DOI: 10.17746/1563-0110.2016.44.1.051-064

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DIFFERENT MODELS OF SETTLEMENT OF THE UPPER PALEOLITHIC CULTURES IN THE NORTHERN FORELAND OF THE MORAVIAN GATE (CENTRAL EUROPE)

On the basis of 94 sites of the Bohunician, Szeletian, Aurignacian, and Gravettian cultures, marking the Neanderthal to Homo sapiens sapiens transition, stages in the evolution of the Paleolithic settlement north of the Moravian Gate are described, with special reference to environmental adaptation. Relevant factors include climate, relief, altitude, proximity of water sources, availability of lithic raw material and floral and faunal resources, as well as the socio-cultural level of the respective groups. While similar in terms of habitat choice, these cultures differed in placement of sites and the exploitation of resources. The most conservative style of exploiting the environment is evidenced by Bohunician sites, which are mostly situated on southeastern, eastern, and southern slopes, 205.5–310.0 m a.s.l. The typical feature of Szeletian sites is central placement on elevations; they are situated in lowland slopes facing north and southwest, mostly at 217–316 m a.s.l. The areas preferred by Aurignacians and Gravettians were larger, with diverse, often rugged terrains. Aurignacians preferred northern mountain slopes, 205–378 m a.s.l. Gravettians settled mostly in lowlands, on southern slopes and terraces, 220–286 m a.s.l. This territorial expansion testifies to growing opportunities due to higher socio-cultural potential, enabling people to inhabit formerly uninhabited zones.

Keywords: *Upper Paleolithic, settlement, landscape-zones, southern Poland.*

Introduction

The history of the interpleniglacial north of the Moravian Gate was determined by the Bohunician, Szeletian, Aurignacian, and Gravettian cultures, which transferred cultural patterns from the south. At that time, the area described in this article constituted the northern edge of the ecumene. The investigation of such areas may reveal the specific features of pioneering prehistoric settlement along the edges of the ecumene, and perhaps even shed new light on the psychomotor profile of the participants in this process. Knowledge of these cultures is primarily based on surface and loose finds. There are insufficient sites whose stratigraphic position is either known, or possible to reconstruct. This has resulted in a certain "flattening out" of the image of settlement in the area, which is an amalgam derived from sites from various periods of time. It should be added that the image may have been distorted by an artificial reduction in the extent of settlement, resulting from the differing progress of research in individual regions. The main area with settlement-potential, coupled with the reduced relic-spectrum of the Beskid Mountains and Silesian Foothills, was concentrated on the Głubczyce Plateau.

To present settlement-strategies one must consider their spatial, structural, functional, environmental, and morphological contexts. There have been basically no comprehensive studies of the Upper Paleolithic

Archaeology, Ethnology & Anthropology of Eurasia 44/1 (2016) 51–64 Email: Eurasia@archaeology.nsc.ru

settlements carried out in the area of the northern foreland of the Moravian Gate that focused on both the spatial and landscape relationships, and human activity. Existing studies describe individual sites, or groups of locations, against the background of their immediate surroundings. This article attempts to provide an overall description covering the reconstruction of the landscape and natural environments, as well as the reconstruction of the social and structural aspects of Upper Paleolithic settlements in the northern foreland of the Moravian Gate.

Study area

The northern foreland of the Moravian Gate shows a strip-like pattern of land-relief (Fig. 1). In front of the mountains (the Carpathians and the Sudetes), the foothills, near-upland high plains, plateaux covered with loess deposits, fluvioglacial deposits, and morainic high plains are spread out in a W to E direction. This area underwent particularly strong shaping by the Odra ice-sheet, and the ice-melt waters generated by its degradation. Fluvial and eolian processes played a much more important role in subsequent periods (Geomorfologia Polski…, 1972).

Mountains and Foothills. In the Beskids and Eastern Sudetes Mountains, three morphological types of relief may be distinguished: medium-high mountains; foothills; and inner-mountain basins and valley floors. The summits of the Beskids and Sudetes Mountains are rounded, with slopes steeply descending into the valley-sides. The valleys often show an uneven longitudinal profile, and sometimes rocky valley-sides. The Silesian Foothills form the lower part of the Beskid Mountains. The morphological region is composed of a belt of hills 5–15 km wide that rises from 300–500 m a.s.l., and is cut across by the valleys of the Olza, Wisła, and Soła Rivers. The northern border of the Foothills is delimited by a scarp 30–50 m high.

Sub-Carpathian Basins. The wide Racibórz-Oświęcim Basin is spread out between the Silesian Foothills and the Silesian-Cracow Upland. There are undulating peri-Carpathian high plains reaching 280–300 m a.s.l. in the southern part of the Basin, and there are slightly lower near-upland high plains (200–260 m a.s.l.) in the northern part. The Rybnik Plateau, which gently declines to the east, is located in the middle.

Sub-Sudeten Area. The sub-Sudeten zone shows a relief similar to that of the Subcarpathian Basins. The only difference is that in the sub-Sudeten area there is a terrace-like passage towards the north incised into the flat landscape of the Silesian Lowland. The surface of this land is located at 200–310 m a.s.l. Near Nysa and Otmuchów, the morphology is made more varied by the hills of the ice-sheet margin zone belonging to one of the phases of the Odra glaciation. In both of these large landscape-zones, a "bolder" landscape occurs within the scarps of the plateaux and high plains, hanging 50 m above deep river valleys.

Uplands. A characteristic feature of the morphology of the Silesian-Cracow Upland is the alternate occurrence of elevations, and the depressions that divide them. Elevations are clearly visible in the land morphology, especially the Chełm Massif (400 m a.s.l.) and Częstochowa Upland (300–500 m a.s.l.).

Methods

The distribution of Upper Paleolithic sites in the northern foreland of the Moravian Gate was analyzed in the context of selected landscape features. Landscape-zones in the northern foreland of the Moravian Gate were delimited in a manner similar to the method of J. Svoboda et al. (2009). When delimiting and classifying these landscape-zones, the elevations, morphologies, and origins of land-forms were taken into account. In the classification of landscape-zones, the division into geomorphological units presented by M. Klimaszewski (Geomorfologia Polski…, 1972) was used. Landscape-zones were classified as follows: A – mountains, B1 – foothills, B2 – uplands, C1 – plateaux, C2 – more elevated high plains, C3 – lower high plains and high terraces, D – hills (moraines and kames), and E – basin floors, ice-marginal valley and river valleys.

