known fact that the areas of raw material sources were settled several times in the prehistoric past, and even by populations of different archaeological cultures, the disadvantage of this material for the detailed chronology and systematics of the Moravian EUP is evident. From the typological point of view, the EUP complex comprises industries of the Bohunice-type, Jerzmanowician elements, Szeletian and Aurignacian. However, the limits and relations between these taxons are not always clear and an exact cultural classification, especially in the exploitation areas, becomes rather a difficult task. The only well stratified, and at the same time absolutely dated site of this period is Bohunice (Valoch, 1976a). This assemblage, made mainly of Stránská skála hornstone, proves the common occurence of the Levallois (prepared flat core) technology with leaf points, dominance of flat end-scrapers and the absence of high Aurignacian scrapers in a period earlier than is supposed for the Central European Aurignacian. Further stratigraphic evidence is expected from Stránská skála and Vedrovice.

The importance of the EUP exploitation areas is of other than chronological and taxonomical level. As there was enough raw material at place, and there was no necessity to spare it, pieces in different stages of the production process were abandoned, thus enabling technological reconstructions. It is probable that the most typical cores were exhausted completely and the present material is composed of the less perfect and misscarried artifacts. The analytical approach should not be static, as in the classical typology of stone artifacts, but dynamic (cf. literature in Schild, 1980), with respect to the logical consequences of the core preparation and extraction processes. The stages of 1. prepared raw material, 2. prepared pre-cores, 3. cores, 4. re-worked cores and 5. core residuals were defined. This process results in the production of three subsequent series of flakes (1.—3.) and, as a by-product, in several types of the special preparation and rejuvenation flakes. The combination of the core and flake analyses can help in reconstructing the complex technological process (Svoboda, 1980).

The techniques applied in EUP Moravia can be divided into three main groups: first, the prepared flat cores (a more general term including the Levallois technological principle), second, the transitional and less prepared core types (prismatic, cubical, semiglobular, with convexe back, pyramidal, with upright preparation), and third, the Upper Paleolithic cores. In the past, the terms "blade technique" and "Upper Paleolithic technique" were used almost as synonyma. However, the term blade technique is more general and it includes different methods based on prismatic and pyramidal core exploitation, used from the Lower Paleolithic to the Neolithic. By the term "Upper Paleolithic technique" we understand the preparation of special narrow core,flattened in its flanks, with extended frontal (and often also dorsal and basal) crest. The frontal crest helps in striking-off first blade, while the dorsal and basal crests could serve in fastening the core during the working process. Comparison of proportions of the three mentioned technological approaches enables to characterize the technologies used in the different exploitation areas.

Further information may be supplied by the settlement pattern studies within the exploitation areas: it shows the position of the main site, temporary "mini-sites", of the primary and secondary workshops in relation to the raw material sources. This helps us to understand the spatial organization of the working processes. The data concerning the extension of the distribution area, as well as the existence of foreign imports in the exploitation area, are also of importance. However, intentional distribution is sometimes difficult to differentiate from natural redeposition, expecially in the fluvial deposits.

Although the ethnographical evidence can never be used as direct argument, it can nevertheless provide further informations on utilitarian, but mainly on non-utilitarian aspects of human behaviour, which an archaeologist dealing with the raw materials should keep in mind (cf. Gould, 1980).

THE ONDRATICE EXPLOITATION AREA (Fig. 1, 2)

Since the end of the last century, the exploitation area of so-called Drahany-quartzites (silicified sandstones) in the vicinity of Ondratice and Otaslavice is under intensive study. This specific raw material, of lower quality for stone working, is scattered in the form of blocks on the SE slopes of the Drahany Highland, and in lower density also on the

plains of the Moravian Karst, in fluvial deposits of adjacent rivers and in the so-called "problematic" gravels of the Kelčská pahorkatina highland. It is a typical non-localized raw material source, which was probably not distributed intentionally. Although found in many EUP industries, especially in their coarse component, workshops specialized in this material are known mainly in the Ondratice area (Skutil, 1940) and in some caves of the Moravian Karst: Býčí skála (not precisely dated) and Pekárna (Late Upper Paleolithic).

FIGURE 1. *The Ondratice exploitation area (after Valoch, 1967 and Skutil, 1940). A — EUP settlement (1—7: Ondratice I—VII). B — Cumulations of the raw material blocs.*

The specific character of the Ondratice industry was first accentuated by K. Absolon. He noticed the presence of extremelly big artifacts, the so-called gigantolithism,"eine funktionelle Anpassung an verschiedene uns heute noch nicht bekannte Lebensbedürfnisse des paläolithischen Jägers" (1935/6, 5). Today, some of these pieces are regarded as special heavy-duty tools for raw material working, while others are forms of prepared raw material, pre-cores and debris.

