THE GRAVETTIAN ALONG THE DANUBE






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DOLNOVĚSTONICKÉ STUDIE, SVAZEK 11
THE DOLNÍ VĚSTONICE STUDIES, VOL.11

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Editors Jiří A. Svoboda and Lenka Sedláčková

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CONTENTS

INTRODUCTION

As a result of the 80 years-tradition of regional Upper Paleolithic research at the foot of the Pavlovské Hills, the friendly rural atmosphere, and local wine, Pavlov, Dolní Věstonice and Mikulov hosted several international workshops and meetings during the past decade. The last one in this series, the Gravettian along the Danube, *has been organized on November 20.-21., 2002, by the Paleolithic and Paleoethnology Research Center of the Institute of Archaeology, Academy of Sciences of the Czech Republic (Brno and Dolní Věstonice), in the castle kindly provided by the Regional Museum at Mikulov, and with the generous support by the Maison des Sciences de l'Homme Foundation (Paris), the Council of American Overseas Research Institutes (Washington, D.C.), and the Andrew W. Mellon Foundation (New York).*

The meeting at Mikulov was divided in two parts: the first one resuming the newly accumulated evidence concerning prehistory of the Danube river, a major European communication axis, about 30 - 20 thousands years ago. The contributions we ordered from the west to the east: south Germany, Austria, Moravia, Poland, Slovakia, Hungary, Slovenia and Bulgaria, including comparative overviews from Italy and northern Russia, and general synthetic papers as seen from the Belgian and American perspectives. The second part informed about the long-term and multifacetted project of processing and publishing the site of Pavlov, excavated by Bohuslav Klíma in 1952-1972, and still providing a wealth of materials to be analysed or re-analysed from several viewpoints.

This two-fold structure of the Mikulov meeting is also reflected in the publications. The volume now at hand covers the first part, starting with introductory overviews of the culture, the stratigraphy and the chronology, continuing to regional papers and new field discoveries, and concluding with a couple of general papers. Our next publication will be the third volume on Pavlov (Southeastern part, excavations 1954-1956) *which will include the remaining presentations from Mikulov, accompanied by additional contributions, so as to complete the general picture of this part of the Pavlov site.*

Besides the Institutions involved in the organisation – as mentioned above - we would like to thank personally to Dobromila Brichtová, director of the Regional Museum at Mikulov, Olga Špilar, acting for the Maison des Sciences de l'Homme in Paris, and Marcela Koňáková from the Tourist Information Center at Mikulov. Without their help and contribution the meeting would probaly not have taken place.

Jiří A. Svoboda and Lenka Sedláčková, editors

ÉVOLUTION DU GRAVETTIEN AU MOYEN DANUBE

M. Otte et P. Noiret

Abstract

Radiometric dates, typology and sedimentology suggest an autochthonous origin for the Gravettian culture in the Middle Danube. Its complex development is marked by tool specialisation, a demographic increase and an apparent sedentism. Subsequently, this key region spread to the east or the west by autonomous migratory movements during each phase (Bayacian, Kostenkian). The form of religiosity that is finally associated with this culture constitutes the first artistic creation evidencing a matriarchal system. Through the artistic forms, this belief system is also modified through time and across space: it is characterised as well by recognisable artistic "styles". The broad Gravettian entity, in its distribution and the finesse of its adaptation, was a product of continental Europe, for which it constitutes the origin of later cultures and populations. At the same time, its plastic expressions seem to result in an Aurignacian acculturation, and its anatomy a blend of Neandertals with incoming modern humans. Curiously, recent phases are limited to the eastern Danube Basin. The Pleniglacial B seems to have interrupted western contacts, where the Magdalenians would soon appear, until Moravia. From then on, Europe as a whole would no longer be unified. In consequence, new approaches to the study of the Danubian Gravettian should be oriented towards the eastern plains, Moldavia and the Crimea.

KEYWORDS: chronology, typology, art, Gravettian, Central Europe.

1. Introduction

La « culture gravettienne » est proprement européenne, dépourvue d'analogie ou d'origine extérieure à ce continent. Dans ses phases essentielles, comme durant sa genèse, sa répartition est surtout centrée sur l'« Europe moyenne », c'est-à-dire les plaines et les plateaux, généralement couverts de lœss ou de limons. Cet exposé vise à retracer quelques grandes étapes de son développement, à l'intérieur du continent et spécialement le long de l'axe du Danube, sur lequel elle s'articule essentiellement.

2. Phasage

D'une manière très simple mais, pensons-nous, très logique, nous nous sommes fondés sur la superposition stratigraphique, afin de définir les tendances évolutives du Gravettien en cinq stades (Otte 1990, Otte *et al.* 1996a). Ainsi, même en dehors de toute date, peut-on reconnaître un « rythme » des transformations, issu des analogies entre les séquences reconnues aux sites stratifiés principaux. D'une façon très encourageante, on a pu reconnaître également des analogies inter-régionales, sur lesquelles furent alors élaborées des propositions de diffusion latérale, d'une région à l'autre.

Les séquences essentielles sont fournies par quelques grands sites-clefs, comme Willendorf II en Basse-Autriche, Dolní Věstonice en Moravie, Mitoc–Malu Galben en Roumanie et Molodova V en Ukraine. Très simplement, nous avons cherché à y reconnaître des critères techniques, typologiques ou stylistiques, propres à chacun des cinq stades. Nous pouvons ainsi proposer une « histoire » de cette culture, assortie de suggestions quant aux éventuels déplacements dans l'espace, reconnus au fil de cette évolution, soit vers l'Est (« Kostienkien »), soit vers l'Ouest (« Bayacien ») par rapport à la région centrale.

3. Évolution

Le **Stade 1** se trouve au cœur du continent, en Basse-Autriche et Moravie, et en Jura Souabe (Figure 1). Dans ces régions, il apparaît abruptement, superposé à l'Aurignacien intrusif, dont il ne garde aucun souvenir sur le plan technique. L'industrie est légère, très directement maîtrisée aux fins de façonnement des pointes de La Gravette, des micro-gravettes et, surtout, des « fléchettes » faites sur lamelles.

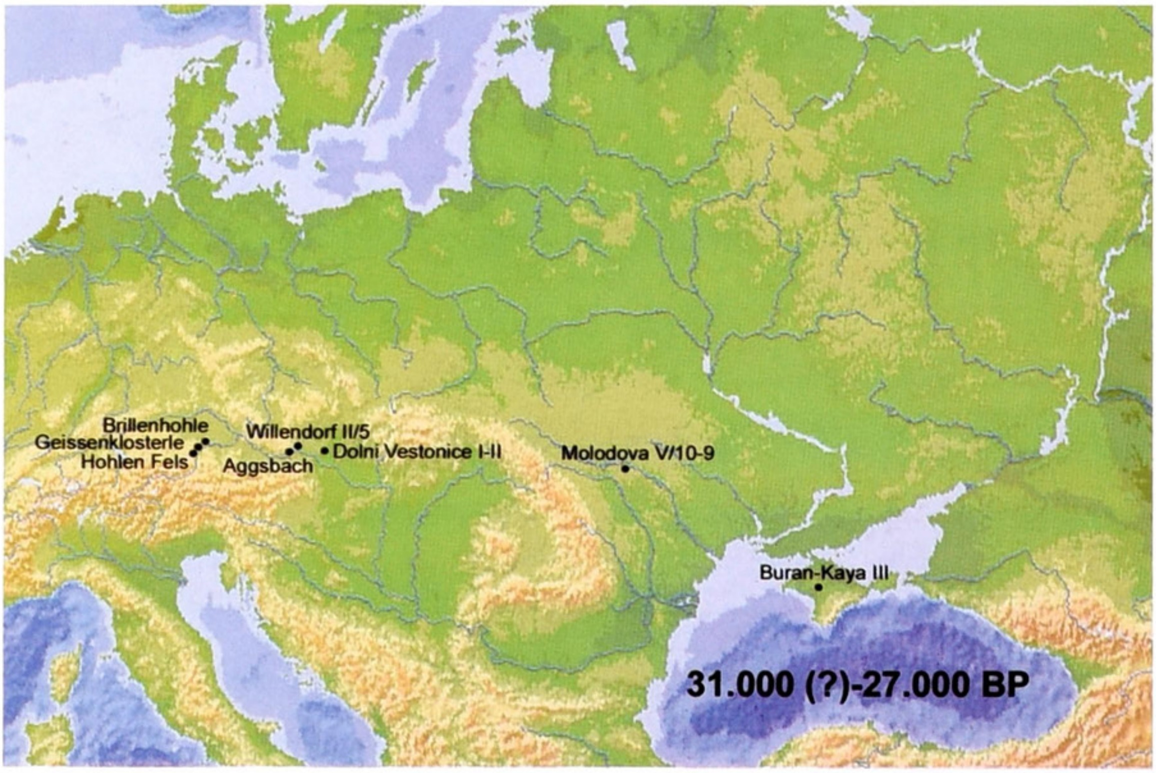

Figure 1. Localisation des principaux ensembles gravettiens entre 31.000 et 27.000 BP.

À Willendorf II, le niveau 5 est lié à un petit horizon humifère associé à l'interstade de Schwallenbach III (Arcy), vers 31.000-30.000 BP (Haesaerts *et al.* 1996) (Figure 2). C'est le « sol de Stillfried B » (ou paléosol W 2/3) que l'on retrouve au site aurignacien de Stránská skála (niveau culturel IIIa-3, daté de 30.980 ± 360 BP [GrN-12605]) (Damblon *et al.* 1996), démontrant la contemporanéité de ce premier Gravettien avec l'Aurignacien.

D'autres industries sont en relation avec cette phase ancienne, à Dolní Věstonice I (station inférieure) et Dolní Věstonice II (station A, western slope/unit 2-3). Elles sont caractérisées par certains outils d'allure un peu aurignacoïde (Svoboda 1994, p. 56). Les burins y sont plus nombreux que les grattoirs et il existe quelques lames à retouche unilatérale, beaucoup de micro-gravettes et de microlithes, et des fléchettes (Kozłowski 1996, Svoboda 1996). On les rencontre également à Aggsbach, où la datation radiométrique de 26.800 BP est sans doute trop jeune (niveau culturel dans des lœss soliflués; Haesaerts 1990). Ce Gravettien ancien a probablement duré de 31.000 (?) à 27.000 BP et consiste en de petites occupations dispersées, aux industries lithiques déjà homogènes, bien différenciées de l'Aurignacien et du Szélétien, auxquels il succède.

Il s'est également étendu vers l'Allemagne (le Jura Souabe), ce dont témoignent les industries de Brillenhöhle (couche VII), Hohle Fels (couche II) et Geissenklösterle (couche I), dans la vallée de l'Ach, où les fléchettes sont représentées (Hahn 2000, Scheer 2000). Bien établi dès 29.000 BP, il est localisé en grottes. Les modes d'approvisionnement en matières premières lithiques ne correspondent pas à ceux de l'Aurignacien antérieur (ni à ceux du Pavlovien) ; les formes d'expression artistique sont rares. Les

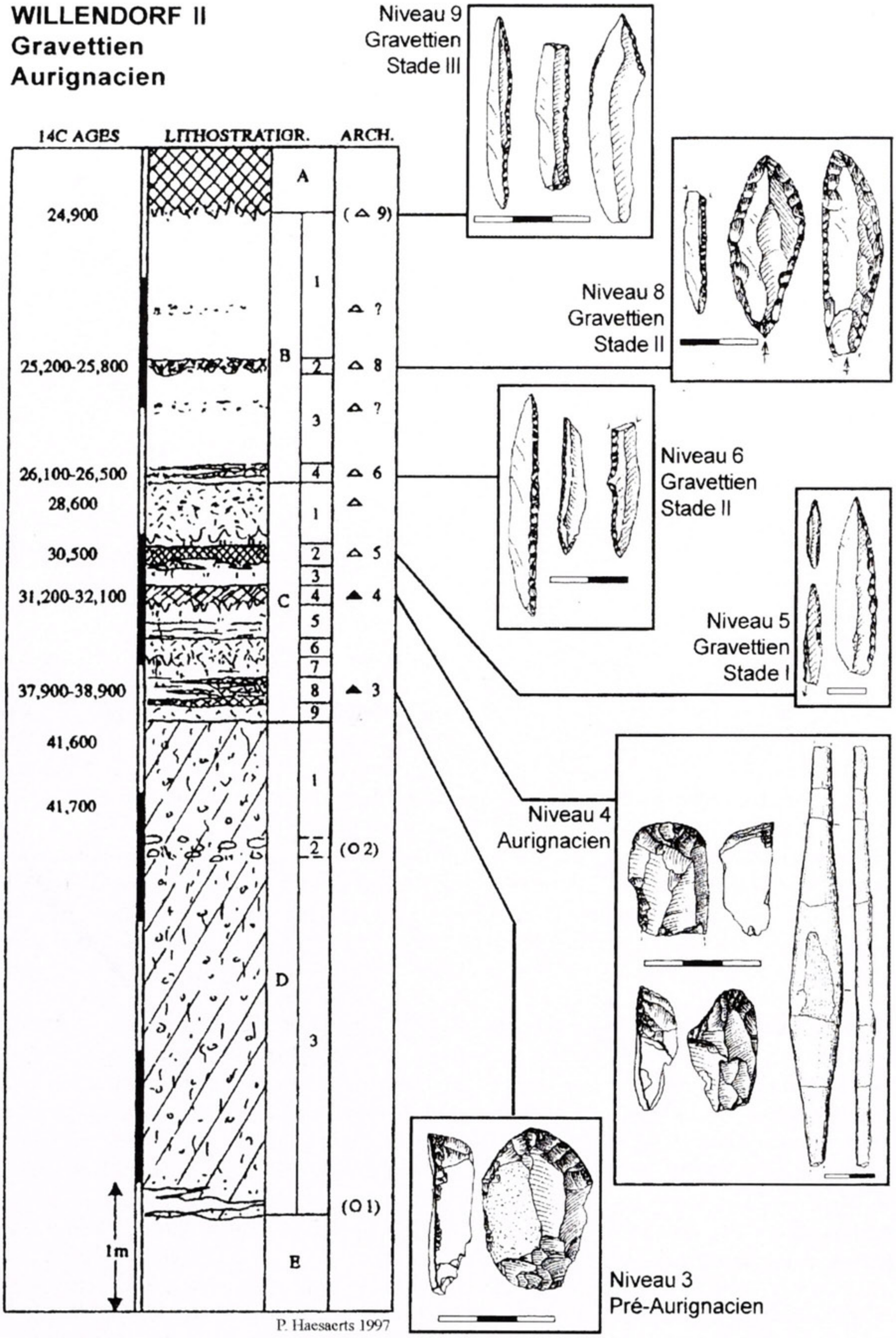

Figure 2. Willendorf II (Basse-Autriche). Séquence stratigraphique et niveaux archéologiques gravettiens et aurignaciens (d'après P. Haesaerts, Hahn 1977, Otte 1981).

datations de la couche I de Geissenklösterle situent plusieurs sols d'occupation entre 29.000 et 27.000 BP. À Hohle Fels, les niveaux gravettiens IId, IIc et IIb sont datés entre 29.000 et 25.000 BP. Plus loin, Weinberghöhlen à Mauern a été daté de 28.260 BP.

À Dolní Věstonice I, l'association des datations anciennes avec le Gravettien des étages inférieurs du site, a été remise en question par M. Oliva (2000a). Selon cet auteur, une occupation antérieure au Gravettien était présente au gisement, probablement aurignacienne. Les plus anciennes dates fiables pour le Gravettien à Dolní Věstonice proviendraient du site II, et ne seraient pas antérieures à 27.000-26.000 BP. Quoiqu'il en soit, l'ensemble du niveau 5 de Willendorf II atteste l'ancienneté indiscutable de ce premier Gravettien d'Europe centrale.

Le **Stade 2** correspond à l'extension maximum en Europe centrale, avec les occupations principales des grands sites de Basse-Autriche (Willendorf II, niveaux 6-8) et de Moravie (Dolní Věstonice I et II, Pavlov I et II). Une vaste extension latérale se manifeste avec les sites des hauts bassins fluviaux, alimentant la mer Noire, en Roumanie (Mitoc–Malu Galben, ensembles gravettiens I à III) et en Ukraine (Molodova V, niveaux 10-8) (Figure 3). L'outillage est caractérisé par de grandes lames appointées, dans des ensembles encore dominés par les burins (Figure 4).

Figure 3. Localisation des principaux ensembles gravettiens entre 27.000 et 25.000 BP.

Durant cette phase, on constate une forte densité démographique des sites, désormais de très vaste extension. Cette densité d'habitat est compatible avec l'idée d'une sédentarité au moins partielle du groupe. Cette mutation a pu expliquer, en partie au moins, l'importance symbolique prise par la femme génitrice dans l'iconographie religieuse du Gravettien.