Land situated up to 1500 m a.s.l. was considered medium-high mountains; and land with an elevation of approx. 500 m a.s.l., low mountains. Both these morphometric types of mountains also reach 300 m relative height (above the adjacent areas). The ranges of settlement and the economic

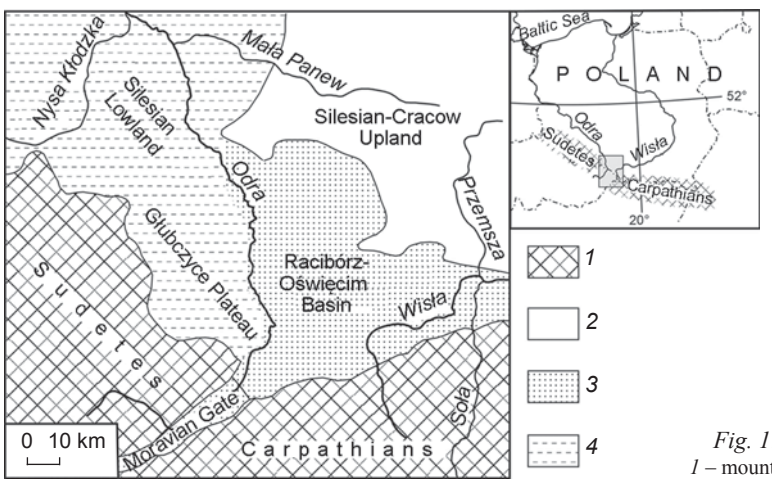

Fig. 1. Landscape-zones in the study area.
1 – mountains; *2* – uplands; *3* – basins; *4* – lowlands.

activity zones of the communities of the Bohunician, Szeletian, Aurignacian, and Gravettian cultures were then investigated in relation to the landscape-zones in which they took place; and also the location of the sites was investigated in relation to landform elements, heights above sea-level, and the hydrographical network. Analyses of stream-ordering were conducted according to Hack's (1957) method using 1 : 25,000 and 1 : 10,000 topographic maps. In total, 94 sites (Fig. 2, 3) were analyzed, the majority of which are well-known from the literature, but a few of which are newly discovered. The general characteristics of the sites selected are presented in Table 1.

The subsistence strategies of Upper Paleolithic cultures: results and discussion

Bohunician

In the Bohunician, the area occupied covers up to 104.5 km^2; but if we disregard the rather enigmatic Rybnik-Grabownia 3 region, this is reduced to 53.3 km^2. The indications of Bohunician culture seem to be restricted to the regions C1, C2, and incidentally to region C3 (Fig. 2, *a*). The inhabitants led a relatively sedentary lifestyle, moving within a specified area. The settlement-enclave was found at the fork of the Rozumicki Stream and the Morawka, and along the middle Psina in the Głubczyce Plateau (Dzierżysław 1, 8 and Dzierżysław 4/Třebom; Table 1). Only Racibórz-Studzienna 12 and Racibórz-Ocice, which constituted a kind of bridgehead in the Odra valley, reached beyond the enclave. The maximum distance between the sites did not exceed 14 km, while the closest were located 550–600 m apart. The core area of the Bohunician does not extend outside the boundaries of distribution of the Stranska Skala type hornstone, i.e. the edge of the Drahan Highland and south-west from Brno (Oliva, 2002; Svoboda, 2006a, b).

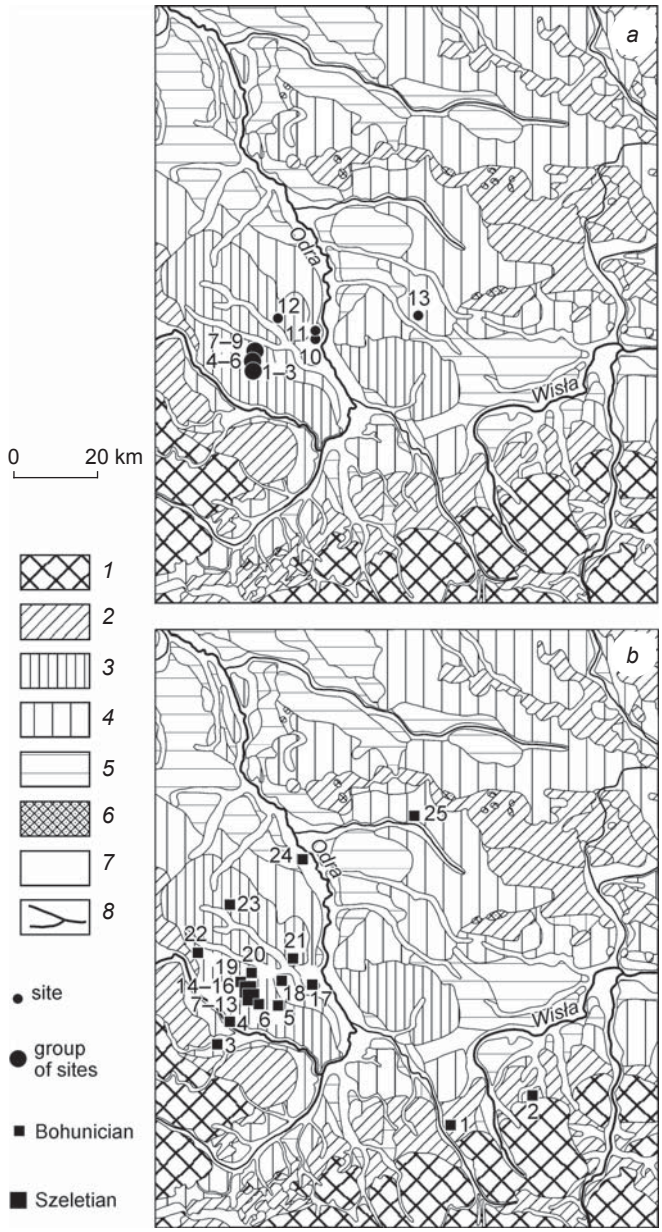

Fig. 2. Location of the Bohunician (*a*) and Szeletian (*b*) sites in landscape-zones.

Landscape-zones (explanation of letter symbols is given in the text): *1* – A; *2* – B1 + B2; *3* – C1; *4* – C2; *5* – C3; *6* – D; *7* – E; *8* – rivers.

Bohunician sites: 1–3 – Rozumice 16, 32, 36; 4–6 – Dzierżysław 1, 4, 8; 7–9 – Kietrz 4, 7, 10; 10 – Racibórz-Studzienna 12; 11 – Racibórz-Ocice 10; 12 – Maków 15; 13 – Rybnik-Grabownia 3.

Szeletian sites: 1 – Cieszyn 1; 2 – Jaworze 8a; 3 – Otice; 4 – Opava-Palhanec, 5 – Chuchelna; 6 – Hněvošice; 7–11 – Rozumice 5, 26, 22, 17, 4; 12 – Pilszcz 63; 13 – Rozumice 33; 14, 15 – Dzierżysław 1, 3; 16 – Třebom; 17 – Bieńkowice; 18 – Samborowice 2a; 19 – Lubotyń 11; 20 – Kietrz 3; 21 – Cyprzanów 3; 22 – Lewice I, 23 – Babice 8; 24 – Cisek 6; 25 – Dzierżno 6.

The Dzierżysław 1 site (lower level) is an example of what was either a longer-inhabited or a repeatedly visited campsite; a hunting and processing site where basic activities were performed such as preparing food supplies, production and repair of tools, processing of bone and wood, and tanning animal hides. Working-areas were situated around a small alas lake, which provided a shallow reservoir of "industrial" water (Fajer et al., 2005). Dzierżysław may have served as a base-camp for a relatively small economic complex. The dwelling-camp and workshop Dzierżysław 8 and Dzierżysław 4/Třebom (Table 1) are located nearby. A base-camp with small camps situated nearby is a typical pattern for the Bohunician (Svoboda, Ložek, Vlček, 1996).