The study of the setlement pattern shows the main Ondratice I site, surrounded by several smaller sites. The quartzite industry from Ondratice I (altogether 11 211 artifacts) was presented by J. Svoboda (1980), while the smaller assemblages of the same area were studied by K. Valoch (1967; 1975b). Apart from local quartzites, different types of hornstones (including the Stránská skála, Boskovice and even Krumlov types) and radiolarite were also used, especially in the smaller sites. Although the stratigraphic evidence is missing, an EUP age is evident both for the quartzites and hornstones. The technology of quartzite working in the site I is analogical to the stratified site of Bohunice. Typologically, part of the material can be attributed to the so-called Szeletian, but isolated spots of Aurignacian occupation must also be supposed (stations I and II). The Levallois technology and the leaf points are present in both quartzite and hornstone, but another important typological element, the Jerzmanowician points (after Chmielewski 1961) was recognized in the hornstone and radiolarite material only.

FIGURE 2. *View of the exploitation area from the Ondratice I site towards the East (numbers of sites correspond to figure 1), during excavations in 1977.*

The main interest of the quartzite material from Ondratice I lies in the relatively extensive way of its working, a feature which caused a higher share of misscarried artifacts and waste. The number of abandoned pre-cores is thus very high (385 pieces), almost as high as that of the exploited cores (494 pieces). This unusual situation enables attempts in

synchronization of the pre-core and core stage (Svoboda 1980, Fig. 32) and in reconstruction of the different techniques (Fig. 31). The technological process is characterized by the prepared flat core and blade techniques, but it shows also certain specific features. One of them is the upright preparation of the back and the striking platform on some of the globular cores, observed in 35 pre-cores and 35 cores. The same type of dorsal preparation was recognized on the Upper Palaeolithic cores with frontal crest (19pre-cores, 29 cores). This observation enables us to trace relations of the Upper Palaeolithic cores to more archaic technological approaches, such as the core with upright preparation, known since the Acheulian. In this sense, it throws some light on the origins of the Upper Palaeolithic from the technological point of view.

THE STRÁNSKÁ SKÁLA EXPLOITATION AREA (Figs. 3—5)

At the eastern vicinity of Brno, the Jurassic limestone cliff of Stránská skála is well-known as an important Lower-Middle Pleistocene paleontological site (I). Prehistoric human occupation concentrated here mainly during the EUP period. One of the reasons is the presence of hornstones in the Jurassic limestone levels (Koutek, 1926), the most important material used (about 92.1 % at the main station at Líšeň). In the same area, however, three further smaller sources of Jurrasic hornstones occure, and the Plio-Pleistocene fluvial gravels offered further types of redeposited material (Jurassic hornstones from the Moravian Karst, Cretaceous hornstones from the Boskovice Furrow, the Drahany quartzites). The radiolarites and hornstones of the Krumlov type must have been intentionally imported into the area. It should be noted that the Stránská skála and Ondratice areas accepted more foreign material importations than the other two areas *(Fig. 12)*.

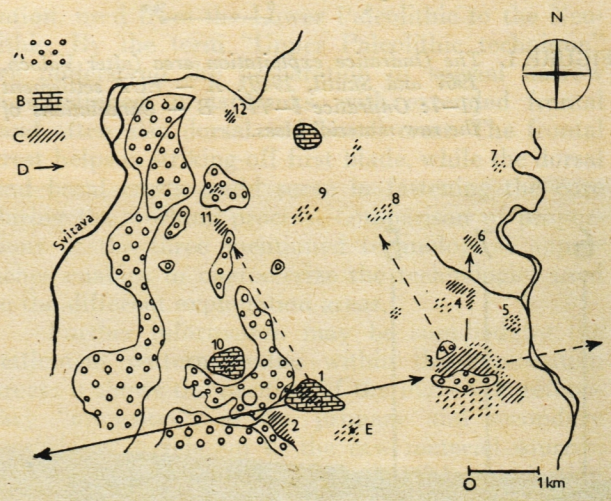

FIGURE 3. *The Stránská skála exploitation area. A — River gravels containing pebbles of different raw material (after Zeman, 1974). B — Jurassic limestone with hornstone concretions. C — EUP settlement (1: Stránská skála II, 2: Podstránská, 3: Líšeň-Čtvrtě, 4: Za zámkem, 5: Úzké, 6: Kosteliček, 7: Staré Zámky, 8: Habří, 9: Velká Klajdovka, 10: Nová hora, 11: Maloměřice-Borky, 12: Občiny), E: place of excavations 1981/82 (Stránská skála III). D — Distribution of the Stránská skála hornstone.*

The main interest of the Stránská skála source is in its limited localization. The fact that raw material is not scattered over a large territory enables to approach better the raw material economy (intentional distribution, spatial organization of the working process). Although most of the material comes from surface collections, the recent excavations by K. Valoch and J. Svoboda and relation to the stratified site of Bohunice may help to supply some chronological indications.