La période 27.000-25.000 BP est caractérisée par la coexistence de deux « faciès » distincts dans le « Pavlovien » (Svoboda 1994, p. 54-57, Svoboda 1996, J.K. Kozłowski 1996). Le premier faciès poursuit

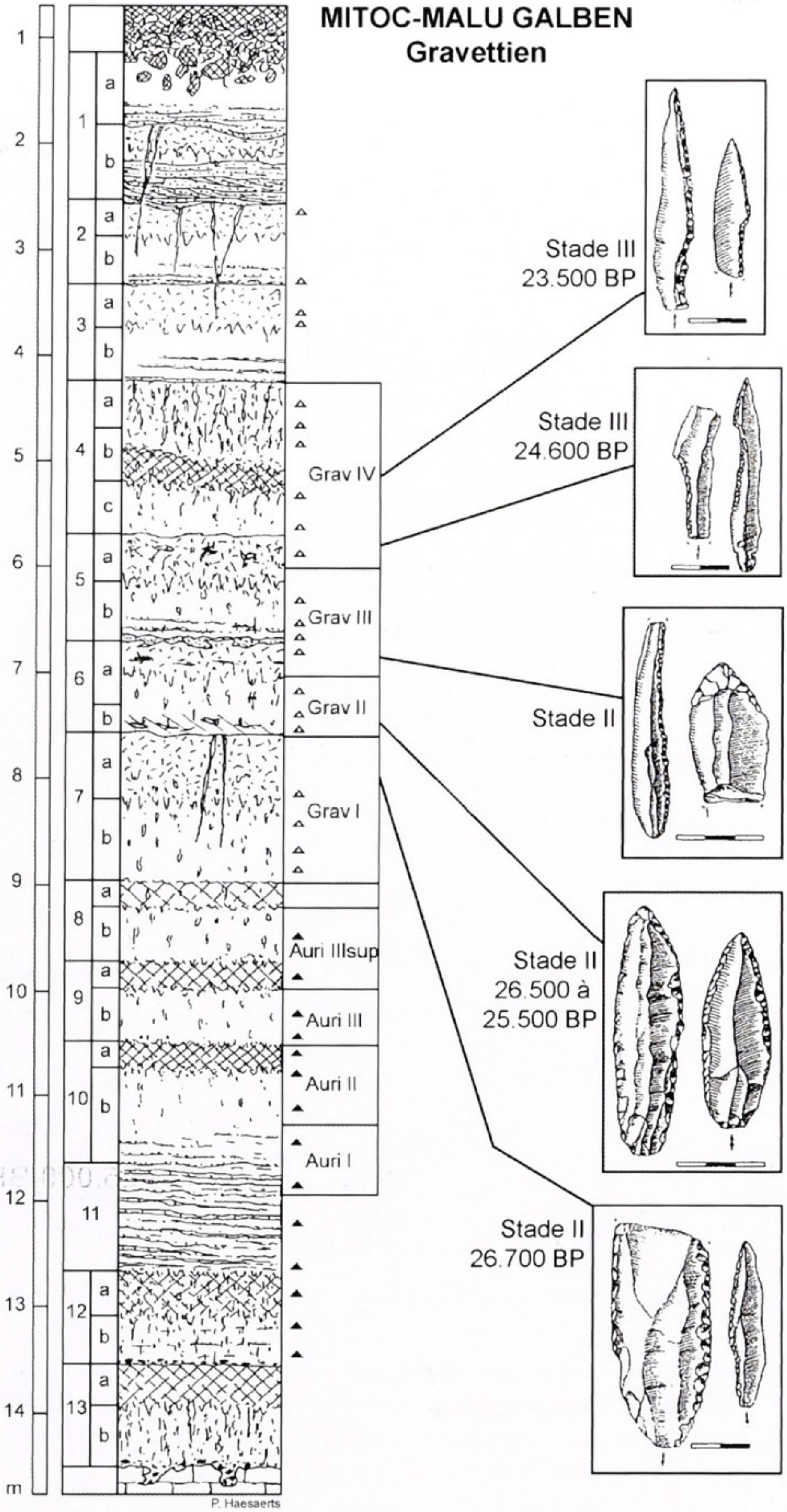

Figure 4. Mitoc–Malu Galben (Roumanie). Séquence stratigraphique et ensembles archéologiques gravettiens (d'après P. Haesaerts, M. Otte).

la tradition des microlithes et correspond à quelques ensembles seulement, parfois caractérisés par un type d'outil particulier (Dolní Věstonice II, unit C; micro-scies à Dolní Věstonice I, station moyenne; microlithes géométriques à Pavlov I, avec les plus anciennes céramiques).

Le second (et principal) faciès a livré des outillages lithiques où la retouche continue bilatérale aménage de grandes lames, appointées ou employées comme supports à d'autres outils (burins, grattoirs). Quelques racloirs réapparaissent et les microlithes sont rares. Ces industries sont les plus caractéristiques du Stade II et on les retrouve dans les ensembles de Dolní Věstonice II (unit B, unit LP/1-4), Předmostí (l'essentiel de l'industrie), Willendorf II (niveaux 6 à 8, entre 26.500 et 25.200 BP), Langelois (26.960 et 25.480 BP, sur le même échantillon) et peut-être une partie de l'industrie de Petřkovice, plus récente (23.370 et 20.790 BP) (voir Haesaerts 1990, Damblon *et al.* 1996).

Entre 27.000 et 25.000 BP donc, le Pavlovien correspond à un faciès régional spécifique du Gravettien européen (Valoch 1986-87). Il est attesté dans la phase froide postérieure à l'oscillation de Maisières, traduite par un paysage de toundra, frais et humide. À Willendorf II, le niveau 6 se trouve dans le lœss, vers 26.500-25.200 BP. Peu après 26.000 BP, la péjoration climatique qui annonce le Pléniglaciaire supérieur débute, avec une augmentation des phénomènes de solifluxion et la formation d'un important gley de toundra (traduisant une phase à permafrost actif). Une seule amélioration climatique est attestée, traduite par un petit sol humifère par dessus ce gley. Il s'agit d'un bref épisode interstadiaire identifié à Pavlov II et que l'on retrouve à Willendorf II, associée au niveau culturel 8 (entre 25.800 et 25.200 BP). Le lœss du Pléniglaciaire supérieur se dépose ensuite (Haesaerts 1990, Haesaerts *et al.* 1996).

La faune chassée inclut principalement le mammouth, le lièvre et le renne, ainsi que des animaux à fourrure (loup, renard), sans spécialisation particulière (Musil 2000), bien que ce ne soit l'opinion de tous les chercheurs. M. Oliva (1998, 2000) pense que les Pavloviens ont avant tout exploité le mammouth; les dépôts d'ossements de cette espèce sont d'ailleurs caractéristiques (Svoboda 2001). Les matières premières lithiques sont importées de Silésie et du Jura de Cracovie (silex), du Danube (radiolarite) et de Slovaquie orientale ou de Hongrie (obsidienne). Il n'existe pas de rapport entre la fréquence d'utilisation de ces roches et la distance d'approvisionnement ; à cet égard, le comportement vis-à-vis des matières premières siliceuses n'est pas « économique » (Oliva 2000, Svoboda *et al.* 2000).

Une extension vers l'est est attestée par certaines industries rencontrées de la Hongrie à la Plaine russe, par exemple à Bodrogkesztúr–Henye (Hongrie), à Mitoc—Malu Galben, à Molodova V et à Kostenki 8, niveau inférieur (Russie). Dans ses caractéristiques typologiques, cette extension relève du Stade II, mais il est intéressant de se poser la question de savoir si elle n'est pas liée au Stade précédent.

En effet, il existe pour les premiers ensembles gravettiens de Molodova V (niveaux 10 et 9) une datation de 29.650 ± 1.230 (LU-15A; niveau 9), qui est fiable et cohérente par rapport à la chronostratigraphie générale du site (P. Haesaerts, comm. pers.). Les deux industries, très similaires, sont situées au sein d'un paléosol dédoublé, entre des composantes humifères correspondant aux oscillations d'Arcy et de Maisières. Les outillages sont caractérisés par quelques micro-gravettes, mais surtout par de grandes lames retouchées et appointées, très caractéristiques du Stade II. Il pourrait d'agir d'une forme d'invention locale, similaire mais antérieure à ses équivalents moraves.

La situation de Bodrogkeresztúr–Henye est également intéressante, dans la mesure où la publication de L. Vértes (1966) montrait une industrie caractérisée par un assez grand nombre de petites pièces à dos, alors qu'une partie de la collection étudiée par l'un de nous (M.O.) présentait toutes les caractéristiques du Stade II (Otte 1998). Le niveau culturel est daté de 28.700 ± 3.000 BP (GxO-195) et 26.318 ± 365 BP (Deb-2555) et l'ensemble de l'industrie est aujourd'hui considérée comme homogène, appartenant à une même entité culturelle (Dobosi 2000, p. 105). Cette industrie est l'une des seules à présenter des grattoirs supérieurs en nombre aux burins (Kozłowski 1986, p. 155).

Le statut à accorder à l'industrie du niveau inférieur (II) de Kostenki 8 (Telmanskaya) reste également incertain. Ce niveau est daté de 27.700 ± 750 BP (GrN-10509), mais deux autres résultats plus récents existent (24.500 et 23.020 BP) (Sinistyn et Praslov [éd.], 1997). L'industrie est caractérisée par de nombreux microlithes (surtout des pointes à dos, avec retouche inverse de l'extrémité, mais aussi des segments et des trapèzes) et des burins plus nombreux que les grattoirs (Anikovich 1992). Une riche industrie osseuse y est associée, qui rappelle celle d'une autre tradition culturelle locale, un peu antérieure, le Gorodstovien (Kozłowski 1985). Si l'on ne tient pas compte des outils osseux, ce niveau semble culturellement isolé, dans une zone, le Don moyen, où les industries contemporaines ou antérieures ne sont pas gravettiennes. L'industrie du niveau II de Kostenki 17 est la seule à présenter des pièces à dos. Elle est attribuée au Spitsynien, vers 32.000 BP, mais a parfois été analysée conjointement avec les ensembles du Gravettien oriental ancien, dont elle serait proche. La technologie est tout à fait laminaire et on y rencontre quelques lamelles à dos à retouche plate inverse basale (Kozłowski 1986, p. 155, 157 et figure 3.18).

Figure 5. Localisation des principaux ensembles gravettiens entre 25.000 et 22.000 BP.

Le **Stade 3** voit l'extension aux plaines orientales jusqu'aux sites de la Plaine russe : Kostenki 1/I, Avdeevo, Gagarino, principalement (Figure 5). Le critère technique essentiel et nouveau consiste dans le mode d'emmanchement cranté, appliqué autant aux pointes qu'à des outils domestiques. Le débitage y est particulièrement soigné, aboutissant à de longues lames régulières, à faible incurvation. La retouche inverse, tronquant les extrémités pour les amincir et faciliter l'emmanchement (« couteaux de Kostenki ») semble être liée à ce mode de débitage. Les burins se diversifient.

Les centres pavloviens disparaissent et aucun des grands sites moraves n'a livré d'industries riches en pointes à cran. La continuité est pourtant nette, dans les modes de débitage, les systèmes d'approvisionnement en matières siliceuses (à partir de la Silésie et de la Pologne), les stratégies planifiées de chasse et les expressions symboliques (statuettes féminines) (Kozłowski 1998).

La diffusion semble avoir pour origine le niveau 9 de Willendorf II (daté entre 24.900 et 23.900 BP). C'est l'ensemble le plus ancien ayant livré de nombreuses pointes à cran. Il est situé après le sol humifère de Pavlov II, donc dans le lœss du Pléniglaciaire supérieur (Haesaerts *et al.* 1996). Elle a eu lieu dans plusieurs directions, vers la Petite Pologne et la Slovaquie, déjà fréquentées durant le Pavlovien, et vers la Plaine russe, en passant semble-t-il par la Moldavie. Elle a eu pour conséquence la diffusion de « l'horizon à pointes à cran », reconnaissable dans une série d'industries étalées de l'Europe centrale à la Plaine russe, en réponse à l'impact de la dégradation climatique entamée dès 26.000 BP.

En Pologne, le site de Cracovie-Spadzista a livré dans la section C2, une succession d'industries attribuées au Pavlovien évolué, au « Proto-Kostenkien », au Kostenkien, puis à l'« Épi-Kostenkien ». Cette séquence est marquée successivement par les lames retouchées, puis quelques pointes à cran et des couteaux de Kostenki, qui se multiplient dans la phase typique et sont remplacés finalement par des lamelles à dos simples. Le site montre dans son ensemble un spectre fonctionnel large, avec quelques emplacements réservés à des activités très spécialisées (Kozłowski 1996a).

En Slovaquie, le niveau culturel de Nitra–Čermáň, daté de 23.000 ± 3.000 BP (GrN-2449), se trouve au-dessus d'un sol humifère daté de 24.440 BP et correspondant à l'oscillation de Pavlov II (Haesaerts 1990), c'est-à-dire qu'ils se trouve dans une position stratigraphique comparable à celle du niveau 9 de Willendorf II. D'autres ensembles en sont à peu près contemporains (Cejkov I, Moravany-Lopata, Moravany-Podkovica). Certains ne sont que des occupations saisonnières de courte durée (Kašov I, niveau inférieur).

Sur la Plaine russe, les grands ensembles de Kostenki 1/I, Kostenki 13, Kostenki 14/I, Kostenki 18, Avdeevo, Gagarino et Zaraysk relèvent aussi de cette phase, souvent identifiée en tant que phénomène culturel indépendant (Willendorfien–Kostenkien). Certains auteurs y placent également les sites de Berdyzh (Biélorussie) et de Khotylevo II (Budko 1972, Sinitsyn et Praslov [éd.] 1997, p. 115). Les pointes de Kostenki y sont caractéristiques, de avec les couteaux de Kostenki, un art analogue aux canons esthétiques, voire aux techniques, de Moravie. Les installations humaines ont fortement diminué d'intensité en Europe centrale, à l'inverse des sites russes aux structures d'occupation importantes, aménagées à l'aide d'ossements de mammouths (autre transfert technologique ?) et partiellement enterrées.

En Moldavie par contre, il est peu probable que l'extension ait été aussi déterminante. Des pointes à cran existent bel et bien, à Molodova V/7 (entre 25.000 et 23.000 BP ; P. Haesaerts, comm. pers.) (Figure 6), à Mitoc–Malu Galben (ensemble gravettien IV, entre 24.600 et 23.400 BP; Otte *et al.* 1996a, 1996b) et probablement dans quelques autres sites, dont Zamostie I (non daté, au contexte stratigraphique déplorable; Boriskovsky 1958, p. 101; Kozłowski 1998). Toutefois, ce ne sont pas des « pointes de Kostenki » typiques : plutôt que larges et à retouche inverse distale et proximale, elles sont étroites, à cran peu marqué, le plus souvent sans retouche inverse. Le reste de l'outillage est très similaire à celui attesté durant le Stade II. La continuité technologique, typologique et chronologique se manifeste à Molodova V et à Mitoc–Malu Galben, où les ensembles à pointes à cran (et nombreuses micro-gravettes) succèdent immédiatement aux ensembles à lames appointées. La zone moldave n'a d'ailleurs pas livré de témoins esthétiques comparables à ceux du Pavlovien ou du Kostenkien, comme si cette vague de diffusion vers l'Est était passée « au large » de la Moldavie.

Tous les sites postérieurs à 25.000 BP n'appartiennent cependant pas au Stade III. Quelques sites moraves ont livré des industries lithiques un peu différentes, par exemple à petites pointes à cran d'affinité méditerranéenne, portant une retouche ventrale occasionnelle (Milovice, secteur G; Oliva 1999). D'autres sont dépourvus de pointes à cran, ou ont livré des pointes à cran postérieures (parfois même antérieures). Si les pointes à cran existent, elles sont isolées (un ou deux exemplaires), alors qu'à Willendorf II/9, Cracovie-Spadzista /C2 ou Kostenki 1/I par exemple, elles ont été retrouvées par dizaines.

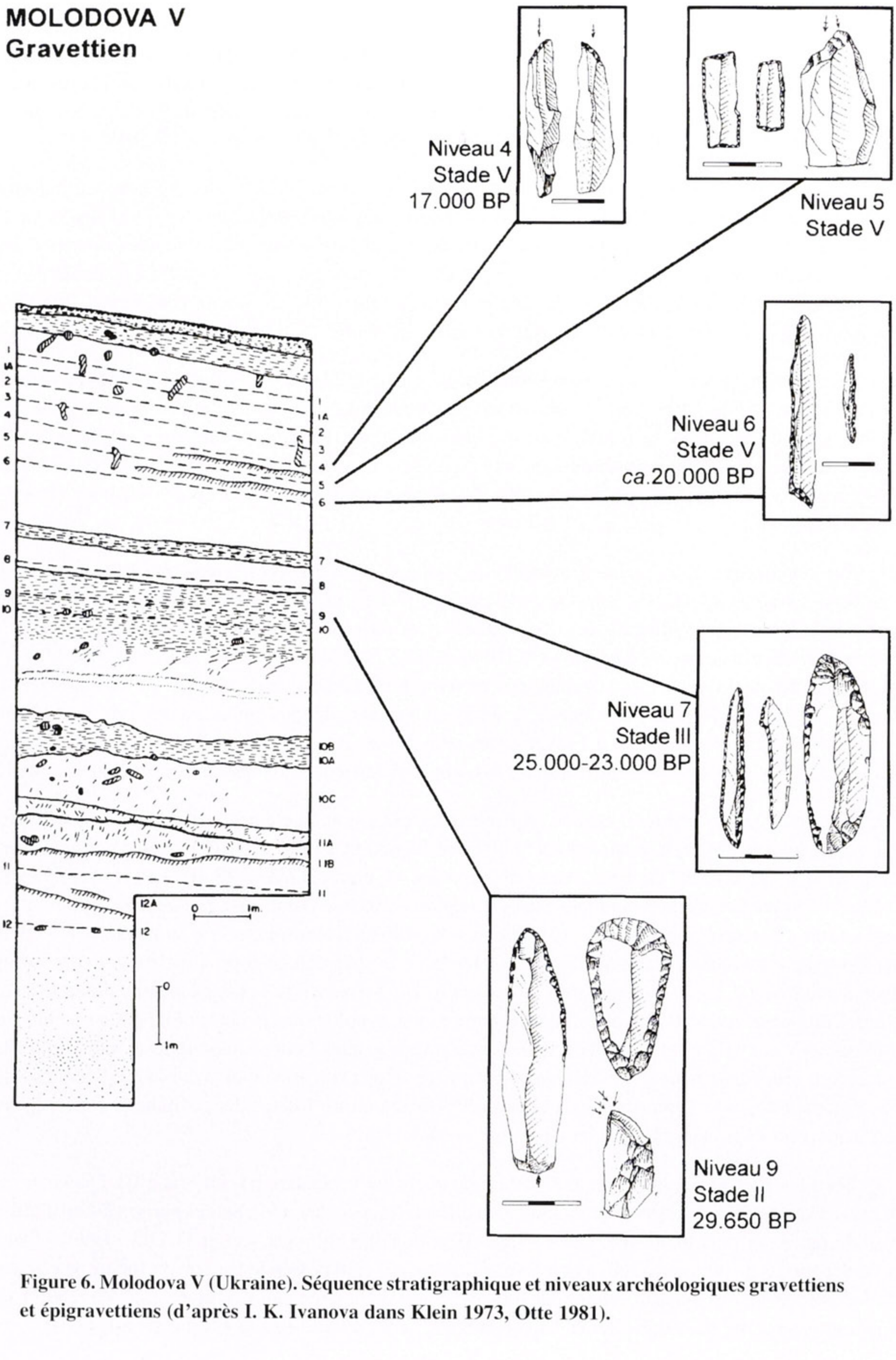

Figure 6. Molodova V (Ukraine). Séquence stratigraphique et niveaux archéologiques gravettiens et épigravettiens (d'après I. K. Ivanova dans Klein 1973, Otte 1981).