The collections (consisting of a few elements and loose points from temporary campsites, hunting and *ad*

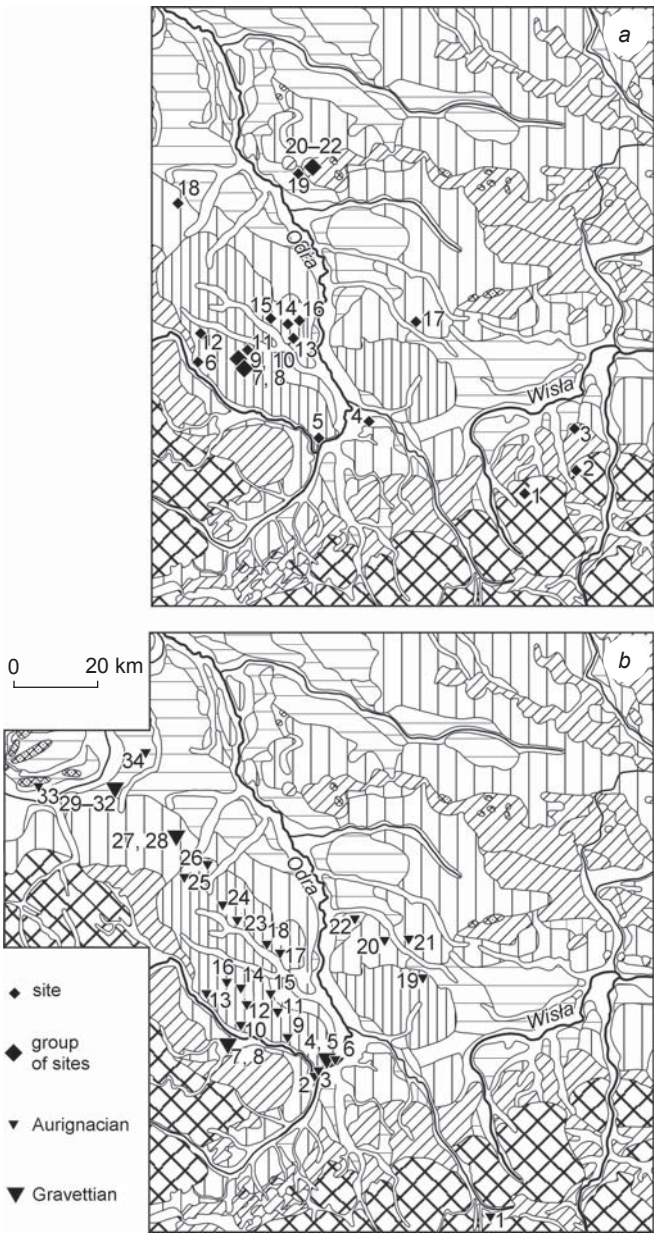

Fig. 3. Location of the Aurignacian (*a*) and Gravettian (*b*) sites against landscape-zones (symbols of landscape-zones as in Fig. 2)

Aurignacian sites: 1 – Jaworze Ostry; 2 – Bielsko-Biała Czupel; 3 – Bestwina 8; 4 – Bohumin-Zablati III; 5 – Ostrava-Hoštalkovice I; 6 – Branice; 7, 8 – Dzierżysław 2, 79; 9, 10 – Lubotyń 1, 11; 11 – Kietrz 2; 12 – Zubrzyce N; 13 – Pietrowice Wielkie 4b; 14 – Kornice 11; 15 – Maków 12; 16 – Racibórz-Miedonia; 17 – Rybnik-Wielopole B; 18 – Śmicz 18; 19 – Zakrzów 41; 20 – Ligota Dolna; 21, 22 – Wysoka 57, 4.

Gravettian sites: 1 – Istebna 7; 2, 3 – Ostrava–Hoštalkovice I, II; 4–6 – Ostrava-Petřkovice II, III, I; 7, 8 – Opava I, II; 9 – Koźmice; 10 – Opava-Kateřinký; 11 – Chuchelna; 12 – Dzierżysław 79; 13 – Boboluszki 2; 14 – Rozumice 3; 15 – Pietraszyn 18; 16 – Chróścielów 2; 17 – Cyprzanów 1; 18 – Maków Z3; 19 – Rybnik-Gotartowice J; 20 – Rybnik-Stodoły C; 21 – Rybnik-Golejów C; 22 – Ruda Kozielska; 23 – Baborów 7; 24 – Debrzyca 1; 25 – Pomorzowice 17; 26 – Szonów; 27, 28 – Śmicz 6, 18; 29–32 – Domaszkowice 6, 16, 17, 38; 33 – Wójcice 1; 34 – Sowin.

hoc resting campsites, affiliate flint workshops, and kill-sites) have to be mentioned (Kozłowski, 2000; Foltyn, 2003). The workshop-sites could have been used for the preparation of semi-finished products and tools for personal use, on the site or outside of it. The presence of Drahan quartzite pre-cores in Dzierżysław 1, 8, and Maków 15 indicates relations with the Ondratice lithic exploitation area, and maybe even with the Ondratice site itself, as the starting point of further expansion into the northern foreland of the Moravian Gate. The admixture of Upper Silesian flint in the inventories from Ondratice 1 (Oliva, 1995) supports such an interpretation. The very limited presence of this material in the Moravian sites (Kozłowski, 1991; Svoboda, 1999) speaks in favor of other reasons for human migration north from the Moravian Gate than the search for flint-supplies. The fact that quartzite pre-cores were abandoned after the settlement of a camp, without any further processing, seems to demonstrate that they were used as reserve material that became redundant upon reaching the local resources of Upper Silesian flint (Foltyn, 2003). The Upper Silesian flint could have ended up in the Moravian region as a non-deliberate find, and have been offered upon return from a hunting expedition (Kozłowski, 1972/73). The capacity to migrate east from the Odra River is confirmed by finds in the Rybnik-Grabownia 3 site; and also, indirectly, by artifacts from Mohelno in the Moravian region, made from flint material originating from the Cracow-Częstochowa Upland (Škrdla, 2000), and flakes from the Dzierżysław 1 site made from Mikuszowice chert (Foltyn, Kozłowski, 2003). The temporary penetration of areas north of the Moravian Gate by people living in the Bohunice area should be interpreted as evidence of their hunting activity.

The main role in the settlement and communications system was played by 4th-order streams (66.7 %; Fig. 4). There are convenient routes connecting the sites near Dzierżysław and the valleys of the Morawka and Rozumicki streams—dry, erosion-denudation valleys which served as traps for game heading for watering-points. The fact that settlement-sites are distant from the main rivers corresponds to the situation in the Moravian region (Svoboda, 1999; Oliva, 2002). Valleys of small watercourses provided good shelter, and a source of drinking water, for men and animals. The wide valleys of large rivers, usually having a N–S orientation, were more exposed to winds and the ponding of cold air.