The first group of industries, based almost exclusively on the Stránská skála hornstone, is pre-

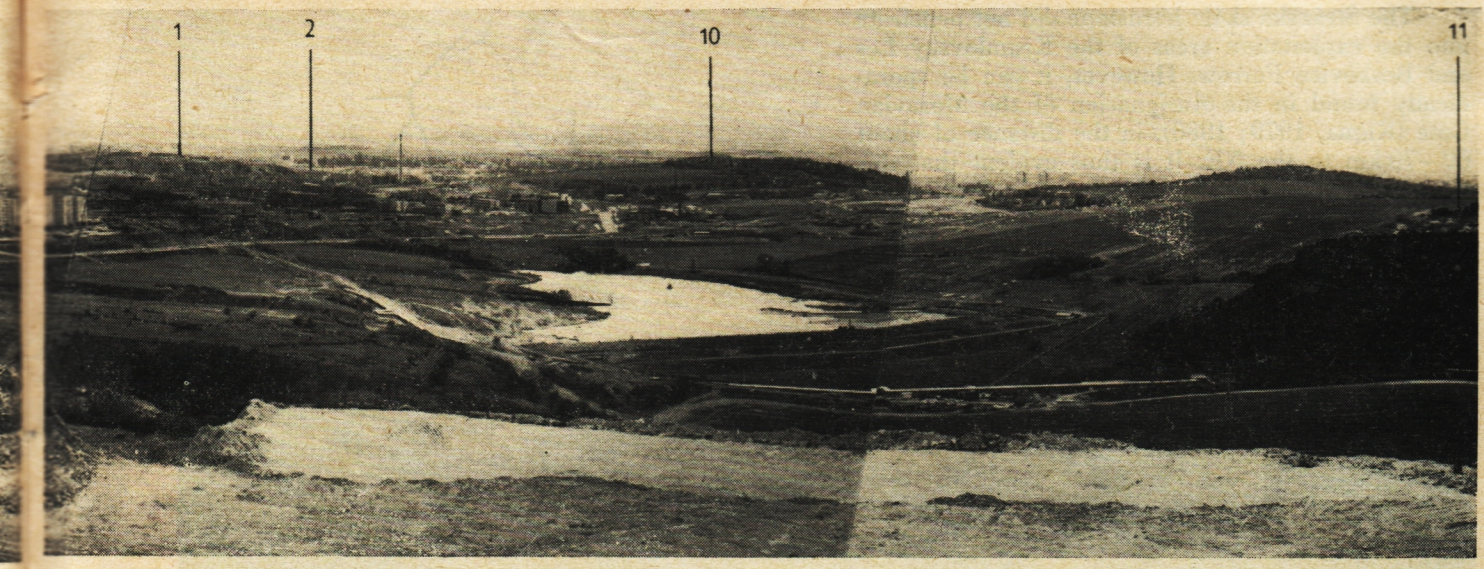

FIGURE 4. *General view of the Stránská skála exploitation area towards the South (numbers of sites correspond to figure 3).*

sented by the sites of Stránká skála II (Valoch, 1954), Podstránská (Valoch, 1974), the stations of Líšeň, but also Bohunice (Valoch, 1976a), a site located about 7 km from the source, outside the exploitation area, on the opposite outskirts of the Brno Basin. This means that the inundation river bed at the confluence of Svitava and Svratka did not present sufficient bar for the raw material transport. Industries of this group are based on the technology of prepared flat core (Levallois) with important share of the Upper Palaeolithic and other blade core types. Only at the smaller station of Stránská skála II, where the technological structure is not so expressive, the blade cores and non-typical cores dominate. The technological process of raw material working is best represented in the material of Líšeň sites, at a distance of about 2 km from the hornstone sources, while the site at the top of Stránská skála is rather of living site character. The number of artifacts collected from the Líšeň sites (total of 27,619 artifacts) suggest that the main or most frequently settled center was located here, and that this was the the place of concentration of the working precesses. Only 4.2 % of the manufactured blanks (flakes and blades) were selected for further working (retouching into tools). The prehistoric hornstone knappers were probably attracted here by the water source: the Říčka river at the eastern side of the sites. Technological analysis shows that the raw material was transported from Stránká skála in the form of knolles and debris, but also as primary worked pieces and prepared pre-cores. The transport of pre-cores is probable also in the case of the other sites (Podstránská, Bohunice). Recent excavations (Stránská skála III) document partly the primary working process near the rock extraction locals where debris, flakes, miscarried cores and other by-products dominate and where the rare tools are made from foreign rocks (radiolarite, etc.).