Dans la même fourchette chronologique (24.960 et 23.660 BP), le site de Khotylevo II sur la Plaine russe reste difficile à classer. En Moravie, un autre site pose problème: Petřkovice I, de très grandes dimensions et ne correspondant sans doute pas à une occupation unique. Ceci a poussé M. Oliva et P. Neruda (1999) à contester l'idée de l'unité du Willendorfien-Kostienkien en tant que système culturel indépendant.

Quoiqu'il en soit, les industries à pointes à cran disparaissent à leur tour, après 23.000 ou 22.000 BP. Une raréfaction des occupations est alors nettement perceptible en Europe centrale et orientale, de durée variable selon les régions : jusque vers 20.000 BP (Moldavie), 19.000 BP (Basse-Autriche), 18.000 BP (Slovaquie) ou 17.000 BP (Pologne).

Le **Stade 4** correspond ainsi aux quelques industries lithiques, attestées entre 23.000-22.000 et 20.000-19.000 BP. Elles sont souvent peu caractéristiques, très dispersées et rarement représentées en Europe centrale. Depuis peu cependant, quelques séries de datations radiométriques suggèrent qu'il n'y a pas réellement eu désaffection complète de tous territoires durant le maximum du Pléniglaciaire. Il y aurait plutôt eu raréfaction des grandes installations, ou des installations saisonnières à multi-saisonnières.

Le cas de la région de Kostenki est intéressant : plusieurs ensembles y ont été découverts, datés de cette période et peu homogènes (Praslov et Rogachev [éd.] 1982, Kozłowski 1986, p. 149; Sinitsyn et Praslov [éd] 1997). Le niveau supérieur (I) de Kostenki 4, daté de 23.000 et 22.800 BP, a livré de petites pièces à dos, accompagnées de pointes foliacées et de statuettes zoomorphes en pierre rappelant le Kostenkien. De même, le niveau II de Kostenki 11, daté de 21.800 BP, a livré des pointes de La Gravette et des pointes élancées à dos convexe. Dans un autre registre, le niveau supérieur (I) de Kostenki 8, daté de 22.900 et 20.000 BP, est caractérisé par une industrie à pointes à face plane rappelant les pointes de Jerzmanowice, auquel elle a été comparée autrefois (Chmielewski 1961, p. 40 ss.). Le niveau III

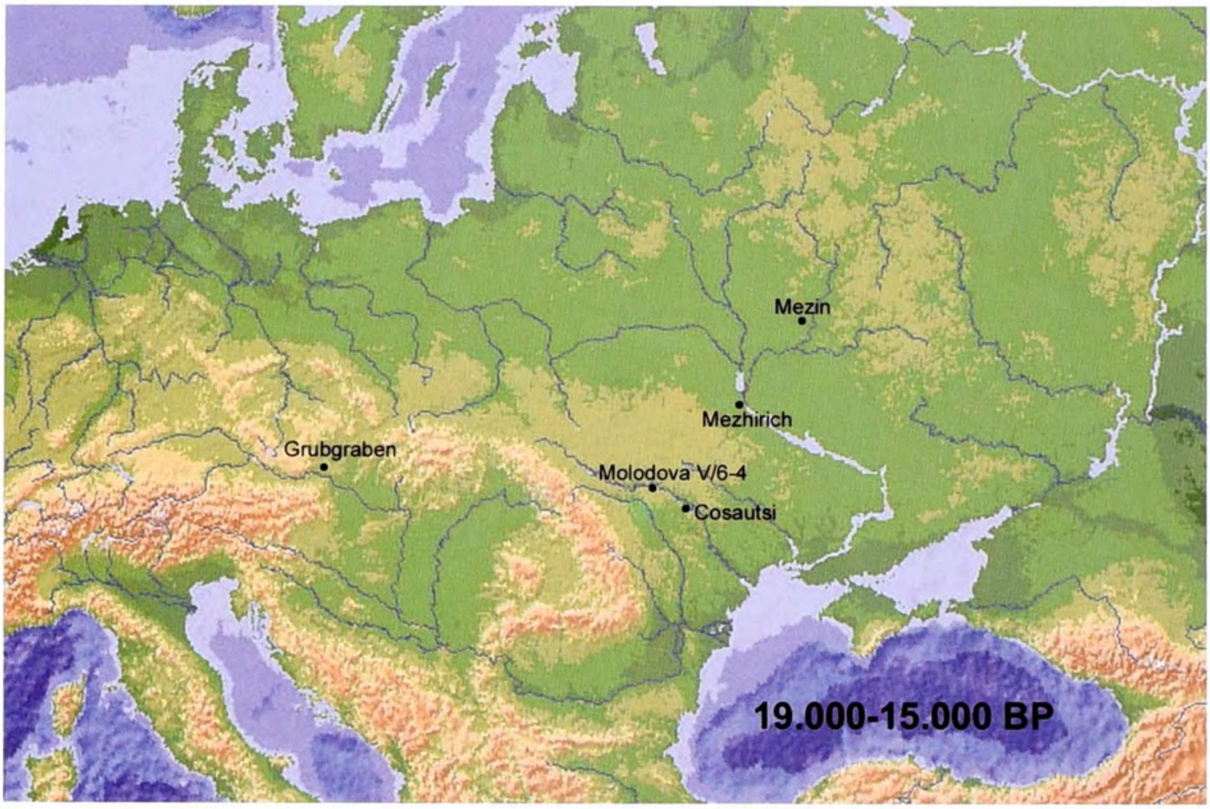

Figure 7. Localisation des principaux ensembles épigravettiens entre 19.000 et 15.000

de Kostenki 21, daté de 22.270 et 21.260 BP, a livré une industrie à pointes à cran atypiques (les « pointes de Gmelin »).

Le **Stade 5** est caractérisé par des occupations plus denses en Europe du Sud-Est, entre 20.000 et 17.000 BP (Figure 7). L'outillage est alors léger, fait sur lamelles, utilisées dans la fabrication des microlithes. L'industrie en matières osseuses est riche et variée.

Le site de Grubgraben est l'un des plus caractéristiques de la région danubienne (Montet-White [éd.] 1990), mais d'autres occupations relèvent de la même période (Stránská skála IV, Kašov I [niveau supérieur] et Wiesbaden-Igstadt en Rhénanie). Elles ne correspondent pas à un phénomène culturel homogène, en tout cas pas à un modèle unique d'occupation du territoire. Cette période est encore mal connue ; des publications récentes font état de nouvelles datations et/ou de révisions d'attribution qui suggèrent la présence d'industries variées, notamment à éclats et/ou à pièces aurignacoïdes. Ces industries sont attribuées à l'Épigravettien, à l'Épi-Aurignacien, ou rappellent le Badegoulien (Kozłowski 1996b, Oliva 1996, Street et Terberger 1999, Svoboda 1996, Terberger et Street 2002).

Plus à l'Est, une tradition épigravettienne a été mise en évidence à Molodova V, Korman IV et Cosăuți (Chernysh 1977, 1987; Borziac 1991, 1993), ainsi que dans de multiples autres sites. Les occupations ont pris place dans une période de sédimentation de lœss sableux, traversé de sols humifères attribués aux oscillations climatiques de Laugerie et de Lascaux, entre 19.500 et 17.000 BP (Haesaerts *et al.* 1998). Les ensembles lithiques sont très homogènes, caractérisés par des armatures à dos, des lamelles à dos, des burins et grattoirs (sur petites lames, désormais non retouchées), avec quelques perçoirs et - à Cosăuți particulièrement - une riche industrie osseuse, composée de pointes de sagaie et d'outils domestiques (marteaux, pics, aiguilles) (Figure 8). Les structures retrouvées correspondent à des installations circulaires organisées autour d'un ou de deux foyers, accompagnées de postes de débitage et de zones de boucherie; la chasse est orientée d'abord vers le renne, puis vers le cheval.

Sur la Plaine russe centrale, des ensembles plus récents (d'après les datations radiométriques) correspondent à d'autres modes d'exploitation du territoire et à d'autres entités culturelles (Soffer 1985). Les outillages lithiques sont très similaires et peu variés. Les particularités culturelles se marquent surtout dans les matériaux organiques, les motifs décoratifs et les modes d'exploitation de l'environnement, qui permettent de différencier le Molodovien (bassin du Dniestr moyen), du Mézinien (bassin moyen du Dniepr), de l'Elissevichien (bassin supérieur du Dniepr), et de la culture de Zamiatnin (bassin moyen du Don), par exemple.

Globalement, le Stade V correspond à une mosaïque de petits groupes individualisés régionalement, structurés, plus mobiles qu'auparavant et qui réoccupent massivement des territoires partiellement désertés ou non-occupés. Il existe probablement de nouvelles structures sociales qui expliquent les différences observées avec les ensembles antérieurs en ce qui concerne les stratégies d'acquisition des matières premières, les modes de chasse et les expressions artistiques (Soffer 1985, Kozłowski 1997).

4. Datations

Nous avons regroupé et traité l'essentiel des datations C14 disponibles, dont un certain nombre furent issues de nos propres recherches. Cette sériation montre la grande continuité d'occupation, au moins durant les phases principales (Figure 9).

En y intercalant la position des stades stylistiques et en utilisant les moyennes des datations exprimées par sites (Figure 10), on peut constater la régularité du rythme évolutif, que nous avions d'abord conçu de façon empirique, en nous fondant sur les stratigraphies et les comparaisons inter-régionales.

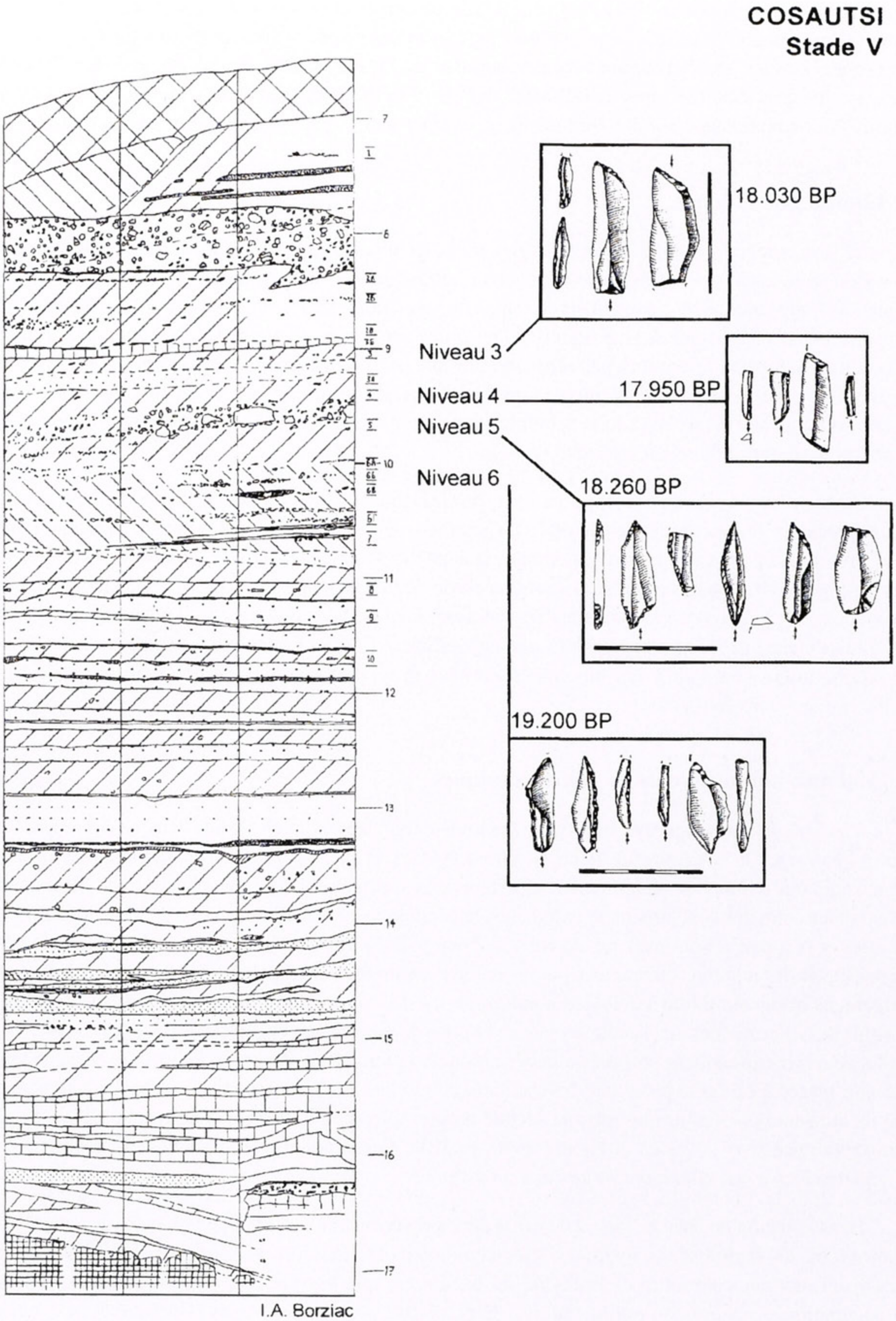

Figure 8. Cosăuți (République Moldave). Séquence stratigraphique et niveaux archéologiques épigravettiens (d'après I. A. Borziac, Otte *et al.* 1996b).

Le tableau général finalement obtenu (Figure 11) manifeste divers phénomènes globaux, d'interprétation « historique » large. Chaque séquence gravettienne régionale repose sur l'Aurignacien, toujours présent à la base de la séquence. Les plus anciennes traces appartiennent aux aires centrales de l'Europe. Dans les phases médianes (contemporaines du Pléniglaciaire), on constate une désaffectation de ces aires centrales. Les aires de diffusion latérale (à l'Est, principalement) poursuivent au contraire une évolution continue, jusqu'au Tardiglaciaire, lorsque les ensembles se chargent en microlithes.

5. L'unité gravettienne

L'unité gravettienne est fondée sur quelques traits techniques et typologiques, qui les différencient des industries antérieures. Ces traits sont, entre autres, un débitage laminaire fondé sur des nucléus à plan de frappe unique ou à deux plans de frappe opposés, préparés par la technique de la crête, exploités et entretenus, et destinés à la production de lames et/ou lamelles étroites, régulières et minces. L'aménagement des armatures par retouche abrupte est l'autre grand trait distinctif. Mais l'unité gravettienne se manifeste également dans les statuettes féminines (« Vénus »), qui témoignent d'une communauté de pensée à travers tout le continent et correspondent à un canon esthétique inconnu dans les traditions culturelles antérieures.

Ces statuettes sont liées à la phase ancienne du Gravettien d'Europe centrale (Stade II), et à une phase plus récente en Europe orientale (Stade III). Certaines régions en sont dépourvues (la Moldavie), mais leur présence sur un vaste territoire démontre autant l'unité de la tradition culturelle gravettienne que les pièces à dos. Les variations régionales et/ou chronologiques ont permis à quelques auteurs d'élaborer des typologies à partir de ces statuettes (Z. Abramova, M.D. Gvozdover), ou simplement de constater qu'elles n'étaient pas identiques les unes aux autres (Soffer 1987). La statuette féminine est un « thème » iconographique commun à la plupart des groupes gravettiens; toutefois, chaque groupe le traite différemment dans les détails.

6. Activités non-utilitaires et unités ethniques

Les témoignages artistiques et rituels du Pavlovien sont bien connus. Il attestent de pratiques liées au shamanisme (la sépulture de Brno II, Oliva 2000c), d'un possible matriarcat (les « Vénus ») et d'un souci des défunts (les nombreuses sépultures). Les techniques sont très développées: les matières organiques animales sont largement exploitées; la céramique est fabriquée à partir de lœss; le tissage des textiles et la vannerie sont maîtrisés (Svoboda 1996, p. 285). L'ensemble témoigne de la complexité de la société et des relations entretenues par les hommes, entre eux et avec leur environnement. Les motifs artistiques et décoratifs du Pavlovien conduisent à « déduire que le système décoratif du Gravettien fournit des informations sur l'unité sociale et la prise de conscience de cette unité » (Svoboda 1997, p. 100), ce qui correspond au plus près à la définition de l'ethnie. En effet, pour les ethnologues, ce terme désigne un groupe de gens possédant des traditions culturelles, linguistiques et religieuses caractéristiques, qu'ils utilisent pour établir leur identité sociale propre, souvent à l'intérieur d'une unité sociale de plus grandes dimensions (Whitten et Hunter 1990, p. 301). Ceci implique en particulier la conscience de l'appartenance à une ethnie *par opposition* à une autre.

Dans la région du Danube, un tel degré de développement culturel n'est apparu qu'avec le Pavlovien morave et, en réalité, dans quelques sites seulement. De manière générale, il faut constater que ces manifestations culturelles évoluées ne se rencontrent que lorsque certaines conditions spécifiques d'occupation d'un territoire sont réunies. C'est-à-dire lorsque les vestiges retrouvés témoignent de la présence d'une population sans doute abondante, occupant de grands sites riches en matériaux lithiques ou organiques, et auxquels elle retourne de manière récurrente pendant une ou plusieurs saisons.