Kame hills were the most frequently approached feature, while terraces or hillside ledges were approached far less frequently. Only slightly-sloping hillsides were regarded as convenient for settlement,

Table 1. **General characteristics of selected archaeological sites**

	Site	Type of site	Location				Artifacts (%)									Sources
			Height, m a.s.l	Relative height, m	Land relief	Exposure	Pre- cores	Cores	Flakes and chunks	Blades	Burin spalls	Tools	Hammer stones	Macrolithics forms	Waste	
Bohunician	Dzierżysław 1 (lower level)	Dwelling	282.5–284	60	Hill, interfluve	S	–	3.3	67.6	13.2	–	9.3	0.3	–	6.3	Foltyn, Kozłowski, 2003; Fajer et al., 2005
	Dzierżysław 8	Dwelling + workshop	287	35	Edge of a plateau	SE	2.5	11.2	50.5	20.6	–	10.7	0.2	–	4.3	Foltyn, 2003
	Dzierżysław 4/ Trebom	Same	270	45	Hillside	E	–	5.5	52,0	19.2	–	8.2	1.4	–	13.7	Ibid.
Szeletian	Dzierżysław 1 (upper level)	Dwelling	288.4	53	Hilltop	–	–	7.5	58.3	12.8	–	12.1	1.3	–	8.0	Kozłowski, 1964a, 2000; Foltyn, 2003
	Otice	Dwelling with workshop elements	310.7	50	Hill, interfluve	N	–	7.0	45.4	2.7	–	36.2	2.2	–	6.5	Klima, 1974, Foltyn, 2003
	Samborowice 2a	Same	230	25	Valley slope	N	1.0	6.2	37.2	10.3	–	33.5	1.0	–	10.8	Foltyn, 2003
Aurignacian	Lubotyń 1	Workshop	307.3	67	Upper hillslope zone, interfluve	W	–	16.3	71.5	3.1	–	9.1	3.4	–	–	Kozłowski, 1964a
	Lubotyń 11	Same	309.8	69	Hilltop, interfluve	–	3.3	28.2	43.6	5.0	–	8.3	1.8	–	8.3	Ibid., Foltyn, 2003
	Wysoka 57	Dwelling with workshop elements	345–348	~100	Edge of a morphological step	NW	–	3.0	63.0	13.4	1.8	13.7	–	–	5.1	Masojć, Bronowicki, 2003
	Ostrava-Hoštalkovice I	Same	248–249	45–50	Top part of a residual hill	NE	–	24.4	36.3	13.8	–	16.2	–	–	9.3	Neruda, 1997
Gravettian	Ostrava-Petřkovice I	Dwelling	248	50	Same	NE	–	1.5	30.0	15.3	0.8	5.1	–	0.7	46.6	Klima, 1955, Petřkovice…, 2008
	Ostrava-Petřkovice II	Same	230–245	25–40	Valley slope	SE	–	3.1	–	84.6	–	12.3	–	–	–	Klima, 1969
	Wójcice	Same	230–233	30	Moraine hill; foot of slope	SE	–	2.5	–	89.5	–	8.0	–	–	–	Dagnan, Ginter, 1970
	Cyprzanów 1	Workshop	210–215	20	Valley slope	SW	3.2	2.4	82.9	6.0	–	3.1	–	–	2.4	Kozłowski, 1964a

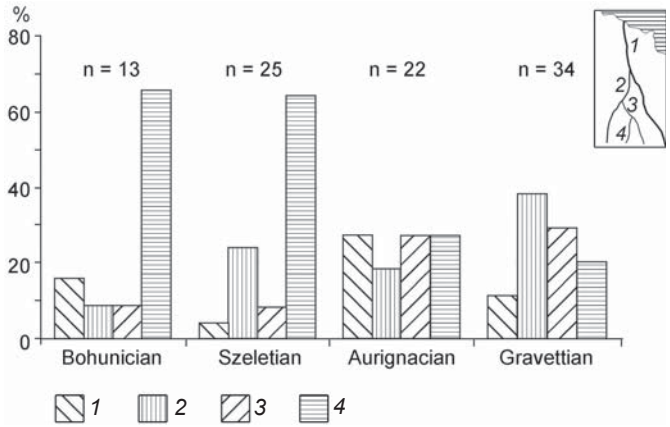

Fig. 4. Distribution of archaeological sites vs. order of streams.
1 – 1st-order; *2* – 2nd-order; *3* – 3rd-order; *4* – 4th-order.
n – number of sites.

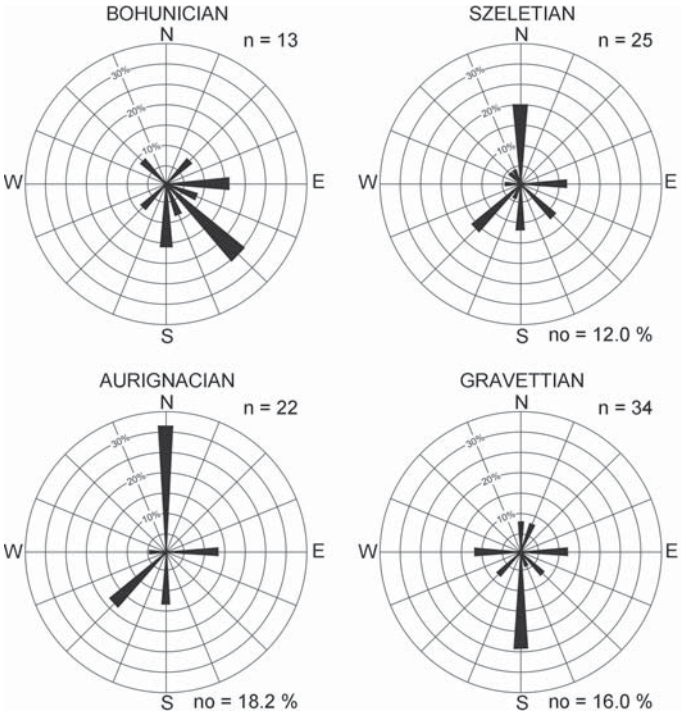

Fig. 5. Distribution of archaeological sites vs. preferred slope-exposure.
n – number of sites; no – percentage of sites without clearly determined slope exposure.

while summits were avoided. In the Moravian area, such settlement-sites are found both on summit areas and below high points (Škrdla, 2002). Staying in the shadow of hills created a feeling of security and provided cover from strong winds. A small breeze in the shelter chased annoying flying insects away. The location of settlement-sites on slopes ensured good visibility in only one, but the most convenient, direction—towards the valley (Oliva, 1998a). The location of settlement-sites on land elevations dominating the surrounding area, or on the ridges of valley divides and highlands, allowed visual prospecting of the valley and plateau (Svoboda, 1999; Oliva, 2002; Fajer et al., 2005). These two zones have specific vegetation covers and, in consequence, seasonal variability of food resources, mainly game species (Oliva, 2002). Most certainly, the groups exploited large gregarious species, mostly horses (Svoboda, Simán, 1989). They were also satisfied with individual specimens of smaller species. Remains of horse-, mammoth-, and aurochs-bones were found at the Stranska Skala site and at Brno-Bohunice (Musil, 1976, 2003; Seitl, 1984).