Typologically there are some differences between the sites of this group. The stratified industry of Bohunice was taken as the eponyme assemblage of the Bohunice-type (in the sense of Svoboda, 1980). The industry from Líšeň differs by the presence of Jerzmanowice points and industries from Podstránská and especially from Stránská skála II by the high Aurignacian scrapers. The leaf-points are present in Bohunice and Líšeň, and they are often (not always) made not of local material, but of foreign types of hornstone. In Bohunice, Podstránská and Líšeň the atypical points of the Chatelperron type occure sporadically.

It is interesting to note the more limited occurence of the Stránská skála hornstone in the Aurignacian industries of the NW part of the exploitation area, at a distance of only 3—4 km from the extraction point (sites of Maloměřice-Borky and Občiny). Their location at the river gravels of Svitava led to more intensive exploitation of this raw material basis. There is another Aurignacian site, located only about 6 km to the E from Stránská skála, with a very exceptional raw material composition: the site of Tvarožná (Valoch, 1976b). 67.78 per cent of this industry is made from radiolarite, a rare but attractive rock imported from the highlands forming the Moravian-Slovakian border (or, eventually, from the Vienna region). It is possible that Tvarožná presented a secondary distribution centre of this material for some of the sorrouding EUP stations.

Another group of industries, with a certain share of the Stránská skála hornstone material, is represented by the sites of the Bobrava valley, about 10 km to the SW, and by the site of Ondratice, 33 km to the NE. In the both regions, distribution of this raw material is connected with industries based on the flat core (Levallois) technique and the Upper Palaeolithic technique, and with the leaf-points (again, often made from other than local hornstones).

The Stránská skála hornstone did not penetrate into the exploitation areas of the Krumlovský Les and Boskovice Furrow. However, it can be sporadically found in the Aurignacian of the Moravian Gate (Klíma, 1979; 1980), in the distance of about 60—70 km to the NE. It is thus evident that this

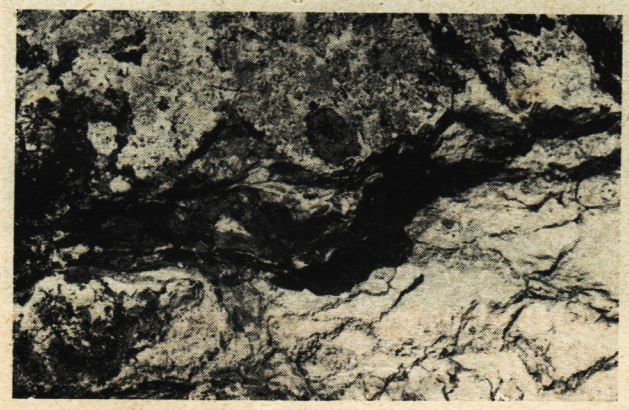

FIGURE 5. *Hornstone concretions in the Stránská skála limestone layers.*

raw material was not distributed in concentrical circles, but in a linear direction from SW to NE, along the foot of the Bohemian massif. Its distribution may be related to common technological and typological elements and to the geomorphological features of the landscape *(Fig. 12).*

THE BOŘITOV EXPLOITATION AREA
(Figs. 6—8)

Another type of honey-coloured hornstones was found in several locations in the Cretaceous deposits of the Boskovice Furrow (Zvejška, 1946) and distributed in secondary position in the river gravels, mainly of Svitava river. Industries of the exploitation area near Bořitov were discovered and collected by A. Štrof beginning with the early 70'ies. A. Štrof was able to recognize the local variety from foreign Cretaceous hornstones with the rest of pebble cortex, comming from another primary deposits further to the north. Traces of human settlement and exploitation activity continue in the same direction (Klíma, 1965). Hornstones of other types, with the exception of some pieces of Jurassic origin, were practically not imported into this exploitation area. The Drahany quartzites are rarely found, but they were probably collected from non-localized sources in the area.

Thanks to its secondary redeposition, the Cretaceous hornstones could be collected and worked in regions rather distant to the south, even if in forms of lower quality (smaller, often crackelled pebbles). Thus it is difficult to trace intentional distribution of this material. It is frequent in the

FIGURE 6. *The Bořitov exploitation area (after A. Štrof). Position of the EUP settlement (1: Bořitov-Horky, 2: Bořitov-Písky, 3: Bořitov I). The subsoil is formed by Permian and Cretaceous (Cenoman and Upper Turonian) deposits.*

FIGURE 8. *Cretaceous hornstone sources on top of the Velký Chlum mountain.*

FIGURE 7. *General view of the Bořitov exploitation area towards the West (numbers of sites correspond to figure 6).*

caves of the near-by Moravian Karst, mainly in the Micoquian levels (Kůlna). K. Valoch (1977, 1978) believes that the elements of Micoquian are present in the exploitation area of Bořitov too, and supposes a sort of symbiosis between the Late Micoquian and Aurignacian populations in this region. However, it is also possible to explain some of the "Micoquian" elements of flat surface working as current patterns of core preparation (Valoch, 1977, Fig. 6:4). The leaf-points, high Aurignacian scrapers and some typical points indicate an EUP age for the greater part, at least, of the settlement.