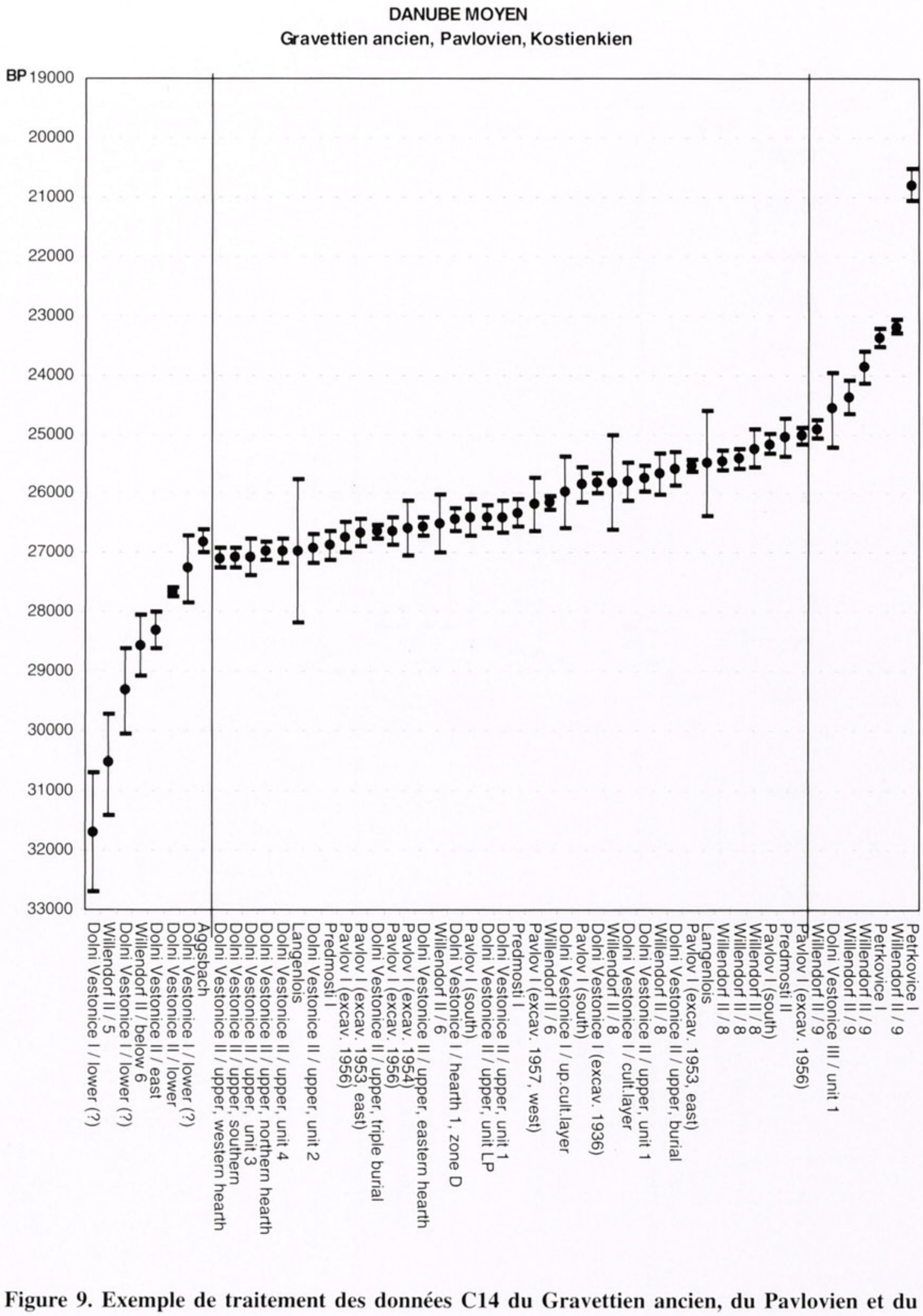

Figure 9. Exemple de traitement des données C14 du Gravettien ancien, du Pavlovien et du Kostienkien du Danube moyen, en datations BP non calibrées. Les résultats sont sériés par ancienneté. Les traits verticaux indiquent les changements de phases techniques et stylistiques. Les intensités variables entre les dates en certaines phases reflètent à la fois l'activité des chercheurs concernés, mais aussi – indirectement – l'intensité réelle prise par chaque phase.

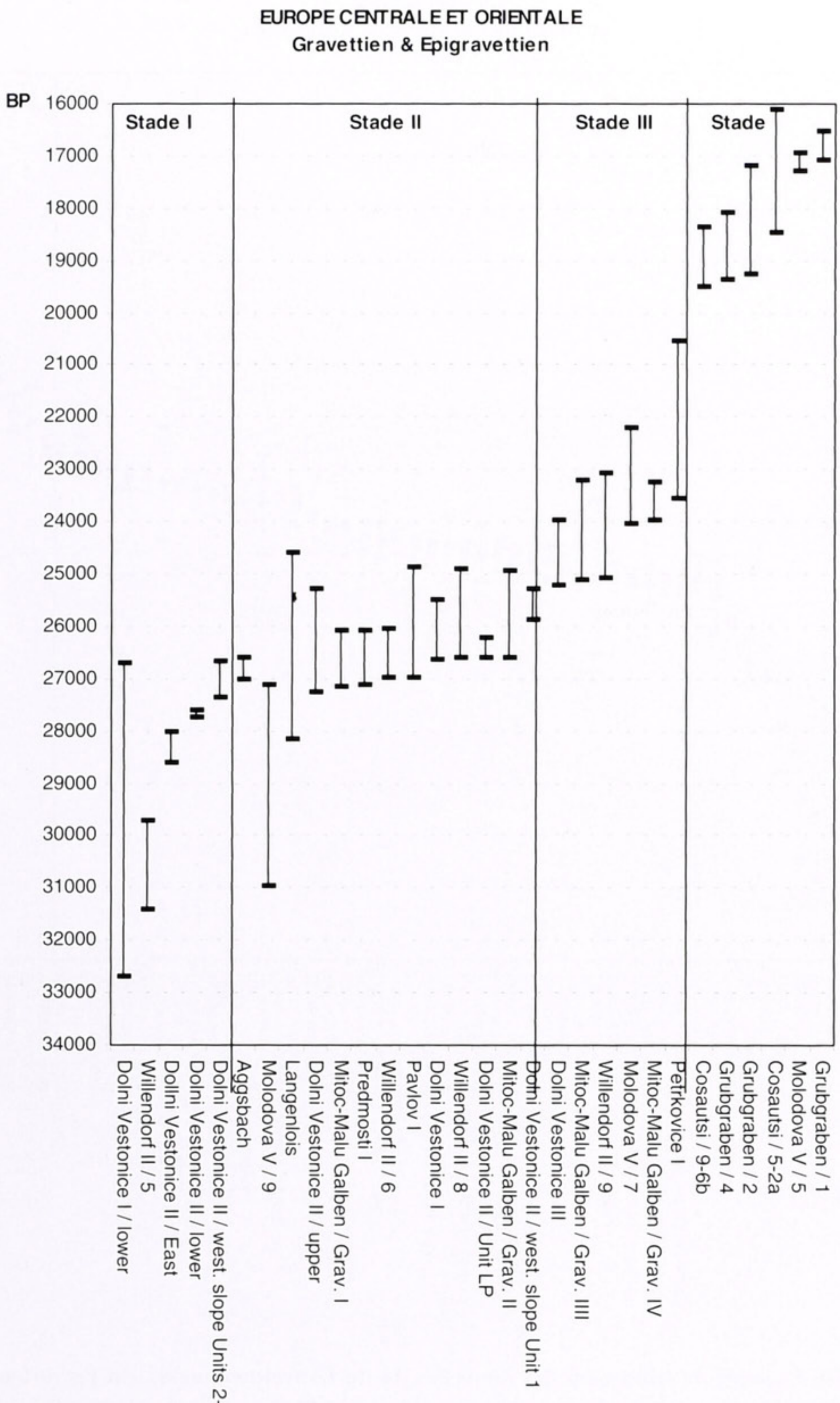

Figure 10. Pour le Gravettien et l'Épigravettien d'Europe centrale et orientale; le traitement par moyennes des datations C14 exprimées par sites manifeste plus fidèlement la succession des stades gravettiens, consolidant l'hypothèse fondée sur la stratigraphie.

BP	Ouest	Centre	Est-Carpates
16.000			
17.000		Grubgraben / 1	Cosăuti / 5-2a, Molodova V / 5-4
18.000	^ ^	Grubgraben / 2	^ ^
19.000	Wiesbaden-Ingstadt	Grubgraben / 4	^ Cosăuti / 9-6b, Molodova V / 6
20.000			
21.000			
22.000		^	
23.000		^ ^	^ ^
24.000		Willendorf II / 9, Petřkovice I, Cracovie-Spadzista	Molodova V / 7, Mitoc-Malu Galben / Grav. IV
25.000		^ ^	Mitoc-Malu Galben / Grav. III
26.000		^ ^	Molodova V / 8, Mitoc-Malu Galben / Grav. II
27.000		Dolní Věstonice I-II, Pavlov I, Předmostí, Willendorf II / 8	^ Mitoc-Malu Galben / Grav. I
28.000		^	
29.000	Geissenklösterle (I), Brillenhöhle (VII), Hohlen Fels (IId)	^ ^	Molodova V / 10-9
30.000		Willendorf II / 5, Aggsbach, Dolní Věstonice I / lower (?)	
31.000	AURIGNACIEN	AURIGNACIEN	AURIGNACIEN

Figure 11. Transposé sur le plan spatial, cette chronologie de séquences régionales montre l'ancienneté des aires centrales et l'importance prise par ces traditions dans leurs phases récentes, vers l'Est du continent.

Ainsi, aucun des ensembles relevant du Stade I ne présente-t-il ces caractéristiques. Au Stade II, ces conditions sont réunies en Moravie et en Basse-Autriche. Au Stade III, ces conditions ont été déplacées vers d'autres régions, la Pologne méridionale et la Slovaquie, d'une part, la Plaine russe, d'autre part. Avec le Stade IV, aucune installation importante n'est attestée dans la zone géographique envisagée et il faut attendre le retour des installations épigravettiennes pour que ces conditions soient de nouveau réunies, au Stade V. Nous les retrouvons en Moldavie, où les occupations de Molodova V, Korman IV, Cosăuți en présentent la plupart des caractéristiques (structures d'occupations organisées, orientation de la chasse vers une espèce principale, le renne, activités artistiques et activités rituelles, ces dernières traduites par la sépulture d'enfant du niveau 2b de Cosăuți; Borziac 1991, p. 62). Sur la Plaine russe, les entités bien définies telles que le Mézinien et l'Elissevichien, ou plus à l'est la culture de Zamiatnin, présentent chacune leurs particularités propres, et témoignent d'activités non-utilitaires, artistiques et rituelles développées. Il semble que dans la zone des steppes du nord de la mer Noire, la situation soit similaire. En Ukraine méridionale, le site d'Anetovka II montre un complexe interprété comme lieu rituel, associant une accumulation des vestiges lithiques et fauniques à un cercle de mâchoires de bison colorées en rouge (ocre) et à une petite aire de sol colorée en blanc (kaolin) et vide de vestiges (Stanko 1999).

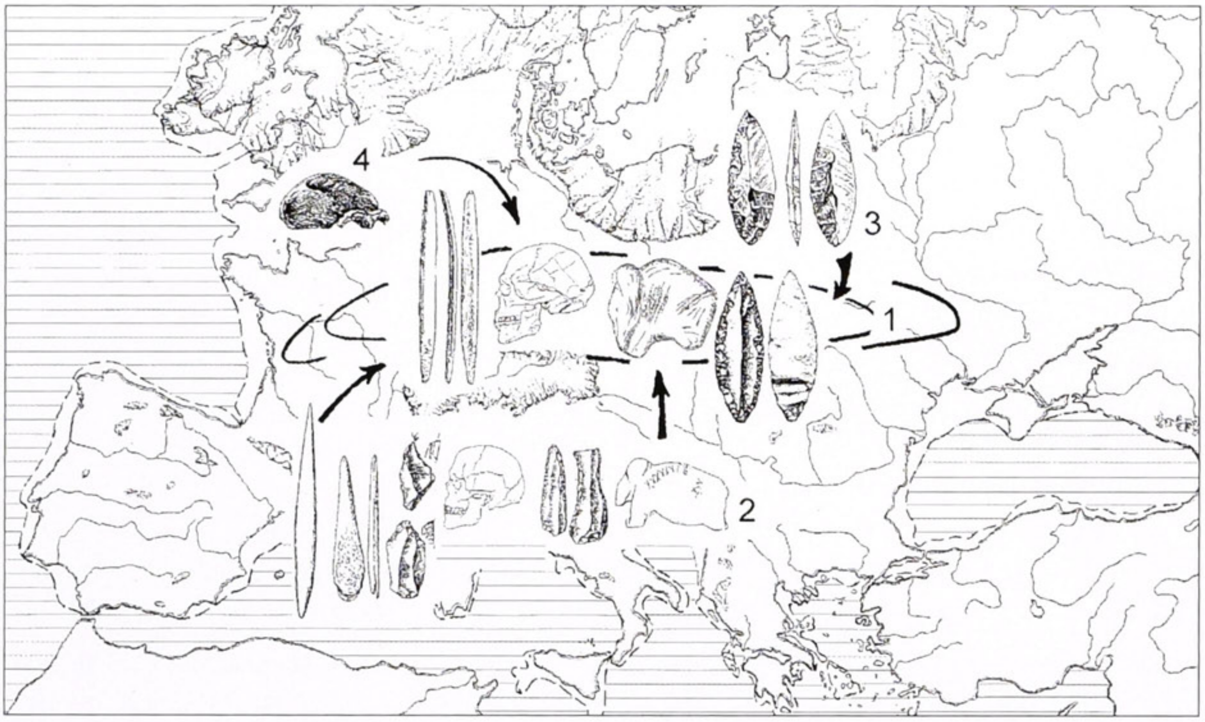

Figure 12. Considéré globalement, le phénomène gravettien s'axe sur le Moyen Danube, d'où il semble originaire (n° 1). Il est bordé par l'Aurignacien, plus méridional et plus ancien (n° 2), par les derniers Néandertaliens (n° 4) et par les ensembles initiaux du Paléolithique supérieur en Europe septentrionale (n° 3). Manifestement, un transfert s'est opéré, de l'Aurignacien au Gravettien, quant aux images animales mobilières et peut-être quant à leur signification mythique. Un impact a pu avoir lieu à partir des aires septentrionales (n° 3) dans la gestation du Gravettien ancien, où des pointes foliacées sont connues. Enfin, la morphologie anatomique des Gravettiens anciens de Moravie suggère la présence d'une possible composante génétique néandertalienne (d'après Otte 1995).

À certaines périodes, il existe donc des régions qui correspondent à des unités gravettiennes autonomes et qui présentent tous les caractères de groupes ethniquement définis. Conformément à la définition de l'ethnie, cela implique qu'il existe des relations entre les groupes, puisqu'en effet on ne peut se définir soi-même que si l'on a connaissance de l'autre.

Ces unités correspondent à autant de modèles de gestion de l'espace et des ressources de l'environnement. Nous pouvons les différencier pendant une même période ou sur le long terme. Par exemple, le Pavlovien correspond à un modèle d'occupation de vallées larges, par des sites de plein air; il est lié à l'exploitation du mammouth et entretient des contacts à longue distance pour l'acquisition des matières premières lithiques. Au même moment, les groupes gravettiens d'Allemagne méridionale occupent des grottes et s'approvisionnent en roches plus locales; la prédation n'est pas autant spécialisée. En Moldavie, les occupations mettent à profit de vastes terrasses ou des promontoires situés le long de rivières et de fleuves; le silex est toujours disponible et exploité très localement, mais la chasse ne devient spécialisée que plus tard, à partir de 20.000 BP, au moment où les occupations s'intensifient. Cette spécialisation tardive vers le renne fait écho à celle du Pavlovien vers le mammouth. Le système régional autonome du Molodovien, pressenti dès 27.000-26.000 BP, se développe alors pleinement; il est probablement saisonnier et fondé sur des retours récurrents aux mêmes emplacements (Molodova V, Korman IV, Mitoc-Malu Galben, Cosăuţi). Le Molodovien correspond également à la plus longue occupation à peu près unitaire d'un même territoire, dans le Gravettien oriental. Moins « spectaculaire » que le Pavlovien, il semble avoir été au moins aussi efficace.

Figure 13. Les statuettes aurignaciennes du Jura Souabe (à gauche) initient la création plastique : premières images, premiers mythes incarnés. Leur cohérence iconographique et stylistique démontre l'importance de leur signification. Cette cohérence se retrouve à Chauvet (au milieu), en dépit du changement survenu dans le mode d'expression, de la sculpture au dessin et à la peinture. L'ensemble se trouve transmis au Gravettien, dans des contextes culturels et ethniques pourtant totalement différents (Cussac, Předmostí, Dolní Věstonice). Il y eut peut-être transfert mythologique partiel, à travers des traditions différentes mais globalement proches, à la fois dans le temps et dans l'espace; tout comme la religion celtique imprégnait celle imposée par Rome.

7. Origines

Si l'on s'en tient au strict plan de la chronologie, la question de l'origine du Gravettien n'est pas résolue. Les datations les plus anciennes proviennent d'Europe centrale, nous l'avons vu, mais nous avons aussi souligné que leur relation au Gravettien est partiellement discutée.

D'autres datations très anciennes existent au moins dans deux régions orientales: en Moldavie (niveaux 10 et 9 de Molodova V), et en Crimée. Dans cette région, les auteurs ont participé à la fouille du site de Buran-Kaya III, en compagnie de l'inventeur du site, A. A. Yanevich, et de chercheurs ukrainiens et américains. Des artefacts gravettiens furent découverts dans les horizons 17-18, et datés de 30.740 ± 460 BP (OxA-6682). Leur contexte paléo-climatique n'est pas établi, mais d'autres datations au même site confirment l'existence d'un Gravettien ancien vers 30.000-29.000 BP. Il est superposé à de l'Aurignacien de type Krems-Dufour, du Micoquien de type Kiik-Koba et du Streletskien (voir Yanevich et Stepanchuk 1996, pour la présentation du site; Pettitt 1998, pour les datations; Marks et Monigal 2000, pour l'industrie streletskienne). Dans les deux cas, une contemporanéité avec l'Aurignacien est assurée, par les ensembles aurignaciens de Mitoc-Malu Galben (Otte et Chirica 1993) et de Siuren I (Otte *et al.* 1996b, Demidenko *et al.* 1998).