Usually it was SE (25 %), E and S (up to 16.7 %) slopes that were found suitable for a longer stay (Fig. 5). Dwelling-sites had the best southern and south-eastern exposures. Southern slopes absorb twice as much heat as northern slopes (Soffer, 1985). Eastern slopes also enjoy high insolation. People sought places lying on sand and gravel ground, avoiding loess soils: the humid climate, melting snow and ice (as well as melting frozen soils) turned loess ground into swamps of wet mud. As far as the hypsometric factor is concerned, the sites are located at altitudes of 205.5–310 m a.s.l. (Fig. 6). The situation was very similar in the Moravian region, where settlement-sites are located at altitudes of 230–330 m a.s.l. (Škrdla, 2002).

Szeletian

During the period of the Szeletian culture, the range of the ecumene had visibly increased, reaching up to 3290 km^2. It would have been possible to observe the acquisition of new territories, and a vast and more complex settlement-network developed. Dependence on upland areas lost its significance. Nevertheless, settlement-processes in the lowland zone were less intense. The Szeletian culture expanded into the lands of C1, E, C2, B (Fig. 2, *b*). The northern boundary of that culture area ran along 50°17′ N, while its eastern frontier was at 18°57′ E. Stone materials permitted a much larger area of exploitation to be indirectly defined, extending up to the line of the Nysa Szalona (16°08′ E) and Raba (19°43′ E) along an east-west axis.

The distribution of sites seems to indicate the existence of two micro-regions of settlement. Moreover, randomly-located individual sites have also been registered. The first micro-region is outlined by the Rozumicki Stream and the Morawka. Another, though with fewer sites spread further apart, was uncovered along the Psina-Grabia valley.

Settlement-points are not situated further apart than 6.25 km, with a minimum distance of 350–400 m. Such a settlement-pattern is a good match for the concept of a logistically efficient system of enclosed human settlement-concentrations with more-or-less-permanent base-camps and short-term hunting camps (Allsworth-Jones, 1986; Oliva, 1995; Valoch, 1996; Svoboda, 2006a).

The Dzierżysław 1 and Třebom 1 sites, which seem most likely to have constituted the centers of exploitation-territories with a radius of 10 km, belong to the dwelling-sites. The Dzierżysław 1 site (upper level) located at the top of Black Hill dates back to TL 36.5 ± 5.5 ka BP (Kozłowski, 1964a, 2000; Foltyn, 2003). Artifacts occur in the form of two flint stone clusters joined at the back to the outline of the base of a unique shack-structure reinforced with erratic stones (Kozłowski, 1964a; Fajer et al., 2005). A grinder covered with limonite shows (Kozłowski, 1964b) that a limonite dye must have been prepared in the camp, and that some work for which it was used may have been performed. A settlement complex with a central site on a land elevation, surrounded with a ring of small settlement-locations, is considered to be the typical pattern of the Szeletian culture (Oliva, 1992; Svoboda, 2001a; Svoboda et al., 2009). Widespread sites with a low focal concentration of artifacts are interpreted as palimpsests (Oliva, 1995). Dispersion of stone material on a surface area of >30 m^2 basically excludes the possibility of identifying traces of multiple-settlement occupation of the site (Kind, 1985).

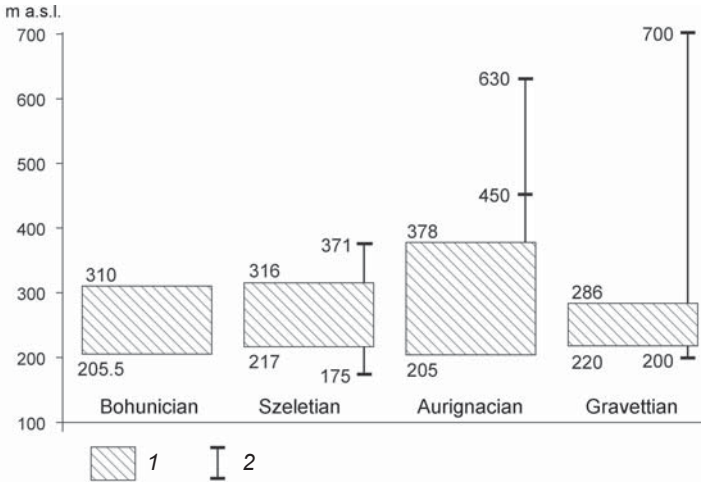

Fig. 6. Distribution of archaeological sites vs. elevation (m a.s.l.).
1 – main site groups; *2* – individual sites.

The functional variations between sites are complemented by transitory satellite hunting-campsites and extempore workshops (Kozłowski, 1964a; Foltyn, 2003; Svoboda et al., 2009; Bobak, Połtowicz-Bobak, 2009). The hunting-camps were probably used for small-scale semi-product processing for the hunters' own needs. Leaf-points without the context of other items seem to belong to the category of lost (or abandoned) traces of stopping for rest, or hunting (Pazda, Bagniewski, 1968; Foltyn, 2003).

The hunting strategy used required supervision of open land-areas, and the elimination of unpredictable factors by operating on a wider territory (Svoboda, Ložek, Vlček, 1996). The search for, and processing of, stone materials was a phenomenon *arising* from settlement, not its purpose. This is confirmed by the lack of obvious workshop-type sites concentrating on the production and acquisition of cores and semi-products. On sites in the Moravian region, the Upper Silesian material accounted for 4 % of the total (Kozłowski, 1991; Valoch, 1996, 2000; Nerudová, 1997). Expeditions to search for stone material were certainly not organized. The Upper Silesian flint was, rather, brought along incidentally during migrations for other purposes; or as Binford (1979) referred to it, the flint was "embedded" in hunting expeditions (Kozłowski, 1972/73).

The main areas penetrated were those around 4th-order (64 %) and 2nd-order (24 %) streams (Fig. 4). Campsites established near small stream valleys, and dry valleys dissecting highland slopes, provided shelter from strong winds. Staying near a medium-sized 2nd-order river provided a view into the valley, plus observation of the migration-routes of game-animals, watering points, and river crossing points—the locations where herds of game-animals crossed rivers during their seasonal migrations. Such crossings were repeated and regular, allowing the hunters to predict them (Oliva, 2007). Besides, we suspect that animal-trails were much more discernible and legible on the long sections along the bottoms of wider river valleys (Valoch, 1996). Additionally, the steep slopes of 2nd-order river valleys (such as Opava, Olza, Psina, or Kłodnica) could have played a significant role in hunting-routines. Sites in Slovakia and Moravia, which were situated in similar terrain-conditions, contained remains of mammoth, bison, aurochs, horse, and elk (Oliva, 1995).

The Upper Silesian sites are located in strategic positions—mainly on hills or low, longitudinal elevations. Summits, slopes, and areas at the foot of the mountains were selected with equal favor, in a deliberate manner. Terraces, plateau edges or mound-like rocky hills were less likely to be chosen.