THE KRUMLOVIAN EXPLOITATION AREA (Fig. 9)

Pebbles of Jurassic and probably Cretaceous hornstones are found in secondary position in Tertiary (Ottnang) sediments covering the SE slopes of the granitoide Krumlovský Les Upland. One of their characteristic features is their black warnish (however, it was recently observed that similar warnish can evolve on the Jurassic hornstones of the Moravian Karst and on the Cretaceous hornstones of the Boskovice Furrow too). A. Přichystal was able to recognize two varieties (I, II) of this raw material. One of them (II) is of high quality, resembling some flints of northern origin. Both were intensively worked and distributed to other regions, including the Stránská skála and even Ondratice areas. In several locations of the Krumlovian area occure silicified breccias of unknown age (Dlabač, 1976). Importations of foreign rocks (radiolarite, Cretaceous hornstone), into the area are very rare.

Sites of this exploitation area were discovered in late 50'ies by V. Effenberger and since that time are studied by K. Valoch. Industries with higher share of coarse pieces and initially worked pebbles (Maršovice) were attributed to the "Tayacian of Fontechévade-type" (Valoch, 1960) or "Krumlovian" (Valoch, 1971), for which a Rissian or Eemian age was suggested. Another group of sites (Vedrovice and Kupařovice) was explained as Aurignacian, but, with respect to the coarser character and typological features of the industry, a very ancient one again (Lower Würmian; Valoch, 1976b). Finally, the central stations with leaf points belong to the archaic

Szeletian (Jezeřany I, II; Valoch, 1966), or to a transitional Micoque-Szeletian horizon (Oliva, 1979). This typological construction was first critisized by J. K. Kozlowski (1966 and later) with reference to the lack of stratigraphic evidence and to the fact that the "archaic" elements may be by-products of Upper Palaeolithic workshops. Since that time, our knowledge concerning the specific technology and typology of Palaeolithic workshops further evolved (Ginter, 1974). I believe that the chronological or cultural explanation of the "archaic" appearence of some of the assemblages can lead not only to an uncorrect interpretation of the Krumlovian exploitation area, but it can influence also the complicated six-phases (Valoch, 1976b) or five-phases (Oliva, 1980) classification of the Moravian Aurignacian: if the same typological criteria are applied to materials from localities within the lithic exploitation areas and outside of them the first ones will in most of cases automatically seem to be "more ancient".

Another one of the possible explanations, based on the supposed organisation of working process and on the exploitation area concept, was suggested in discussion at the UISPP colloque in 1980 (Svoboda, 1981): a model of living station or stations sorrounded by circle of specialized sites. The leaf points and coarser bifacial tools are frequent in many of the sites (Valoch, 1965), and the 1982 excavations by K. Valoch at Vedrovice will even precize their chronological position. So far, we can suppose an EUP age for most of the sites, without trying to elaborate more detailed chronological scheme of the settlement and exploitation processes.

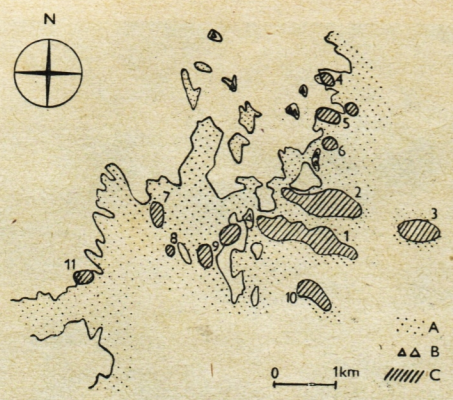

FIGURE 9. *The Krumlovian exploitation area (after Valoch, 1965 and Dlabač, 1976). A — Approximative extension of the Ottnang sediments with concentrations of redeposited hornstone pebbles in its marginal parts. B — silicified breccias. C — EUP settlement (1—3: Jezeřany I—III, 4—6: Maršovice I—III, 7—11: Vedrovice I—V). Note the central position of the two Jezeřany sites.*

FIGURE 10. *The Chmeľová moutain in the radiolarite exploitation area.*

FIGURE 11. *Radiolarites in the limestone layers of the Vršatec castle rock.*

COMPARISONS

1. *Settlement pattern.* Each of the four exploitation areas has at least one large site (stations Ondratice I, Líšeň, Bořitov-Horky, Jezeřany I—II) and a structure of several smaller sites. Example of the Stránská skála area shows that location of this main site was not influenced so much by the position of the raw material source as by factors important for permanent habitation (geomorphology, water sources) . It is not a specialized workshop only, but a combination of living and working site. The industry is characterized by a widest variety of technological processes and artifact types. Differences in relation to the smaller sites can be explained by their different function (hunting post, specialized workshop), length of occupation, but also by cultural differences (presence of the Aurignacian).