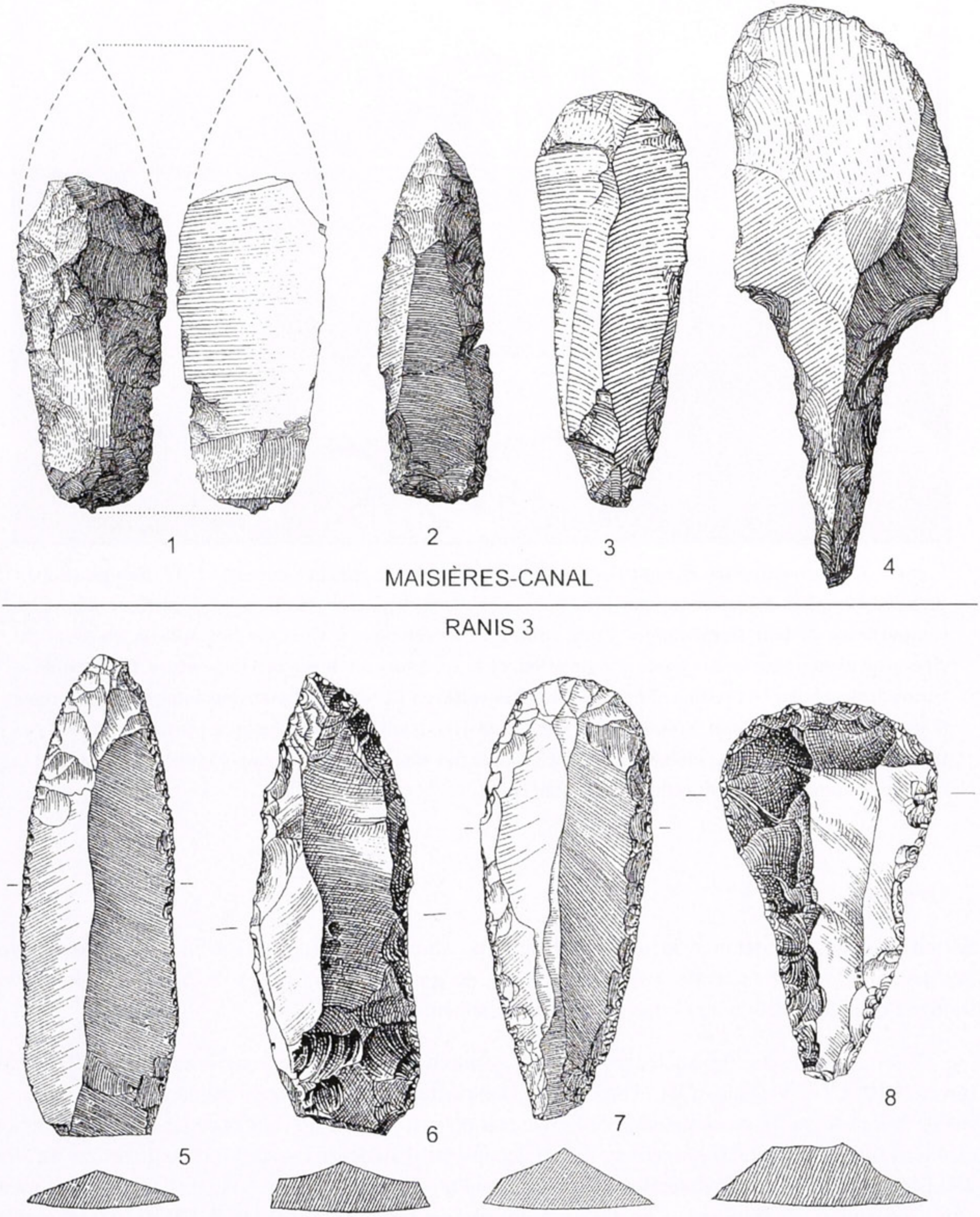

Figure 14. Des traces d'une possible acculturation des Néandertaliens sont visibles dans le passage des pointes foliacées à l'un des faciès du Gravettien ancien. Essentiellement, l'aménagement par retouches plates appliquées aux extrémités des supports y est caractéristiques, comme certains précédés de débitage, orientés vers la production de grandes lames régulières, très différentes de celles produites par l'Aurignacien, partiellement contemporain dans ces aires septentrionales. (Industries aux pointes pédonculées; en haut: Maisières-Canal, d'après de Heinzelin 1973; en bas, Ranis 3, d'après Hülle 1977) (1, 2, 5, 6: lames appointées; 3, 7: grattoirs sur lames retouchées; 4, 8: outils pédonculés).

Si le Gravettien apparaît vers 30.000 BP en plusieurs points de l'Europe (Moravie, Basse-Autriche, Moldavie, Crimée, peut-être Don moyen), le problème de l'identification du substrat techno-typologique à l'origine de ces apparitions, est posé (et multiplié par le nombre de régions concernées). Cette hypothèse est déforcée par le fait que la Moldavie et la Crimée suggèrent l'existence d'un hiatus entre les ensembles gravettiens très anciens et leurs successeurs. Il existe un hiatus de plus de deux mille ans dans la séquence de Molodova V entre les niveaux 10-9 et le niveau 8; cet hiatus est partiellement comblé par les premières occupations gravettiennes de Mitoc, mais pas entièrement et aucune industrie gravettienne n'est assurément attestée en Moldavie entre 29.500 et 27.500 BP. La situation est actuellement mal documentée en Crimée, mais aucune industrie gravettienne un peu plus récente n'a été découverte pour l'instant dans cette région. Il faut chercher à savoir si cet hiatus correspond à une réalité ancienne, ou s'il n'est qu'un artefact de la recherche: en effet, il faut souligner la difficulté qu'il y a à mettre au jour des industries aussi anciennes.

L'existence d'un Gravettien ancien à lames appointées, tel que celui de Molodova V/10-9 suggère également qu'une diffusion *en sens inverse* est possible, de l'Europe orientale vers l'Europe centrale. Cette diffusion pourrait avoir eu comme résultat la coexistence en Moravie et en Basse-Autriche d'industries « microlithiques » et d'ensembles à grandes lames retouchées et appointées.

En réalité, notre proposition d'évolution stadiaire suggère implicitement une origine unique au phénomène gravettien, généralement située en Europe centrale (Palma di Cesnola 1998). Si l'on cherche à en déterminer le mécanisme, plusieurs facteurs doivent être pris en compte.

À la différence de l'Aurignacien, aucun contact extérieur au continent ne semble pouvoir justifier l'origine du Gravettien. L'irruption rapide, dense et définitive de l'Homme moderne avec l'Aurignacien aurait-elle pu susciter l'émergence de cette tradition, sur la base de contacts régionaux, alors en pleine mutation? Quoiqu'il en soit, et avec d'autres auteurs, nous avons plusieurs fois souligné les analogies techniques entretenues entre les ensembles finaux du Paléolithique moyen septentrional (« pointes foliacées ») avec certaines industries du Gravettien ancien (Otte *et al.* 1996a) (Figure 12). Il a donc pu s'agir de persistances, voire de traditions purement européennes, déjà à tendance laminaire marquée, aux origines de ce mouvement.

Sur le plan paléo-environnemental, l'Inter-pléniglaciaire a pu favoriser ces installations dans les plaines du Nord à la fin du Paléolithique moyen. Symétriquement, la reprise des conditions rigoureuses a pu susciter un reflux méridional, en Petite Pologne puis en Moravie, de telle sorte que les contacts avec l'Aurignacien contemporain aient pu avoir lieu. Ces éventuelles traces d'acculturation se manifesteraient alors à la fois par le développement de la technologie osseuse et, plus profondément, par la transmission de cortèges iconographiques (Figure 13). Cette transmission concerne directement les thèmes zoomorphes, indirectement les thèmes anthropomorphes, puisque l'on constate un transfert de l'homme vers la femme.

Cette hypothèse d'acculturation (Figure 14) s'accommoderait facilement de la constatation, déjà très ancienne bien que souvent ignorée, d'une persistance de traits néandertaliens dans l'anatomie (Figure 15). Ces critères renforceraient donc à la fois le métissage biologique et l'acculturation spirituelle.

Quelle que soit l'opinion de chacun sur ces questions aussi fondamentales, il ne sera bientôt plus permis d'éviter ce problème crucial des origines gravettiennes, car il concerne, au fond, l'origine des Européens actuels. La possibilité d'une contribution néandertalienne doit être examinée selon des critères globaux, tels que l'art, l'anatomie ou les techniques, plutôt que sur des micro-traces d'ADN mitochondrial dont on ignore tout de leur signification sur le plan populationnel.

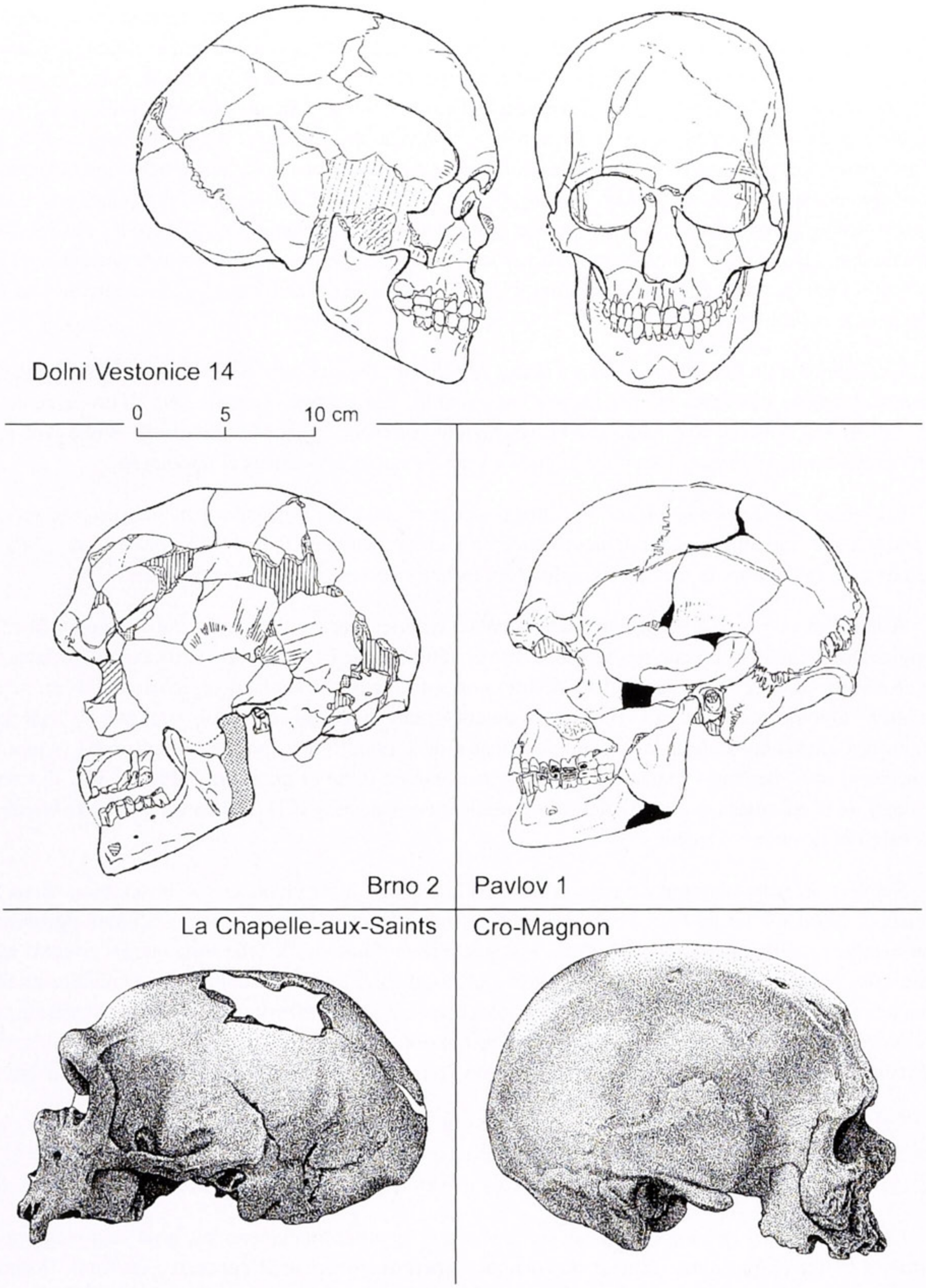

Figure 15. Des traits morphologiques issus des Néandertaliens semblent subsister dans plusieurs crânes du Gravettien ancien de Moravie. Incontestablement de type moderne, cette population suggère un possible métissage, déjà proposé par de très anciennes études, souvent oubliées (crânes de Dolní Věstonice 14, Brno 2 et Pavlov 1, d'après Vlček 1997; crânes de La Chapelle-aux-Saints et Cro-Magnon, d'après Tattersall 1995).

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CADRE STRATIGRAPHIQUE ET CHRONOLOGIQUE DU GRAVETTIEN EN EUROPE CENTRALE

P. Haesaerts, I. Borziak, V. Chirica, F. Damblon, L. Koulakovska

Abstract

In the Middle Danube Basin, the famous sites of Willendorf II (Austria), Dolní Věstonice, Pavlov and Stránská skála (Czech Republic) allowed the reconstruction of a well documented regional loess sequence for the middle pleniglacial (± 45,000 to 26,000 BP), but the chronological setting of the late pleniglacial (26,000 to 10,000 BP) remained limited due to the low amount of Upper Palaeolithic sites of this period. Since 1991, new data obtained in the East Carpathian Area (Middle Prut and Middle Dniester Basins) are based on three well documented local loess records : Mitoc-Malu Galben (NE Romania), Cosautsi (Moldova) and Molodova (Ukraine). In the time-span between 33,000 and 10,000 BP, more than 15 positive climatic oscillations marked by humiferous soils in alternation with loess and cryogenic soils were recorded and chronologically positioned on the ground of some 120 new radiocarbon dates from Groningen and Oxford laboratories. The whole set of data from both West and East Carpathian areas provided a global palaeoclimatic, chronological and archaeological sequence allowing a better understanding of the environmental changes with regard to the Upper Paleolithic occurrences at the scale of Central Europe.

KEYWORDS: loess stratigraphy, chronology, Gravettian, Central Europe

1. Introduction

Dans le domaine loessique d'Europe centrale, la majorité des gisements de plein-air du Paléolithique supérieur sont répartis de manière quasi-symétrique de part et d'autre de la chaîne des Carpates (Figure 1). A l'ouest, dans le bassin du Danube, ils sont bien documentés en Basse Autriche, dans la vallée du Váh en Slovaquie occidentale et le long du couloir morave qui donne accès vers le nord à la plaine baltique. Au-delà des Carpates, les gisements sont très abondants le long du Prut et du Dniestre qui drainent les plateaux loessiques de Podolie et de Moldavie et entaillent les formations riches en silex du Crétacé supérieur.

Au cours des années soixante, les enregistrements de Stillfried B à l'est de Vienne (Fink 1969) et de Dolní Věstonice dans le sud de la Moravie (Klíma 1963; Demek et Kukla 1969) constituèrent la référence pour la seconde moitié du Pléistocène supérieur en Europe centrale. La stratigraphie du système se composait d'un sol humifère daté vers 29.000 BP et rapporté au pléniglaciaire moyen (sol de Stillfried B en Autriche, PK I et sol Würm 2/3 en Moravie), surmonté par un ensemble de loess à pseudogley surtout bien développé à Dolní Věstonice et rapporté au pléniglaciaire supérieur.

Au cours des deux dernières décennies, des stratigraphies complémentaires bien documentées et datées par le 14C furent obtenues pour les gisements paléolithiques pluristratifiés répartis dans la vallée du Danube aux environs de Krems (Willendorf, Stratzing et Grubgraben, notamment), aux environs de Brno (Bohunice et Stránská skála) et dans le sud de la Pologne (Spadzista). D'autre part, en Ukraine occidentale, les remarquables séquences de Molodova et de Korman servirent de référence grâce aux travaux de I. Ivanova et de A. Chernysh (Ivanova et Tzeitlin 1987) mais ces gisements paléolithiques demeuraient inaccessibles aux spécialistes occidentaux.

A partir de 1990, l'ouverture des frontières politiques a favorisé l'accès d'équipes internationales à l'ensemble du domaine est-carpatique dans le cadre de projets de recherches multidisciplinaires. Il fut possible de la sorte d'élaborer une nouvelle séquence régionale basée sur les enregistrements de Molodova V en Ukraine occidentale, complétés par ceux de Mitoc-Malu Galben dans le NE de la Roumanie et de Cosautsi en Moldavie (Haesaerts *et al.* 2003). De même, pour le bassin du Danube, le cadre chronologique de la séquence régionale fut affiné grâce à un grand nombre de datations 14C obtenues pour les principaux sites de Moravie (Svoboda *et al.* 1994) et de Basse Autriche (Haesaerts *et al.* 1996, Neugebauer-Maresch 1999).