Settlement on the summits of land elevations, edges of terraces, and valley sides allowed direct observation of the valleys and upland areas (Ibid.; Svoboda, 1999; Hromada, 2000; Škrdla, 2002). Two sites considered to be dwelling settlements, Dzierżysław 1 and Třebom, are located on summit areas. Siting dwelling settlements on summit areas could have been the result of a need to observe the migration of animal-herds searching for high insolation

and defense against insects. In Dzierżysław 1, there were one or two palsa-type structures next to the camp (Fajer et al., 2005). Such an ice-mound could significantly improve visual control of the surroundings. The Otice site is also worth mentioning, with a dominant position overlooking the valley at the point of convergence of four water courses (Velká, Hvozdnice, Moravice, and Opava).

From the perspective of hunting-camps, the decisive factors were a broad and unrestricted view, and its position against the wind. In windless weather, the scent of humans spreads in all directions with an average velocity of 1 m/min (Meissner, 1990). Settlers preferred sandy or gravel-sand soils where water drains quickly. Apart from summits, sites have usually been found on slopes facing N (20.8 %) and SW (16.7 %) (Fig. 5), the vast majority of which are situated between 217 m a.s.l. and 316 m a.s.l. (87 %), with extreme examples at 175 m a.s.l. and 371 m a.s.l. (Fig. 6). More importantly, traces of the Bohunician and Szeletian settlements generally did not overlap geographically. A similar phenomenon, at a regional scale, was found in the Moravian region (Oliva, 1995; Svoboda et al., 2009).

Aurignacian

Settlement of the carriers of the Aurignacian culture covered an area of 3756 km^2 and was associated with the regions C1, B, A, C2, and C3 (Fig. 3, *a*). It reached from 17°38′ to 19°03′ E and to 50°28′ N, and consequently ignored lowland territories. The sites are concentrated along the valleys of the Morawka, Troja, and Psina rivers and on the Chełm Massif. The sites are located at a distance of 2.6–6.7 km (Morawka-Troja-Psina) and 2.0–4.2 km (Chełm Massif) from one another. The sites in the Silesian Foothills, in the Silesian Beskids, and Mały Beskid, seem to suggest a potential third concentration, while the remaining sites are relatively isolated. The characteristic feature of this culture is the geographical isolation of settlement-groups of diverse character (Hahn, 1977; Svoboda, Simán, 1989; Valoch, 1996; Bánesz, 1998; Svoboda, 2006a).

More significant workshops (Lubotyń 1 and Lubotyń 11), and dwelling-sites combined with workshops (Wysoka 57 and Ostrava Hoštalkovice I; Table 1), were accompanied by smaller workshops and camps—apparently traces of a temporary stay by the hunters occurring on one occasion only, or of camps established for the purpose of renewing tools (Kozłowski, 1964a, 1965; Foltyn E., 2003; Foltyn E.M., Foltyn E., 2003; Masojć, Bronowicki, 2003; Połtowicz, 2003).

A quantitative analysis of the inventories of the Kornice 11 (Chochorowska, Chochorowski, 1986) and Pietrowice Wielkie 4b (Kozłowski, 1964a) sites provides evidence of a surplus of cores, but a limited range of tools. In comparison with sites from the Beskid Mountains, the use of the local Mikuszowice chert, evidently just for everyday needs, seems to indicate sporadic far-reaching journeys in order to find new hunting grounds.

The above indicates that the presence of Aurignacian populations on the northern side of the Moravian Gate can be interpreted as evidence of two types of activity: hunting, and more extensive workshop-type activities. These mainly determined the demand for flint materials (Svoboda, Ložek, Vlček, 1996; Valoch, 1996). Dominance of the Upper Silesian flint was particularly observed in areas of Miškovice type industry (Valoch, 1993; Oliva, 2002). This material also has a significant presence in the Aurignacian sites (Valoch, 1975; Oliva, 2002; Škrdla, 2007). Such a frequent occurrence of Upper Silesian flint in the inventories of the Moravian region means regular supplies. It is possible that special expeditions were organized to areas known to particular groups (Kozłowski, 1972/73; Oliva, 1984), called "direct" by Binford (1979), which could have been combined with seasonal migration of animal-herds. Imports of Jurassic flint from the surroundings of Cracow provide evidence that groups traveled a significant distance towards the east (Oliva, 1984). In the opinion of Oliva, groups traveling to the outcrops could have traded materials. Workshops produced blades and tools (Kozłowski, 2004). Beneficiaries of those products included their closest and more distant neighbors, e.g. eastern Slovakia and Hungary (Kozłowski, 1972/73; Oliva, 1984; Kozłowski, Mester, 2003/04). In the opinion of Svoboda (Svoboda, Ložek, Vlček, 1996), the presence of raw materials from the north in Aurignacian sites could have been derived from contacts with the Gravettian culture. The reasons for expeditions into the mountains could have included specialization in seasonal hunting, and the attraction was the abundance of forest-game in those hunting areas (Kozłowski, 1994).

There is no simple relationship between the type of site and its specific location. Settlement-points occur equally frequently along 1st-order (27.3 %), 3rd-order (27.3 %), 4th-order (27.3 %), and 2nd-order (18.2 %) streams (Fig. 4). Larger settlement-sites do not occur within the range of 3rd-order watercourses. Moreover, dry valleys that flow into river valleys break the continuity of their slopes. Such a specific distribution of settlement-sites in relation to rivers and streams in the northern foreland of the Moravian Gate could be explained tentatively by the function of rivers as corridors connecting different ecological zones (Bahn, 1983), equally attractive to the carriers of the Aurignacian culture. River-valleys and erosion-furrows cutting through moraine, fluvioglacial, and fluvial forms, facilitated access to their components. There is no discernible tendency to exploit simultaneously areas of uplands, valleys, and hollows through adequate selection of locations for campsites. Except for sites located in the mountains, settlers in the remaining areas

also faced the daily issue of combining exploitation of resources with subsistence needs. In order to provide food, hunters most probably went after any game that could be hunted. For example, sites in Austria contained (in addition to a slight predominance of reindeer) a wider spectrum of species, including: mammoth, rhinoceros, deer, fox, alpine ibex, wolf, hare, horse, lion, and bovids (Hahn, 1977). On many sites, artifacts were scattered on the slopes around the summit of the hill; but sites with northern exposure prevailed (31.9 %; Fig. 5). Only some wealthier sites are oriented south-west (Wysoka 57, Pietrowice Wielkie 4b, and Kornice 11) and east (Dzierżysław 79). There is a visible preference for prominently elevated ground. Settlement-sites are located on summits of land elevations or on slopes, often breaking into some types of terrace; or else on the edges of uplands. There are also multiple locations within the range of rock-outcrops (Chełm Massif). In this type of location, the permeability of the ground and water-outflow caused the sites to become overly dry.

Sites on summits, or more generally in strategic locations, were probably related to the need to track movements of game (Oliva, 1987; Svoboda et al., 2009). Long-distance observation allowed hunters to select adequate hunting-tactics with sufficient advance warning (Hromada, 2000). Good examples of such locations are the sites that dominated the Odra Valley within the Chełm Massif and in Ostrava Hoštalkovice I (Masojć, Bronowicki, 2003; Neruda, 1997).

As far as altitude is concerned, the majority (90.9 %) of sites are located within the range 205–378 m a.s.l. (Fig. 6). Two sites are situated at 450 m a.s.l. and 630 m a.s.l.