Another type of behavior seems to have been connected with the radiolarite material. An important exploitation area in the montaneous parts of Moravian-Slovakian borderland (Skutil, 1963), in elevations up to 925 m, was hardly settled in this period. The material, however, is scattered in smaller quantities in many of the EUP industries in and outside Moravia, and concentrated at Tvarožná. It was more intensively worked and retouched than materials from sources easier of access. Before trying to explain these features, more detailed studies of this raw material distribution with respect to its other possible sources (Vienna region) should be realized.

2. *Technology.* When comparing complex technologies of the four exploitation areas, we can recognize two technological groups among them. In the technology of the Stránská skála and Ondratice areas, the prepared flat core (Levallois) technique plays a more important role (42.3 % in Líšeň, 52.5 per cent Stránská skála III, 36.2 % in Bohunice, 39.2 % in Ondratice), but evolved Upper Palaeolithic cores are also present (17.8 % in Líšeň, 12.5 per cent in Stránská skála III, 14.4 % in Bohunice and 6.8 % in Ondratice). It seems that the appearence of the Levallois and Upper Palaeolithic techniques is connected with the Stránská skála hornstones and Drahany quartzites mainly (technology of the Bohunice-type). The qualitative differences between both materials, which are quite important, influenced only slightly the technology: the upright preparation of the core back seems to be typical of the quartzite industries, while the evolved Upper Palaeolithic cores with dorsal and basal crests are most frequent in the Stránská skála hornstone. In the hornstone material, the dimensions of flakes and blades are smaller (see also Allsworth-Jones in Valoch, 1976a), number of flakes of the 3. (last) series is higher and their striking platform preparation is finer. However, the technological principle is always the same.

Although the materials from the Krumlovian and Bořitov regions are not so numerous, important qualitative differences may be stated. The flat cores become more rare and the most frequent are intermediary and non-prepared core types. The role of blade technology is stressed, but especially on the basis of surfacially less prepared prismatical cores. This mainly led K. Valoch and M. Oliva to look in the Krumlovian region for the origins of Aurignacian (and even Szeletian). It should be proved, however, that these materials are really older than the other Aurignacian assemblages.

Technological differences between the both complexes are certainly not influenced by the character and qualities of raw material: if the Cretaceous hornstones from Boskovice furrow penetrated to the Stránská skála or Ondratice exploitation areas, they were worked by the same way as the local materials.

3. *Typology.* A higher share of side-scrapers, often of the Mousterian type, (36.9 % in Ondratice, 15.7 % in Líšeň, 36.5 % in Jezeřany, about 48 % in Bořitov I) and, less pregnantly, of notches and denticulated tools (8.1 % in Ondratice, 11 % in Líšeň) is a typical common feature of the raw material exploitation areas (see Ginter, 1974). The typological comparison (in a brief summary) is engaged in three more important elements: the leaf-points, Jerzmanowice-points and high Aurignacian scrapers.

The leaf-points are present in all four exploitation areas, usually concentrated at the main settlement station, rarely in workshops (Vedrovice, excavations by K. Valoch). Their chronological and cultural importance, however, seems to have been overestimated by the past studies. They are not indicators of one single culture (Solutrean or Szeletian), but a common expression of populations inhabiting the Central Europe and Balkans during the time-span ranging from Mousterian to the EUP. In Moravia, leaf-points are found in the Mousterian cultures, in industries of the Bohunice-type, in the Szeletian, Aurignacian and even Pavlovian, and no morphological difference or evolution of form can be traced. Thus the hypothesis of M. Oliva (1979) that the Bohunician people got their leaf-points by "ramassage" or barter trade from the Szeletian people is rather schematical. The massive bifacial forms found in the exploitation areas are not intrusions of Middle or Lower Palaeolithic origin, as they are often explained, but an integral part of the specialized leaf-point production.