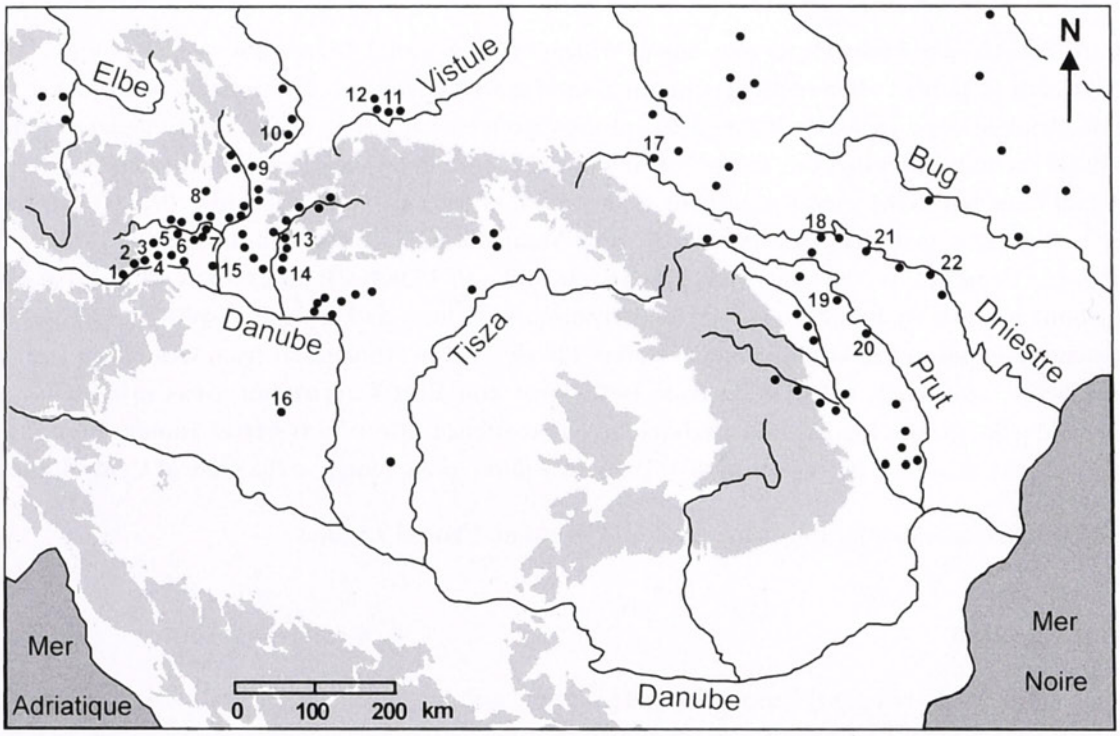

Figure 1. Situation des principaux gisements gravettiens.
1: Aggsbach et Willendorf; 2: Krems-Hundssteig; 3: Stratzing-Galgenberg; 4: Grubgraben et Langelois; 5: Kamegg;6: Alberndorf;7: Dolní Věstonice, Pavlov et Milovice;8: Stránská skála;9: Předmostí;10: Petřkovice;11: Spadzista;12: Brzoskwinia;13: Moravany;14: Nitra Čermáň;15: Stillfried;16: Sagvar; 17: Mejigirzi;18: Molodova;19: Mitoc-Malu Galben et Crasnaleuca;20: Ripiceni-Izvor;21: Cosautsi et Podgor;22: Climautsi.

Les conditions nécessaires étaient donc réunies pour permettre l'élaboration d'une séquence chronostratigraphique et paléoclimatique globale à l'échelle de l'Europe centrale, intégrant un maximum de sites du Paléolithique supérieur. Pour ce faire, nous avons donné la préférence aux gisements pluristratifiés contenant des assemblages lithiques bien documentés, situés avec précision en stratigraphie. L'élaboration de la séquence globale implique par ailleurs la mise en place d'un schéma corrélatif associant les différents enregistrements régionaux, selon le principe de la stratigraphie séquentielle. Ce principe prend en compte la distribution des principales unités lithostratigraphiques ainsi que les signatures paléoclimatiques des séquences considérées, lesquelles reposent sur une évaluation qualitative de l'environnement à partir des données pédosédimentaires et paléontologiques des enregistrements locaux

(Haesaerts et Van Vliet 1974). La démarche vise également à intégrer les différentes séries de dates radiométriques disponibles en considérant en priorité le positionnement stratigraphique et la qualité du matériel daté. En effet, bien que constituant un ensemble de données extérieures, les dates ne peuvent être en aucun cas dissociées des séquences stratigraphiques et paléoclimatiques dont elles contrôlent la cohérence interne et fixent le cadre chronologique. Parmi le large éventail des dates 14C reprises cidessous, un grand nombre de dates nouvelles furent obtenues à partir de 1993 dans le cadre de projets financés par l'Etat belge et l'INTAS. Celles-ci furent réalisées essentiellement sur charbon de bois traité de manière à éliminer tout produit et matériel contaminant (Damblon *et al.* 1996; Damblon et Haesaerts 2002).

2. Le bassin moyen du Danube

Ce domaine régional regroupe la Basse Autriche, la Moravie et la Slovaquie occidentale où sont concentrés les principaux gisements gravettiens (Figure 1). Ceux-ci sont répartis le long d'un axe joignant la vallée du Danube à la plaine baltique via la Moravie et la vallée du Váh. Les gisements de Willendorf et de Grubgraben sur le Danube, de Dolní Věstonice, de Stránská skála et de Předmostí en Moravie jalonnent cet itinéraire qui aboutit à Spadzista dans le sud de la Pologne. Tous ces gisements sont associés à de longs enregistrements pédostratigraphiques bien documentés qui constituent l'ossature de la séquence du pléniglaciaire moyen et du pléniglaciaire supérieur dans le bassin moyen du Danube. D'autres gisements paléolithiques présentant des stratigraphies beaucoup plus réduites mais néanmoins susceptibles d'être positionnées avec plus ou moins de précision dans la séquence régionale ont également été sélectionnés. Citons en particulier Krems-Hundssteig, Alberndorf et Kamegg en Basse Autriche, Milovice et Petřkovice en Moravie, Nitra Čermáň et Moravany-Lopata en Slovaquie. Par contre, les sites de Hongrie et de Slovaquie orientale, pour lesquels l'information stratigraphique est trop limitée ou auxquels nous n'avons pas eu accès, n'ont pas été considérés ici.

2.1. La seconde partie du pléniglaciaire moyen (de ± 45.000 à 26.000 BP)

En Autriche-Moravie, l'essentiel de l'information stratigraphique et chronologique pour le pléniglaciaire moyen est enregistré le long de la vallée du Danube, à l'ouest de Vienne, principalement à Willendorf et à Stratzing ainsi qu'en Moravie, à Dolní Věstonice et à Stránská skála (Figure 2). A Willendorf II et dans le site adjacent de Schwallenbach, cette période intègre deux unités distinctes préservées entre les couvertures loessiques pléniglaciaires, au sommet d'une basse terrasse du Danube (Haesaerts 1990a, Haesaerts *et al.* 1996). La première (unité D) correspond à un dépôt colluvial et incorpore la couche culturelle 2 qui a fourni un premier assemblage lithique laminaire de type Paléolithique supérieur (Haesaerts et Teyssandier 2003). La partie supérieure des colluvions, datée entre 41.700 et 39.900 BP, porte un sol brun carbonaté associé à une faune malacologique qui témoigne d'un épisode de réchauffement climatique majeur dénommé ici interstade de Willendorf. Par son faciès et sa position, cette pédogenèse peut être mise en parallèle avec le sol de Bohunice en Moravie associé à l'industrie lithique du Bohunicien et bien daté entre 43.000 et 38.750 BP (Svoboda *et al.* 1994).

A Willendorf et à Schwallenbach, la seconde unité (unité C) qui couvre la période entre 39.000 et 26.000 BP, traduit un environnement climatique nettement contrasté et relativement humide. Elle comprend un ensemble de loess sableux avec gleys de toundra qui alternent avec trois horizons humifères rapportés respectivement aux interstades de Schwallenbach I (39.000 à 37.400 BP), de Schwallenbach II (vers 32.000 BP) et de Schwallenbach III (vers 30.500 BP) par référence au site du même nom où ces horizons sont préservés *in situ* (Haesaerts *et al.* 1996). Dans la coupe de Willendorf, la première couche aurignacienne (couche 3) datée 38.880 et 37.930 BP est incorporée dans le sol Schwallenbach I; celui-ci est ici séparé par un hiatus des sols humifères Schwallenbach II et Schwallenbach III qui contiennent respectivement la couche aurignacienne 4 datée 32.060 BP et la couche gravettienne 5 datée 30.500 BP.

Ce doublet de sols humifères est probablement contemporain du sol de Stillfried B également présent à Stratzing-Galgenberg au nord de Krems et associé aux concentrations aurignaciennes qui sont datées entre ± 31.790 et ± 29.200 BP (Neugebauer-Maresch 1996).

En Moravie, la période 33.000 - 30.000 BP correspond globalement au sol W 2/3 décrit par B. Klíma (1963, 1995) à la base de la séquence loessique à Dolní Věstonice et à Pavlov (Figure 2). Il s'agit également d'un horizon complexe, le plus souvent étiré par solifluxion et localement dédoublé. Les charbons de bois qu'il contient ont été datés 29.940 BP dans la briqueterie et 31.700 BP dans la partie basse de la station A (Haesaerts 1985, 1990b), tandis que la partie inférieure de l'horizon a fourni un âge de 32.850 BP à Dolní Věstonice I (Klíma 1995). Dans l'ensemble, le contexte archéologique du sol W 2/3 et des dépôts associés n'est guère documenté, excepté à Milovice où la couche culturelle aurignacienne datée 29.230 BP est incorporée à des lentilles solilfluées de sol humifère (Oliva 1989). Enfin, à Stránská Skála, l'horizon humifère supérieur est également complexe et contient plusieurs concentrations aurignaciennes datées respectivement 32.350 et 30.980 BP (Svoboda *et al.* 1994), ce qui correspond à l'âge des sols Schwallenbach II et III à Willendorf.

Dans la Wachau, mais aussi à Krems et à Stillfried, les dépôts limoneux sus-jacents aux sols Schwallenbach II et Stillfried B portent un épais gley de toundra témoin d'une péjoration climatique de peu antérieure à 26.000 BP qui précède directement les premiers apports éoliens du pléniglaciaire supérieur (Figure 2). Ces dépôts contiennent les témoins de plusieurs concentrations gravettiennes datées 28.560 BP à Willendorf et 27.940 BP à Krems-Hundssteig (Neugebauer-Maresch 2000), ainsi que la couche culturelle principale d'Alberndorf attribuée à un Aurignacien évolué qui a fourni plusieurs dates sur os entre 26.900 et 20.500 BP (Bachner *et al.* 1996) mais fut datée récemment de 28.360 BP sur charbon de bois (Haesaerts *et al.*à paraître). Enfin, une seconde génération d'occupations gravettiennes est associée à la partie sommitale du gley de toundra; c'est le cas de la couche culturelle 6 de Willendorf datée 26.500 et 26.150 BP et probablement aussi de l'occupation principale d'Aggsbach qui a fourni des âges équivalents (Otte 1981).

Dans la plupart des secteurs de Dolní Věstonice et de Pavlov, les dépôts directement sus-jacents au sol W 2/3 atteignent en moyenne un mètre d'épaisseur et se composent d'une succession de lentilles limoneuses et de couches loessiques solifluées; ces dépôts sont affectés par une importante pédogenèse de type gley de toundra (gley G1, cf. Klíma 1963, 1995), équivalente à celle développée au sommet de la séquence du pléniglaciaire moyen à Willendorf, à Krems et à Stillfried B (Figure 2). C'est dans la moitié supérieure de ce complexe que se situe la majorité des couches culturelles du Pavlovien dans les secteurs Dolní Věstonice I, Dolní Věstonice II et Pavlov I, pour lesquelles on dispose d'un grand nombre de dates radiométriques cohérentes comprises entre 27.500 et ± 25.500 BP (Figures 2 et 3, Klima 1995, Svoboda *et al.* 1994, Svoboda 2001). Par ailleurs, dans les profils du secteur Dolní Věstonice II, les occupations attribuées au Pavlovien sont distinctement postérieures à un léger horizon humifère fortement étiré, daté vers 28.000 BP, qui paraît bien traduire un épisode climatique positif également enregistré par la palynologie (Svobodová 1991), dénommé ici épisode interstadiaire de Dolní Věstonice (Haesaerts 1990b, Haesaerts *et al.* 1996).

2.2. Le pléniglaciaire supérieur et le Tardiglaciaire (de 26.000 à 10.000 BP)

En Autriche, cette longue période a connu plusieurs phases de sédimentation loessique dont la stratigraphie fut établie à partir des enregistrements complémentaires de Willendorf, Krems-Hundssteig, Stillfried et Grubgraben (Figure 2). A Willendorf, la première phase loessique correspond à l'unité B datée entre ± 26.000 et ± 25.000 BP; elle comprend deux couches de loess poudreux séparées par un sol humifère incipient qui contient la couche culturelle gravettienne 8 datée entre 25.800 et 25.230 BP dans la coupe du champ de fouille ouverte en 1981 et 1993 (Haesaerts *et al.* 1996). La couche 9 à Gravettien évolué (Willendorfien cf. Kozlowski 1986), située dans le loess supérieur environ un mètre au-dessus de la couche

8, n'a pas été rencontrée dans la coupe de 1993 mais fut datée 24.910 BP sur la partie centrale d'un gros os provenant des fouilles de J. Bayer (1930). Notons à ce propos que la position stratigraphique de la célèbre vénus de Willendorf, classiquement rapportée à la couche 9, est contestée par cet auteur, lequel attribue cette vénus à une petite concentration lithique nettement distincte située environ 50 cm en dessous de la couche 9 (Bayer 1930, 54).

La partie médiane de la couverture loessique, dépourvue de repères chronologiques, est accessible en position de versant dans plusieurs sites de Basse Autriche. A Schwallenbach, à Krems-Hundssteig et à Stillfried B, elle se compose d'un complexe de loess homogènes alternant avec plusieurs petits gleys de toundra, surmonté d'un dépôt loessique finement litté. Cette succession est également présente dans la partie inférieure de la séquence de Grubgraben dans une large combe ouverte vers le sud en direction du Danube, sous un épais complexe de trois dépôts loessiques séparés par des chenaux sableux (Figure 2). En particulier, la présence dans la partie inférieure du premier dépôt loessique de trois petits horizons humifères associés à plusieurs couches culturelles supposées épigravettiennes (Montet-White 1990) et datées entre 19.380 et 18.380 BP (non publié), constitue un repère précieux qui atteste d'une sédimentation complexe au cours de la seconde partie du pléniglaciaire supérieur dans un contexte climatique contrasté et relativement humide (Haesaerts 1990c). Enfin, à Grubgraben, la sédimentation s'est probablement poursuivie jusqu'au Tardiglaciaire, ce dont témoigne l'environnement nettement plus sec de l'unité loessique supérieure (LC). Cette dernière génération loessique est également présente à Kamegg dans le vallée de la Kamp au-dessus de dépôts sablo-limoneux à fentes de gel qui contiennent une industrie rapportée au Magdalénien (Otte 1981), datée récemment sur os à Groningen de 14.100 BP (non publié).

En Moravie, c'est la couverture loessique de Dolní Věstonice, au pied des Monts Pavlov, qui sert de référence pour le pléniglaciaire supérieur (Demek et Kukla 1969, Klíma 1963, 1969, 1995). Parmi les gleys de toundra G2 à G7 qui constituent la signature de cette formation, l'horizon G2 et le doublet G3-G4 associé à un réseau de coins de glace sont les mieux exprimés, un second réseau de coins de glace étant présent au sommet du doublet G6-G7 (Figure 2). A Pavlov I, à Dolní Věstonice II (Figure 3) mais aussi dans le secteur G de Milovice (Oliva 1989), un petit groupe de dates proches de 25.000 BP obtenues à Groningen sur charbon de bois, pourrait témoigner de la persistence des occupations du Gravettien moyen au cours de la phase initiale du pléniglaciaire supérieur, comme c'est le cas des couches 7 et 8 à Willendorf, mais ici les processus de solifluxion qui affectent le sommet du gley G1 ne permettent pas de les différencier stratigraphiquement des occupations antérieures. Toutefois, dans les profils du chemin creux à l'est de la station Pavlov II, B. Klíma signale la présence d'un horizon humifère décimétrique contenant des éléments de la couche culturelle, lequel était préservé au contact du gley G1 et de la couverture des loess sus-jacents (Klíma 1976); ce petit horizon humifère, probablement équivalent à celui de la couche culturelle 8 de Willendorf, traduirait également une légère amélioration climatique voisine de 25.500 BP dénommée oscillation positive de Pavlov (Haesaerts 1990b).

Quelques témoins d'occupations plus tardives existent également dans d'autres stations de la région, notamment à Dolní Věstonice III où une concentration lithique proche du Gravettien supérieur, datée 24.560 BP, est présente dans la partie inférieure des loess (Škrdla *et al.* 1996, Svoboda 2001). C'est le cas également de la concentration d'ossements de mammouth du secteur C-D à Milovice qui a fourni un âge de 22.250 BP et appartient à partie médiane de la couverture loessique sans plus de précision (Oliva 1989). Quant aux dates 18.400 et 15.350 BP réalisées sur la fraction humifère des loess de la briqueterie à Dolní Věstonice (Demek et Kukla 1969, Klíma 1995), elles sont dépourvues de signification chronologique car fortement rajeunies comme le sont toutes les dates sur humus obtenues pour les loess d'Europe centrale (Haesaerts 1985, 1990b).