Gravettian

The dispersion of sites of the Gravettian culture reveals a phenomenon of a wider territorial scale, covering an area of 6565 km^2. Settlement took place within the lands C1, C3, C2, A, and E (Fig. 3, *b*). Migrating northwards, the Gravettian groups reached 17°12′ E to 18°55′ E, and this fact confirms considerable resilience, lability, and elasticity on their part as regards settlement organization. Neither did they fear environments with varying parameters. When analyzing the spread of Gravettian sites, a particular density of these should be noted at the point where the Hlucin High Plain joins the Ostrava Basin. Sites were recorded with proximity in a range of 0.7–8.5 km. Two less-consolidated complexes with sites situated 5–13.5 km apart were identified between the Opava and Osobłoga Rivers and between the Osobłoga and Nysa Kłodzka Rivers. A similar situation is found with the clearly smaller complex in the valley of the Ruda River and its surroundings. The concentration of settlement-sites along river valleys sometimes gives the impression of a linear settlement system (Otte, 1985). Further to the south, the settlements are located along a SE–NW axis. In the northern section, the direction changes to SW–NE. The solitary, ephemeral site, Istebna 7 (Rydlewski, 1983), shows evidence of people's venturing into the mountains.

There are two chronological horizons in the development of the Gravettian culture north of the Moravian Gate. The first to develop was a stage of the so-called Pavlov culture. The second, less marked, is related to a horizon containing shouldered points, or the Willendorf-Kostienki culture and Mediterranean Gravettian culture (Rozumice 3). The cultural content of settlement-points differs. Dwelling camps (Ostrava-Petřkovice I, Ostrava-Petřkovice II, Wójcice; Table 1) with a home workshop each (Cyprzanów 1; Table 1) are the most frequent.

In the Ostrava-Petřkovice I site, two settlement-stages were identified: ^{14}C 23,370 ± 160 BP and ^{14}C 20,790 ± ± 270 BP (Svoboda et al., 2009). Relics of dwelling structures surrounded with storage pits and so-called hematite stains, as well as relics of numerous fires, seem to indicate a longer stay. Similar conclusions can be drawn from finds of the so-called "Venus" figurines, which were very occasionally left behind (Klima, 1955; Otte, 1981; Jarošová et al., 1996; Jarošová, 1999; Oliva, Neruda, 1999).

Small, poor sites give the impression of being just incidental mini-workshops or satellite hunting-camps, e.g. Śmicz 6, 18, Hoštalkovice II (Kozłowski, 1964a; Klima, 1969; Rydlewski, 1983; Neruda, 1995, 1997; Oliva, 1998a; Oliva, Neruda, 1999; Foltyn, 2000; Neruda, Nerudová, 2000; Svoboda, 2000; Svoboda et al., 2009; Foltyn E.M., Foltyn E., 2003; Połtowicz, 2003). If we exclude the possibility that the points were simply lost, individual Pavlov points (regarded as heads for hunting weapons and/or knives) could indicate hunting grounds, and/or places where game was quartered (Kozłowski, 1964a; Foltyn E.M., Foltyn E., Wysocka-Grzanka, 1995).

It cannot be denied that those Gravettian culture populations from the Moravian and Bohemian regions that came to the upper Odra River basin and source catchment-area of the Wisła River were looking for good, high-quality raw materials. Imports of Upper Silesian flint grew to a previously unknown scale (Oliva, 2002; Svoboda, 2003). Its percentage share in the Moravian sites ranges from 6.2 % to 100 % (Svoboda, 2001b; Oliva, 2007; Škrdla, Nyvltová-Fišáková, Nyvlt, 2008; Svoboda et al., 2009). In addition, the material was delivered to eastern Slovakia, Austria, and Hungary (Kozłowski, 1987; Dobosi, 2000). Demand from the settlement-sites in the Moravian region and Slovakia led to the development of a consistent and open system of regular supplies (Svoboda, 1994; Svoboda, Ložek, Vlček, 1996; Oliva, 1998b). The nature of this phenomenon is still to be discussed. There are two possible scenarios.

Following the first, the area of the northern foreland of the Moravian Gate is perceived as the source of raw material. Flint was acquired by periodic special expeditions, or hunting expeditions following animal-migrations (Kozłowski, 1996; Svoboda, Ložek, Vlček, 1996; Oliva, 1998b, 2007; Svoboda, 2001b). If the raw material was to be imported individually, its volume and intensity of consumption would have decreased with the increasing distance from its source (Oliva, 2002). No such phenomenon has been observed, however. The same material dominates even in the most distant locations. There is no evidence of special treatment or increase in efficiency of usage (Oliva, 1998b, 2002). The poverty of sites and, primarily, the very small number of workshops (as compared to the volume of imports), speaks against such a model (Oliva, 2007). The reasons for such a situation seem complex. The occupation of the settlement at the northern foreland of the Moravian Gate was short (summer season?), and therefore its evidence is not very discernible (Ibid.). Some of the sites were destroyed by solifluction processes. Only individual non-diagnostic products can provide evidence of the existence of additional workshop-sites or household workshops (Kozłowski, 1996).

Following the second scenario, an autonomous settlement-center (permanently occupied or occupied for a major part of the year, and formed by adaptation to the local micro-environment) was created in the northern foreland of the Moravian Gate. The identification of a separate small settlement-center in Hungary (Dobosi, 2000) greatly increases the probability of such a hypothesis. Gravettian settlers appreciated the natural values and abundant resources available in Upper Silesia. The Gravettian settlement-activity was further enhanced by the large number of valleys (e.g. in the Głubczyce Plateau the valley density index is equal to 1–3 km/km^2), and also by their N–S, NW–SE, and NE–SW direction. Groups that had decided to spend the winter in this area were able to build up reserves of meat and firewood in the late summer and autumn seasons. In the year-round settlement-sites, craftsmen with access to flint resources were approached by users from the Moravian region and Slovakia who were coming there to acquire the raw materials (Oliva, 1998b). Where there was a periodic, long-term (seasonal) presence of the exploiters on the flint-bearing fields, the material was brought south as they moved to local, more abundant ecosystems. In exchange for the flint, the producers acquired the right to hunt in other groups' hunting areas (Oliva, 1998b, 2007). Such a pattern of distribution is evidenced by the fact that the largest settlements in the Moravian region were inhabited all year round or in winter (Klima, 1994; Svoboda, Ložek, Vlček, 1996; Nývltová-Fišáková, 2013), and the ones in Slovakia in autumn and maybe in winter (Kamińská, Kozłowski, 2002). In both cases, the exchange (or offer of exchange) fulfilled an important social function, and contributed to maintenance of inter-group relationships (Oliva, 2002). In any case, the material was transported in the form of pre-cleaned pebbles and pre-cores, blades or cores (Kozłowski, 1987; Oliva, 1998b, 2007). While exploitation of raw materials remained a priority, groups did not give up hunting. Groups of hunters ventured into the area, and also the mountains (Rydlewski, 1983), starting from base-camps (Ostrava-Petřkovice I, Wójcice ?), sometimes referred to as "material procurement stations" (Klima, 1957). In the light of paleozoological sources, we realize that mammoth (Ostrava-Petřkovice I, Opava I, II, Wójcice ?) was hunted, as well as horse and reindeer (Ostrava-Petřkovice I, Opava I).