Points of the Jerzmanowice-type and related forms with ventro-terminal retouch seem to be a more sensitive typological element. In Moravia, they are found in the large surface stations at the raw material sources (Líšeň and Ondratice), while in the W, NW and NE neighbourhood, and mainly at the southern margins of the North European Plain, their appearence is limited to smaller cave assemblages (the Kačák-Cave in Bohemia, Altmühlian of South Germany, Ilsenhöhle in the GDR and the so-called Jerzmanowician of South Poland). Despite the fact that these points appear later in Eastern Europe, probably in a different cultural context, their occurence in Central Europe is concentrated to the end of the first Würmian Pleniglacial (?), but especially to the following Interpleniglacial (Bosinski, 1967, 63; Mania, 1975, 122; Madeyska, 1979; Kozlowski-Kozlowski, 1977, 106).

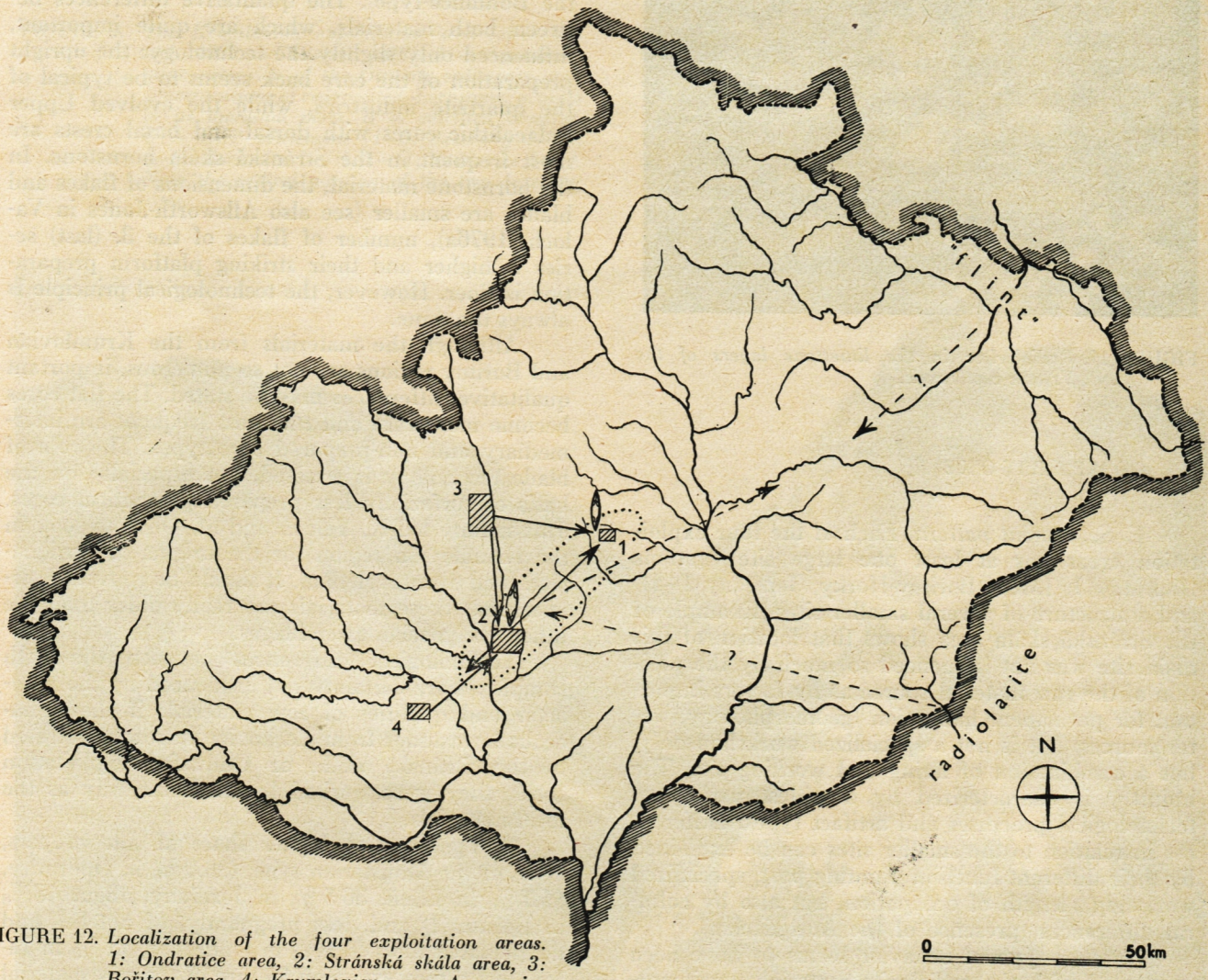

FIGURE 12. *Localization of the four exploitation areas. 1: Ondratice area, 2: Stránská skála area, 3: Bořitov area, 4: Krumlovian area. Arrows indicate transport (both intentional and natural) of local materials among the exploitation areas. The dotted line shows extension of the Bohunice-type technology. Occurences of the Jerzmanowice-points are indicated.*