Dans ce contexte, les enregistrements de Spadzista près de Cracovie (Escutenaire *et al.* 1999) et de Nitra Čermáň (Bárta 1980) en Slovaquie occidentale (Figure 2) permettent de préciser quelque peu le cadre chronologique et archéologique de la couverture loessique pléniglaciaire de Moravie. A Spadzista,

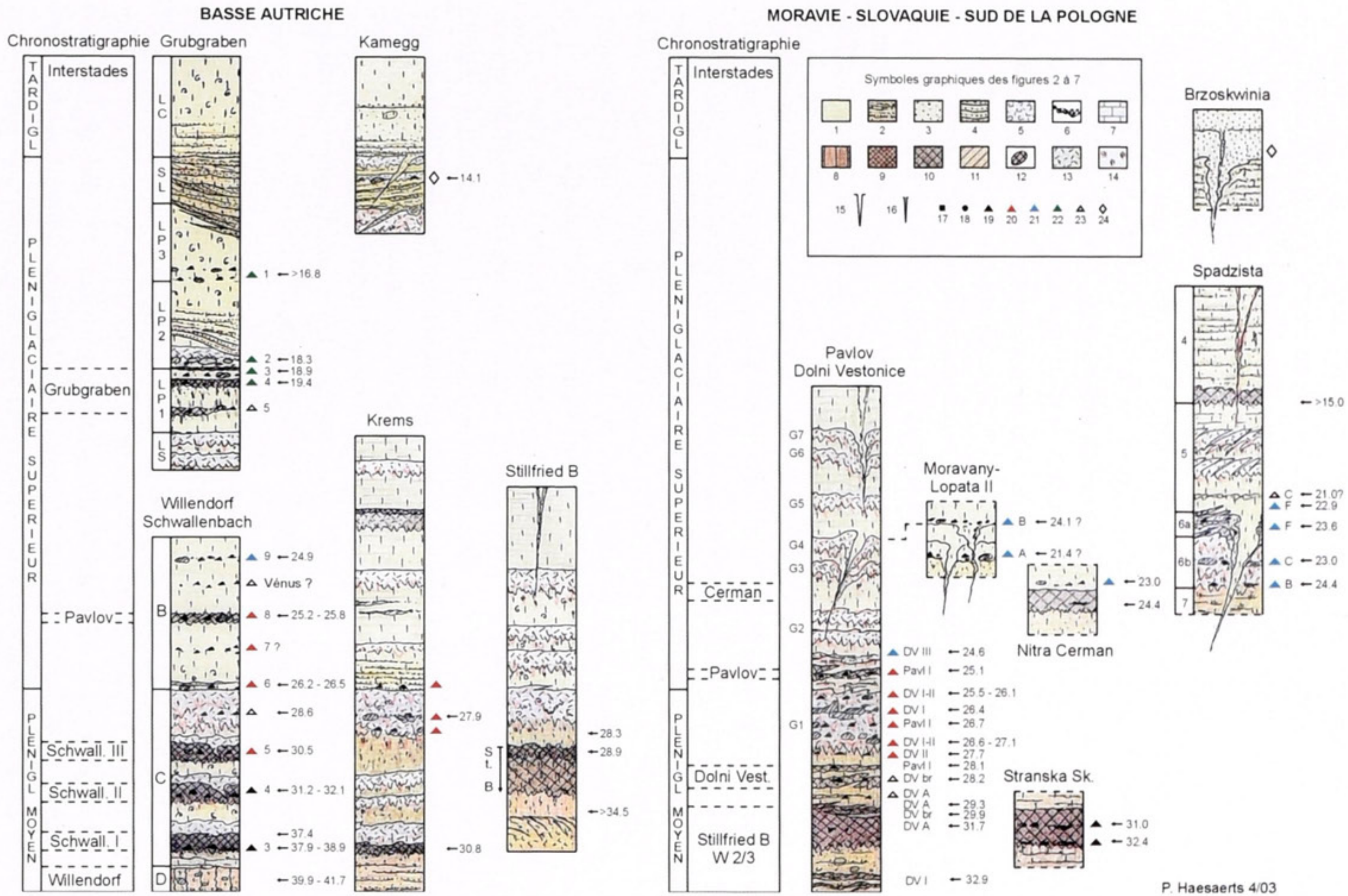

Figure 2. Principales séquences pour la Basse Autriche, la Moravie, la Slovaquie occidentale et le sud de la Pologne: stratigraphie, archéologie et dates 14C. Symboles graphiques des figures 2 à 7. 1: loess; 2: limons; 3: sable limoneux; 4: sable; 5: craie; 6: graviers; 7: calcaire; 8: horizon illuvié (B2t); 9: horizon humifère fortement développé; 10: horizon humifère faiblement développé; 11: horizon brun-jaune bioturbé; 12: krotovines; 13: horizon déferrifié (gley de toundra); 14: hydroxydes de fer; 15: coin de glace; 16: fente de gel; 17: Moustérien; 18: industries de transition; 29: Aurignacien; 20: Gravettien ancien et moyen, Pavlovien inclu; 21: Gravettien supérieur à pointes à cran; 22: Epigravettien et faciès associés; 23: Paléolithique supérieur indéterminé; 24: Magdalénien. Abréviations. Schwall: Schwallenbach; St B: Stillfried B; DV: Dolní Věstonice; Pavl: Pavlov: DV br: Dolní Věstonice briqueterie.

l'épais gley de toundra et les dépôts soliflués sus-jacents associés à un réseau de grands coins de glace (sous-unités 6b et 6a), qui contiennent les principales occupations gravettiennes à pointes à cran datées entre 24.380 et 23.040 BP sur charbon de bois, seraient équivalents au doublet G3-G4 de Dolní Věstonice. De même, l'horizon humifère de peu postérieur à 24.440 BP, présent à Nitra Cerman sous la couche gravettienne à pointes à cran datée 23.000 BP sur charbon de bois à la base de la couverture loessique (Barta 1980), serait à rapporter à un second épisode interstadiaire interne au pléniglaciaire supérieur nettement distinct de l'oscillation de Pavlov, épisode que nous désignons ici sous le nom de "oscillation de Čermáň" (Figure 4).

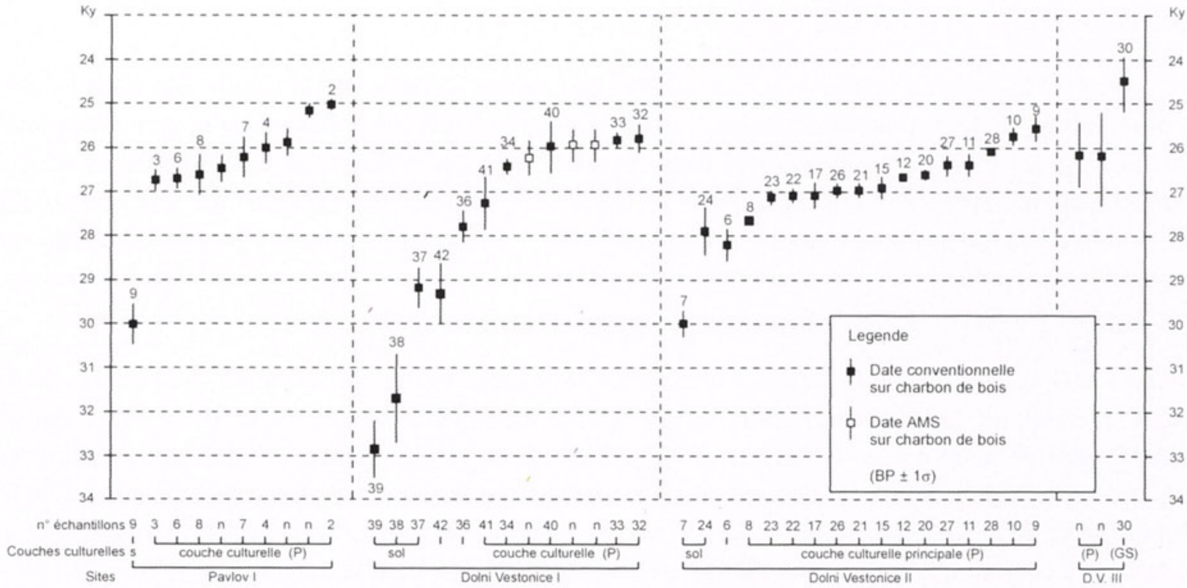

Figure 3. Pavlov et Dolní Věstonice (Moravie): distribution des dates 14C (d'après Damblon *et al.*, 1996).

Par ailleurs, à Spadzista, le loess litté avec gleys de toundra peu développés (unité 5) postérieur à la péjoration climatique de l'unité 6, contient les derniers ateliers gravettiens datés 21.000 BP sur os. D'après Kozlowski (1996, 1998, Escutenaire *et al.* 1999), cette unité loessique également bien exprimée dans les sites paléolithiques du nord de la Moravie et de Slovaquie occidentale, où elle recouvre les concentrations du Gravettien à pointes à cran, se serait mise en place entre ± 21.000 et ± 17.000 BP, soit pendant et juste après le stade glaciaire de Brandenburg-Lezsno. Cette fourchette chronologique nécessite cependant quelques réserves car elle repose sur un corpus de données hybrides associant des âges radiocabone sur os provenant de laboratoires différents, ainsi que des âges TL à larges erreurs statistiques (Escutenaire *et al.* 1999, 23). En particulier, la date sur os de la couche 5 à Spadzista constitue probablement un âge minimum, comme c'est souvent le cas pour du matériel osseux préservé dans les loess carbonatés (Damblon *et al.* 1996, Haesaerts *et al.* 2003). Dès lors, un âge plus de proche de 23.000 BP pour la base de la couverture loessique supérieure et pour la fin des occupations gravettiennes à pointes à cran nous paraît plus probable. Le même phénomène pourrait expliquer la discordance chronologique entre les dates sur os des couches A et B à Moravany-Lopata (Pazdur 1998), la date de 21.400 BP issue de la couche inférieure (A) étant probablement rajeunie et moins fiable que la date de 24.100 BP obtenue pour la couche supérieure (B).

Enfin, dans le sud de la Pologne, la seconde moitié du pléniglaciaire supérieur se caractérise aussi par une augmentation de la composante sableuse des dépôts de couverture et se termine également par une dernière péjoration climatique. Celle-ci se marque par un réseau de grands coins de glace développé au sommet des loess sableux à Brzoskwinia (Sobczyk 1995), lequel semble s'être maintenu pendant la mise en place des sables de couverture associés à l'occupation du site par les chasseurs du Magdalénien au cours de la première moitié du Tardiglaciaire.

3. Le domaine est-carpatique

Cette vaste région située à l'est des contreforts des Carpates, drainée par le Prut et le Dniestre, possède un potentiel de gisements paléolithiques exceptionnel prospecté dès 1929 par N. Morosan (1938). Parmi les nombreux sites de plein air connus en Ukraine occidentale, en Moldavie et en Roumanie, et qui demeurent accessibles, seuls quelques uns présentent de longues séquences stratigraphiques associées à des occupations pluristratifiées du Paléolithique supérieur. Molodova V sur la rive ukrainienne du Dniestre fut exploité par A. Chernysh (1959, 1987) et I. Ivanova (Ivanova et Tzeitlin 1987); Cosautsi sur la rive moldave du Dniestre et Mitoc-Malu Galben sur la rive roumaine du Prut furent fouillés au cours des années quatre-vingt (Borziak 1991, 1993; Chirica 1989, 2001).

Au cours de la dernière décennie, ces sites ont fait l'objet d'études pluridisciplinaires dans le cadre de programmes de recherche internationaux et constituent la structure de base de la séquence régionale (Haesaerts *et al.* 2003). Ils représentent trois enregistrements pédosédimentaires et paléoclimatiques complémentaires avec de multiples couches du Paléolithique supérieur, encadrés par une chronologie 14C solide et bien documentée pour la période 33.000 - 10.000 BP, la résolution optimale de chaque séquence étant contrôlée par la dynamique sédimentaire et par leur position dans le paysage (Figures 5 et 6).

Cosautsi, au sommet de la première terrasse du Dniestre, a fourni une séquence de haute résolution pour la seconde moitié du pléniglaciaire supérieur et le Tardiglaciaire, tandis que Mitoc-Malu Galben, sur le versant de la deuxième terrasse du Prut, a favorisé un enregistrement complémentaire au cours de la phase finale du pléniglaciaire moyen et de la première partie du pléniglaciaire supérieur. Par ailleurs, Molodova V, dans la continuation de la seconde terrasse du Dniestre à quelque 20 mètres au-dessus du talweg, a conduit à la préservation d'une longue séquence couvrant la majeure partie du Pléistocène supérieur (Ivanova et Tzeitlin 1987) avec une haute résolution chronologique pour la période 33.000 - 10.000 BP (Haesaerts *et al.* 2003).

3.1. Partie supérieure du pléniglaciaire moyen (de ± 33.000 à 26.000 BP)

A Mitoc-Malu Galben, cette période correspond aux unités 13 à 7 qui sont préservées sur le versant de la seconde terrasse du Prut (Figure 5). Cette accumulation loessique représente un enregistrement cyclique semi-continu de cinq horizons humifères d'intensité décroissante, avec une sédimentation colluviale (unités 13 à 11) suivie par des apports de loess (unités 10 à 7). Ces cinq horizons, interprétés comme des épisodes interstadiaires nommés Malu Galben 13 à 8, ont été datés par le radiocarbone respectivement vers 33.000 BP (MG 13), 31.200 BP (MG 12), 30.500 BP (MG 10), 28.500 BP (MG 9) et 27.500 BP (MG 8). De plus, les unités 12 à 8 qui couvrent cette période, contiennent de nombreux ateliers aurignaciens, tandis que l'unité 7 incorpore les premiers ateliers gravettiens et porte un épais gley de toundra daté autour de 26.000 BP, indicateur d'un refroidissement drastique qui conclut le pléniglaciaire moyen et constitue un premier marqueur stratigraphique (Figure 6).

A Molodova V, la période de 33.000 à 26.000 BP correspond au pédocomplexe supérieur (unité 10) développé dans les colluvions de la partie sommitale de la séquence du pléniglaciaire moyen (Figures 5 et 6). Ce pédocomplexe comprend deux sols bruns de type para-rendzine (sous-unités 10-1 et 10-2), datés autour de 32.600 et de 30.400 BP et donc contemporains des épisodes MG 13 et MG 10. Ces sols sont suivis par un horizon humifère gris foncé (sous-unité 10-3) daté entre 28.730 et 27.700 BP, qui correspond à l'épisode MG 9 et porte aussi un épais gley de toundra bien daté entre 26.640 et 25.760 BP. A la différence de Mitoc-Malu Galben, le contenu archéologique de l'unité 10 à Molodova V est limité aux couches gravettiennes 10 et 9 qui appartiennent distinctement à l'épisode froid séparant les sols humifères 10-2 et 10-3.

3.2. Première partie du pléniglaciaire supérieur (de 26.000 à ± 20.000 BP)

A Molodova et à Mitoc, cette période enregistre à nouveau une sédimentation cyclique avec deux ensembles de loess sableux jaune pâle qui reflètent des conditions climatiques froides et encore contrastées. A Mitoc, le premier ensemble de loess (unités 6 à 4) comprend trois épisodes d'apports éoliens alternant avec des gleys de toundra; le gley supérieur daté autour de 23.000 BP est le mieux développé et constitue un second marqueur stratigraphique. Ce premier complexe loessique présente encore deux horizons humifères assimilés à des épisodes climatiques positifs (MG 6 et MG 4) qui sont bien datés vers 25.500 et 23.700 BP à Molodova V.

Dans ces deux sites, le premier ensemble de loess contient les couches culturelles gravettiennes principales. A Mitoc, les concentrations gravettiennes II et III, datées entre 26.450 et 24.780 BP, appartiennent au Gravettien moyen tandis que la partie supérieure de la concentration III et la concentration IV datées entre 24.780 et 23.290 BP sont rapportées au Gravettien supérieur à pointes à cran (Otte *et al.* 1996). A Molodova V, la situation est légèrement différente car seule la couche culturelle 8 dans l'horizon humifère 11-2 appartient au Gravettien moyen. Quant à la couche culturelle 7 rapportée au Gravettien supérieur à pointes à cran (Chernysh 1987), elle fut datée entre 25.280 et 25.130 BP dans la partie supérieure du loess 11-3; cette couche se poursuit également dans l'horizon humifère 12-1 daté 23.650 BP et dans le gley de toundra sus-jacent (12-2) daté 23.000 BP (Haesaerts *et al.* 2003).

En ce qui concerne le second ensemble de loess du Pléniglaciaire supérieur, les unités 3 et 2 de Mitoc et l'unité 13 à Molodova V reflètent clairement des conditions environnementales devenant de plus en plus sèches entre ± 23.000 et ± 20.000 BP. Au cours de cette période, les apports loessiques alternent avec trois épisodes de gel intense et un court épisode positif avec formation d'un horizon incipient bioturbé daté 21.540 BP. Quant aux témoins archéologiques, ils se limitent dans les deux sites à de petites concentrations dispersées à différents niveaux dans le loess.

3.3. Seconde partie du pléniglaciaire supérieur (de ± 20.000 à ± 14.500 BP)

Dans la zone est-carpatique, cette période se caractérise également par une évolution climatique cyclique. Celle-ci est la mieux enregistrée à Cosautsi sur la terrasse du Dniestre (cycles VII à V) ainsi que dans la partie supérieure de Molodova V (unité 14).

Entre ± 20.000 et ± 17.000 BP prévaut un environnement assez humide avec une sédimentation éolienne réduite alternant avec plusieurs complexes humifères. Ces derniers sont assimilés à des épisodes interstadiaires datés respectivement autour de 20.400 BP (Cosautsi VII), entre 19.400 et 19.000 BP (Cosautsi VI) et entre 18.000 et 17.500 BP (Cosautsi V) et vers 17.200 BP (Cosautsi IV); ils sont séparés par des épisodes de gel profond datés autour de 20.000 BP et vers 18.200 BP (Figures 6 et 7). Les dépôts de cette période ont fourni de nombreuses concentrations épigravettiennes. A Cosautsi, environ 15 couches culturelles distinctes ont été rencontrées depuis la sous-unité 7-1 jusqu'à la sous-unité 5-1. A Molodova V, la première occupation épigravettienne datée 20.400 BP (couche culturelle 6) appartient à l'épisode interstadiaire Cosautsi VII tandis que les couches 5 et 4 datées vers 19.000 et 17.800 BP devraient correspondre aux épisodes Cosautsi VI et Cosautsi V (Figures 6 et 7).