The sites are most frequently found along the course of the 2nd-order (38.2 %) and 3rd-order (29.4 %) streams (Fig. 4). The dwelling-sites and workshop-sites are often concentrated near the 1st- and 2nd-order watercourses. The most important aspect of such locations was the gathering of animals (mostly mammoth) in the far ends of valleys and the uncovering of stone-bearing material on the valley slopes. Wide valleys of the 1st- and 2nd-order rivers provided feed all year round (Oliva, 2007). The edge of the plateau hanging over the valley was preferred to the hills. The settlement-sites were located on slopes, hillsides, or terraces. This may have been related to a desire to control the valley and upland area, and a need for access to drinking-water. Settlers were not ready to move down to the valleys, as happened in the Moravian region (Oliva, 1998a), where they feared insect nuisance, floods, winds or cold-air ponding.

The Moravian region and Hungary indicate that a general rule was the location of more permanent campsites near, and on, the summits of prominent dominating elevations (Ibid.; Oliva, Neruda, 1999) visible within a several-kilometer radius. Hills allow visual prospecting of the surroundings. The Ostrava-Petřkovice I settlement-site on the Landek hill offered an excellent view of the broad Odra River valley, covered in greenery in the spring season. Hunting-camps were established near the mouths of the tributaries of larger rivers (Otte, 1981).

Sites were most commonly situated on southern slopes (24.3 %; Fig. 5). The main point in this case was to find slopes with high insolation. This means a difference as compared with the Moravian region (Oliva, 1998a, 2002; Škrdla, 2006). This discrepancy is partly a result of the different orientation of valleys: longitudinal in the Moravian region, and longitudinal to almost latitudinal to the north of the Moravian Gate. The tendency to choose loess areas is noteworthy. Areas with dominant loess soils guarantee optimum conditions for high levels of production of vegetable matter (herbaceous plants), thus attracting the attention of large mammals (Fajer et al., 2005). At exceptionally convenient locations, camps were established several times over in the same place (Ostrava-Petřkovice I, II, Opava I).

The great majority of sites were discovered at an altitude of 220–286 m a.s.l. (83.3 %). The Istebna 7 site was found at 700 m a.s.l. (Fig. 6). A similar situation has been observed in the Moravian region (Oliva, 1998a; Svoboda, 2003; Svoboda et al., 2009; Škrdla, 2006) and in western Slovakia (Kaminská, Kozłowski, 2002).

Conclusions

The overall view leads to the conclusion that the regularities observed reflect, to a certain extent, real variables such as conditions of the natural environment, economic factors, and human needs clashing with the possibilities and limitations of the environment.

We have been investigating four settlement-adaptation systems resulting from demographic, economic, and social processes that took place within the main original centers to the south. The hunters of the Early Upper Paleolithic and Middle Upper Paleolithic lived in the area of the northern foreland of the Moravian Gate, in a way specific to this population, in harmony with the environment. While they selected areas with similar landforms, the distribution of the specific sites where they lived, and their manner of using the lands they occupied, were slightly different (Table 2).

In the Bohunician settlement-pattern, small areas were settled that were limited to kame hills with elevations of up to 310 m a.s.l.. The location of the sites in the vicinity of the 4th-order streams on the SE, E, and S facing slopes well away from summits is of particular significance here. The seasonal inflow and activity of the population conditioned the demand for food and raw materials, not necessarily for stone.

Another more dynamic model refers to the Szeletian culture. Their increased mobility led to an increase in settlement-intensity and the size of "estates". A shift of Szeletian culture towards the landscape-zones C1, E,

Table 2. **Relationship between Upper Paleolithic settlement in the northern foreland of the Moravian Gate and landscape-zones**

Landscape-zones	Elevation, m a.s.l	% of the area analyzed	Landscape	Raw materials	Archaeological site	Culture
A	600–1400	8.61*	Medium-high mountains, rounded summits, steep-sided valleys	+	Hunting camp	Aurignacian, Gravettian
B1+B2	300–500	10.35+9.18	Undulating topography (Silesian Foothills); heights, long relatively high ridges; karst landforms (Silesian-Cracow Upland)	+	Dwelling camp with workshop elements Hunting camp Short-term camp	Szeletian, Aurignacian
C1	260–310	6.21	Flat to gently undulating topography; loess cover; surfaces deeply dissected by valleys	+	Workshop Mini-workshop Dwelling camp Dwelling camp with workshop elements Short-term camp Kill-site	Bohunician, Szeletian, Aurignacian, Gravettian
C2	200–260	28.52	Flat and undulating topography	+	Dwelling camp with workshop elements Short-term camp Hunting camp	Same
C3	160–200	19.3	Flat and gently undulating topography	+	Dwelling camp with workshop elements Short-term camp Hunting camp	Bohunician, Szeletian, Gravettian
D	240–320	0.72	Elongated or irregularly shaped hills	+	–	–
E	140–260	17.36	Flat, large valley bottoms, terraces	+	Workshop Short-term camp	Szeletian, Gravettian

* Without Eastern Sudetes Mountains.

C2, and B became clearly visible. During the migration-cycles, settlement developed along the valleys of streams, generally of the 4th and 2nd order. Szeletian groups established their camps at an altitude of 217–316 m a.s.l.; primarily on kame and rocky hills, and only later on terraces or the edge of the moraine plateau. They usually headed for slopes facing N, SW, S, E, and SE. Forays towards the N were undertaken in order to hunt, in addition to conducting workshop-type activity.

Characteristic features of the Aurignacian model included operating in C1, B, and A, crossing the barrier of the mountains (A) and climbing upwards, with a vertical range reaching 425 m (205–630 m a.s.l.). Elevated sites (kame, moraine, mountainous, rocky or upland) were those mainly chosen for settlement, sticking with equal frequency to streams of the 1st, 3rd, 4th, and (slightly less frequently) those of 2nd order. The occurrence of sites on N, SW, E, and S slopes needs to be emphasized. The seasonal nature of the activity was diminishing in the Aurignacian groups, as they obtained flint-material and hunted also in the mountains.

The Gravettian culture groups, like the Szeletian, did not avoid low-lying terrain, and like the Aurignacian ventured, though with difficulties, into the mountains. The lands of C, A, and E fell into the Gravettian settlers' sphere of activity; but in practice this model showed a stronger connection with C1 lands. Certain features were repeated: location within a range of altitudes 220–286 m a.s.l. at the edge of a plateau; and more stable settlement-forms in the shadow of the hilltops and on the summits of naturally defensive elevations, on the streams of the 2nd, 3rd, 4th or less frequently the 1st order. The sites were usually located on S, E, and W slopes. Migrations were undertaken in search of raw materials. Hunting was also a common practice.

To conclude, during the interpleniglacial, the foreland north of the Moravian Gate was the focus of interest for communities representing different material status, different economic, social and organizational, and also different settlement customs.

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Received April 6, 2015.