Especially the relations between the Polish Jerzmanowician assemblages and between the two Moravian stations (Líšeň and Ondratice) could reflect a sort of seasonal movements in the SW-NE direction. It is suggested that the hunters of this period concentrated in the exploitation areas on the SE slopes of the Bohemian Massif. Seasonally, they could have penetrated along the slopes of the Bohemian Massif through the Moravian Gate up to the borders of North European Plain, where specialized stone tool assemblages with an important share of points (hunting posts?) were left in some caves. The linear distribution of Stránská skála hornstone from the Bobrava region to the Moravian Gate could support the hypothesis on EUP movements in this direction *(Fig. 12)*. Possibilities of further raw material exchange between Poland and Moravia in the EUP were not yet studied in detail, but the typical radiolarites of Moravian-Slovakian origin were already recognized in the Polish Jerzmanowician (Chmielewski, 1961).

The typical high end-scrapers (and some types of burins) are common in both Aurignacian and Szeletian, but absent in Bohunice. They were found in varying quantities in all the four exploitation areas. In the main stations of Líšeň and Ondratice, where several occupation phases must be supposed, they occure sporadically, but concentrate at some of the smaller isolated sites without leaf-points (Stránská skála II, Maloměřice Občiny and Borky, Ondratice II, etc.). They are well represented at some sites of the Bořitov and Krumlov areas. Thus we believe that the Aurignacian occupation presents an independent event in the EUP raw material exploitation, but it is often difficult to separate it in the material.

POSSIBILITIES OF DATING

In the exploitation areas of Stránská skála and Ondratice a longer time-span occupation is supposed, covering probably the whole EUP interval. The technological basis corresponds to the definition of the Bohunice-type, while in the typology further elements such as the Jerzmanowician points occure. In several spots, indications of the Aurignacian settlement are observed.

Thus in the absolute chronology we can use radiocarbon data from Bohunice (42,900 +1,700—1,400 B. P.; 41,400 +1,400—1,200 B.P.; 40,173 ±1.200 B.P.; Mook and Switsur in Valoch, 1976a) and the data for the oldest Jerzmanowician with leaf-points from the Nietoperzowa Cave, level 6 (38,160 ±1,250 B.P., Kozłowski—Kozłowski, 1977). The time-span corresponds geochronologically to the phase; Königsaue II-III (Mania—Toepfer, 1973), or to the interstadials of Moershoofd (?) and Hengelo. These more temperate climatical oscillations are separated by a period of maximum cooling and humidity decline, characterizing the first arctic phase of the Pleniglacial, and accompanied by fully evolved fauna of loessic steppes (Mania, 1973; Madeyska, 1979). As there is no direct evidence that populations inhabiting Central Europe would adapt themselves to the extreme conditions of the Pleniglacial, it is more likely to connect the settlement with the two interstadial oscillations, and to suppose a continuity into the following Interpleniglacial. Supplementary data are expected after the evaluation of the recent excavations at Stránská skála III (K. Valoch, J. Svoboda) and Vedrovice (K. Valoch).

For the Aurignacian settlement we can, in the broad outline, accept the datings summarized by J. Hahn (1977) and the new data from Geissenklösterle (36,540 ±1,570 to 31,870 ±1,000 BP., Laville—Hahn, 1981) suggesting an Interpleniglacial (Middle Würmian) age. We are prepared to accept even the existence of Lower Würmian Aurignacian (Valoch, 1976b, Oliva, 1980), if the appropriate evidence will be presented for Moravia, or if the Istállóskö (Hungary) date of 44,300 ±1,900 B.P. and its Aurignacian classification will be confirmed.

In this connection we must mention further radiocarbon data from Moravia, coming from settlements of different character. For level 7a of the Kůlna Cave we have data between 45,660 to 38,600 B.P. (Valoch, 1980), related to the Central European Micoquian and to the anthropological finds of the Neanderthal man (Jelínek, 1981). Mousterian settlement of the Šipka Cave, supplying further Neanderthal find seems also to be relatively late (Valoch et al., 1965). Thus the evolution in Moravia must have been rather complicated: analogically to other parts of Europe (Périgord: Laville, 1976; Romania: Carciumaru, 1979) we must accept that the last Mousterian coincided here with the beginning Upper Palaeolithic.

NOTES ON THE FOOD-RESOURCE BACKGROUND

We known little about the nature and orientation of the economic system practiced by the hunting EUP populations in Moravia. The Central European evidence proves no specialisation in the food-resource exploitation (horse, reindeer, mammoth, rhinoceros, bison, etc.). It is evident that such economic system must have been effective enough to allow longer stay, population concentration and stone exploitation in Southern and Central Moravia. Furthermore, it probably stimulated seasonal movements and penetration into the caves, perhaps in connection with cave-bear hunting, practiced by at least some of the EUP populations.

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