Finalement, de ± 17.200 à ± 14.500 BP, une modification drastique du climat vers des conditions extrêmes avec plusieurs épisodes à permafrost est enregistrée à Cosautsi (cycle IV) et dans la partie supérieure de la séquence de Mitoc (sous-unité 1b). Ces conditions se traduisent par une activité éolienne intense avec des apports croissants de sables locaux et des processus de fonte. Cette phase climatique se termine par un épisode à permafrost marqué par un dernier gley de toundra bien développé (sous-unité 4-1 à Cosautsi et probablement sous-unité 14-4 à Molodova V) de peu postérieur à 16.000 BP. Seules de petites

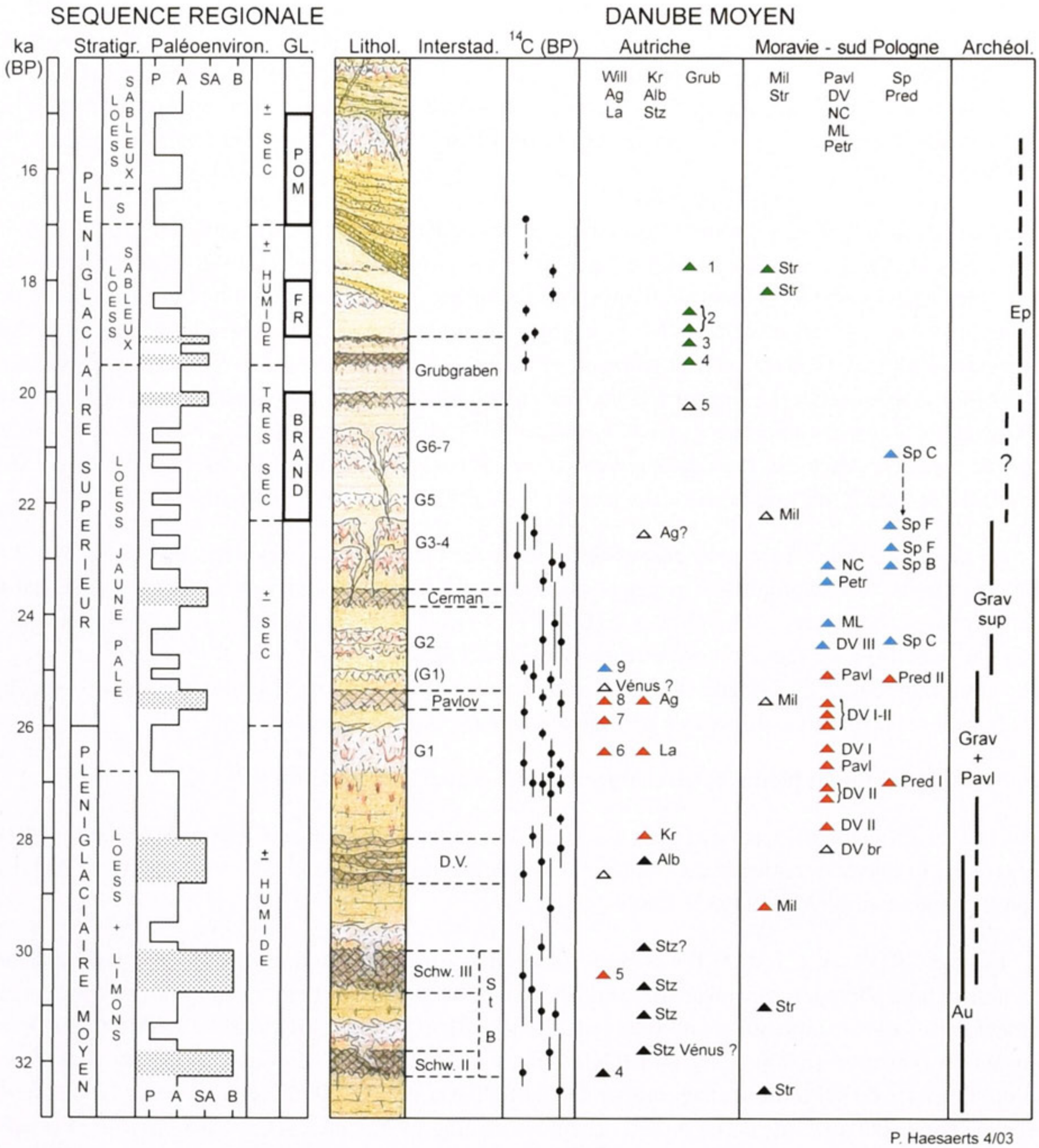

Figure 4. Séquence régionale pour la Basse Autriche, la Moravie, la Slovaquie occidentale et le sud de la Pologne (symboles graphiques: voir figure 2). Abréviations. S: sable; Paléoenviron: paléoenvironnement; P: périglaciaire avec gel profond ou permafrost actif; A: arctique; SA; subarctique; B: boréal; Interst: interstades; GL: stades glaciaires; POM: Poméranie; FR: Frankfurt; BRAND: Brandenburg; Interstad: interstades; DV: Dolní Věstonice; Schw: Schwallenbach; St B: Stillfried B; Will: Willendorf; Kr: Krems-Hundsteig; Alb: Alberndorf; Stz: Stratzing-Galgenberg; Grub: Grubgraben; Ag: Aggsbach; La: Langenlois; Str: Stránská skála; Mil: Milovice; Pavl: Pavlov; NC: Nitra Čermáň; ML: Moravany-Lopata; Sp: Spadzista; Petr: Petřkovice; Pred: Předmostí; Ep: Epigravettien et faciès associés; Grav sup: Gravettien supérieur à pointes à cran:

concentrations préservées dans les sédiments sableux du cycle IV à Cosautsi témoignent d'activités humaines au cours de cette période du pléniglaciaire supérieur terminal.

3.4. Le Tardiglaciaire (de ± 14.500 à 10.000 BP)

A partir de ± 14.500 BP, une période de sédimentation éolienne sous des conditions climatiques plutôt sèches a favorisé le dépôt d'une dernière couverture loessique sur les versants des vallées du Prut et du Dniestre. Les apports éoliens se sont poursuivi, semble-t-il, jusqu'à la fin du dernier Dryas avec une interruption temporaire au cours du Bölling et de l'Alleröd accompagnée de la formation de sols humifères à proximité et dans les fonds de vallée (Cosautsi III et Cosautsi II). A Molodova V, les dates comprises entre 13.370 et 10.940 BP obtenues par Ivanova pour les couches culturelles 3 à 1 de l'unité loessique 14-4, suggèrent un âge tardiglaciaire pour ce loess et les industries qu'il contient. Cette interprétation est toutefois contestée par D. Nuzhnyi (comm. pers.) sur la base des assemblages lithiques, lesquelles plaideraient en faveur d'un âge plus ancien, voisin de 17.500 BP.

4. La sequence stratigraphique globale

La mise en parallèle des séquences régionales établies pour le bassin moyen du Danube et le domaine est-carpatique constitue la seconde étape de notre démarche. Celle-ci vise en particulier l'élaboration d'un schéma corrélatif basé sur l'analyse séquentielle des ensembles pédosedimentaires et de leurs signatures climatiques, destiné à servir de support à une intégration des données paléoclimatiques et archéologiques à l'échelle de l'Europe centrale pour la période comprise entre 33.000 et 10.000 BP. Il importe également de souligner ici le caractère exceptionnel des données climatiques réunies pour la séquence est-carpatique dont la chronologie repose sur de longues séries de datations radiométriques réalisées pour l'essentiel sur charbon de bois. Rappelons à nouveau que les dates ne constituent pas une base de données indépendantes des enregistrements stratigraphiques mais qu'elles sont intégrées au schéma corrélatif pour fixer son cadre chronologique et renforcer la cohérence interne du système. La limite inférieure de notre schéma fut située vers 33.000 BP car au-delà, les données chronologiques précises font défaut dans le domaine est-carpatique, notamment à Molodova V, tandis que dans le bassin moyen du Danube, les stratigraphies de la période antérieure à 33.000 BP sont trop fragmentaires.

La principale caractéristique du schéma corrélatif établi de la sorte pour le domaine loessique d'Europe centrale réside dans la remarquable reproductibilité de l'ensemble des événements de part et d'autre des Carpates; celle-ci concerne non seulement les grandes unités lithostratigraphiques mais surtout la succession des événements climatiques à différentes échelles du temps. De cette manière il apparaît que les événements climatiques spécifiques des différentes périodes sont exprimés de manière similaire de part et d'autre des Carpates même lorsqu'il s'agit d'oscillations de courte durée. C'est le cas par exemple de l'épisode interstadiaire MG 6, voisin de 25.500 BP, qui est enregistré à la base de la couverture loessique du pléniglaciaire supérieur à Molodova V et à Mitoc, lequel est également exprimé à Willendorf et à Pavlov. De la même manière, les courts épisodes interstadiaires Cosautsi VII et Cosautsi VI entre 20.400 et 19.000 BP ont leur équivalent à Grubgraben en Basse Autriche. Le système fonctionne également dans le cas des péjorations climatiques, notamment celles associées aux gleys de toundra G1 à G7 de Dolní Věstonice qui occupent des positions similaires dans les deux séquences régionales (Figure 7). De la sorte, il est possible de reconnaitre des épisodes climatiques d'une durée de quelques siècles supposés synchrones à l'échelle du domaine loessique d'Europe centrale, avec un degré de résolution sensiblement supérieur à celui des datations radiométriques.

La séquence globale établie ci-dessus pour la période 33.000 - 10.000 BP fournit donc un canevas extrêmement précis autorisant une restitution objective de la distribution dans l'espace et dans le temps des différents ensembles culturels du Paléolithique supérieur dans un cadre paléoenvironnemental bien défini, avec un degré de résolution de l'ordre de quelques siècles dans la plupart des cas (Figure 7). Cette démarche concerne en priorité les gisements auxquels nous avons eu accès et intègre principalement des données stratigraphiques et chronologiques de première main (Damblon *et al.* 1996, 1997; Haesaerts *et al.* 1996, 2003); elle reprend également un certain nombre d'éléments discutés dans les différentes synthèses sur le Paléolithique supérieur (Kozlowski 1996, 1998; Djindjian e*t al.* 1999; Svoboda 2000; Djindjian 2002), synthèses dont le cadre chronostratigraphique repose bien souvent sur des âges radiométriques déconnectés des données stratigraphiques.

5. La séquence archéologique

5.1. L'Aurignacien

En Basse Autriche, la séquence aurignacienne débute, semble-t-il, au cours de l'interstade de Schwallenbach I avec la couche culturelle 3 de Willendorf datée 38.880 et 37.930 BP (Haesaerts *et al.* 1996, Haesaerts et Teyssandier 2003), laquelle est probablement contemporaine du Bohunicien en Moravie (Svoboda 2001). Quant à l'Aurignacien classique, il est surtout bien documenté entre ± 32.000 et ± 29.000 BP, période qui couvre notamment les interstades Schwallenbach II et Schwallenbach III (Figure 4). A l'est des Carpates, c'est principalement la séquence de Mitoc-Malu Galben qui sert de référence avec une succession d'ateliers aurignaciens compris entre ± 32.700 et ± 27.500 BP, lesquels encadrent les épisodes interstadiaires MG 12 à MG 9 (Figures 5 et 6). L'Aurignacien était également bien représenté à Ripiceni-Izvor sur la rive roumaine du Prut en aval de Mitoc (Paunescu 1993) mais la stratigraphie de ce site, actuellement noyé sous les eaux d'un lac de barrage, n'a pu être intégrée dans la séquence régionale.

5.2. Le Gravettien ancien et moyen

Première période (de ± 30.500 à 28.000 BP) - Un point important qui concerne directement la problématique de l'origine du Gravettien en Europe centrale, porte sur la position de la couche culturelle 5 de Willendorf dans un horizon humifère daté 30.500 BP et rapporté à l'interstade Schwallenbach III (Haesaerts 1990a, Haesaerts *et al.* 1996). Cette attribution, mise en doute sur la base de données partielles par F. Djindjian, J. Kozlowski et M. Otte (1999, 400), repose cependant sur l'intégration des observations récentes et des levés des fouilles anciennes dans un système stratigraphique et chronologique bien documenté que viennent renforcer la stratigraphie et les datations du site adjacent de Schwallenbach (Haesaerts *et al.* 1996, Haesaerts et Teyssandier 2003). Cet ensemble de données atteste donc la présence du Gravettien ancien à Willendorf dès 30.500 BP dans un contexte régional nettement aurignacien lequel va subsister jusque ± 28.400 BP à Alberndorf en Basse Autriche et jusque ± 27.500 BP dans le N.E. de la Roumanie (unité 8 à Mitoc) et peut-être même au-delà dans certains sites de Moldavie (Borziak 1994, 1996). Un âge voisin de 30.500 BP pour la couche 5 de Willendorf s'avère également cohérent avec le contexte stratigraphique des couches 10 et 9 de Molodova V à nette composante gravettienne (Otte 1981, Chernysh 1987). Celles-ci constituent un ensemble bien individualisé, daté entre 29.650 et 28.730 BP, dont la position au début de l'oscillation froide qui suit l'épisode interstadiaire MG 10 fut confirmée récemment (Haesaerts *et al.* 2003). Enfin, ce schéma s'avère également en bon accord avec l'âge de 29.200 BP obtenu pour les premières occupations gravettiennes à Geissenklösterle dans le Jura Souabe (Conard *et al.* 2002).

Quant aux couches culturelles plus récentes, également attribuées à la phase initiale du gravettien entre 29.000 et 28.000 BP (Djindjian *et al.* 1999), il s'agit principalement de petites concentrations atypiques; celles-ci sont datées 28.560 BP à Willendorf au-dessus de la couche 5 et 28.220 BP dans la briqueterie à Dolní Věstonice (Haesaerts 1990b). Dans ce contexte, il faut aussi mentionner la couche culturelle soliflUée de la station A à Dolní Věstonice I supposée représenter l'occupation la plus ancienne du site (Klíma 1963), dont la position par rapport au sol interstadiaire W 2/3 et par rapport aux charbons de bois datés 29.300 BP demeure problématique (Oliva 2000). De même, la date de 28.950 BP obtenue à Mitoc-Malu Galben pour l'atelier gravettien à la base de l'unité 7 demande à être confirmée car nettement trop vieille par rapport à la chronologie de la séquence locale (Damblon *et al.* 1996).

Deuxième période (de 28.000 à 26.000 BP) - Cette seconde période qui enregistre la dégradation climatique de la phase terminale du pléniglaciaire moyen, correspond également au plein développement du Gravettien moyen et du Pavlovien (Svoboda *et al.* 1996, 2000; Oliva 2000). A Dolní Věstonice II, les occupations bien documentées débutent vers 27.500 BP (concentrations A-B-C); de même, les chasseurs du Gravettien moyen étaient présents à Krems-Hundssteig vers 27.940 BP (Neugebauer-Maresch 2002) mais aussi à Mitoc-Malu Galben sur le Prut à partir de 27.500 BP (base de l'unité 7) et probablement à Mejigirzi sur le Dniestre moyen (Koulakovska et Otte 1998) où la couche principale a été datée récemment 27.070 BP sur bois carbonisé (non publié). Quant aux grandes occupations du Pavlovien datées majoritairement entre 26.500 et 25.500 BP à Dolní Věstonice, à Pavlov et à Předmostí, elles encadrent la péjoration climatique associée au gley de toundra G1 qui termine le pléniglaciaire moyen (Figures 3 et 4). C'est également le cas de la couche 6 de Willendorf, de l'occupation principale d'Aggsbach et des premiers grands ateliers gravettiens de Mitoc-Malu Galben datés entre 26.450 et 25.050 BP, lesquels occupent une position similaire dans la partie sommitale du gley de toundra et à son interface avec la couverture loessique du pléniglaciaire supérieur.

Dans ce contexte, les concentrations successives d'habitats du Pavlovien autour de sites occupant une position remarquable dans le paysage, notamment à proximité d'accumulations probablement naturelles d'ossements de mammouth comme c'est le cas à Dolní Věstonice, pourraient répondre à l'emprise des conditions rigoureuses spécifiques de la fin du pléniglaciaire moyen. Toutefois, on ne peut exclure d'autres pistes pour expliquer la concentration des habitats pavloviens, notamment l'attrait que les particularités géomorphologiques et lithologiques de ces sites pouvaient avoir exercé sur les grands herbivores suite à des exigences spécifiques dues au stress lié aux conditions rigoureuses. De plus, les habitats pavloviens se distinguent des occupations gravettiennes et aurignaciennes antérieures qui étaient plus dispersées dans le paysage dans un contexte climatique diversifié et relativement humide avec une couverture végétale en mosaïque de type steppe-arborée (Svobodová et Svoboda 1988, Svobodová 1991).

Troisième période (de 26.000 à 25.000 BP) - Pour terminer, il nous faut considérer ici un dernier ensemble du Gravettien moyen contemporain des premiers apports loessiques du pléniglaciaire supérieur mis en place localement le long des vallées principales entre 26.000 et 25.000 BP. Cet ensemble qui assure en quelque sorte la transition vers le Gravettien supérieur, regroupe les couches 7 et 8 de Willendorf et la couche 8 de Molodova V (Figure 7), ces deux dernières étant chacune incorporée dans un sol humifère intra-loessique bien daté vers 25.500 BP, également reconnu à Pavlov II. Le même ensemble comprend les occupations terminales du Pavlovien datées entre 25.500 et 25.000 BP à Dolní Věstonice, à Pavlov et à Předmostí, ainsi que la couche principale de Milovice en Moravie et la partie supérieure de la concentration gravettienne II à Mitoc-Malu Galben.

5.3. Le Gravettien supérieur

Première période (de 25.000 à 23.000 BP) - En Europe centrale, la distribution de ce complexe techno-culturel caractérisé par des pointes à cran (Otte 1981, Kozlowski 1986), reposait classiquement sur six sites ou groupes de sites: soit, Spadzista (sous unités 6b et 6a), Petřkovice, Moravany, Nitra Čermáň, Willendorf (couche 9) et Molodova V (couche 7). Depuis, s'y sont ajoutés Mitoc-Malu Galben (Gravettien IV: Otte *et al.* 1996) et probablement Dolní Věstonice III (Škrdla *et al.* 1996). L'ensemble est classiquement situé entre 24.500 et 22.000 BP (Kozlowski 1986, 1996; Djindjian *et al.* 1999), mais les nouvelles données de Willendorf, Molodova et Mitoc permettent de préciser cette chronologie (Haesaerts *et al.* 1996, 2003).

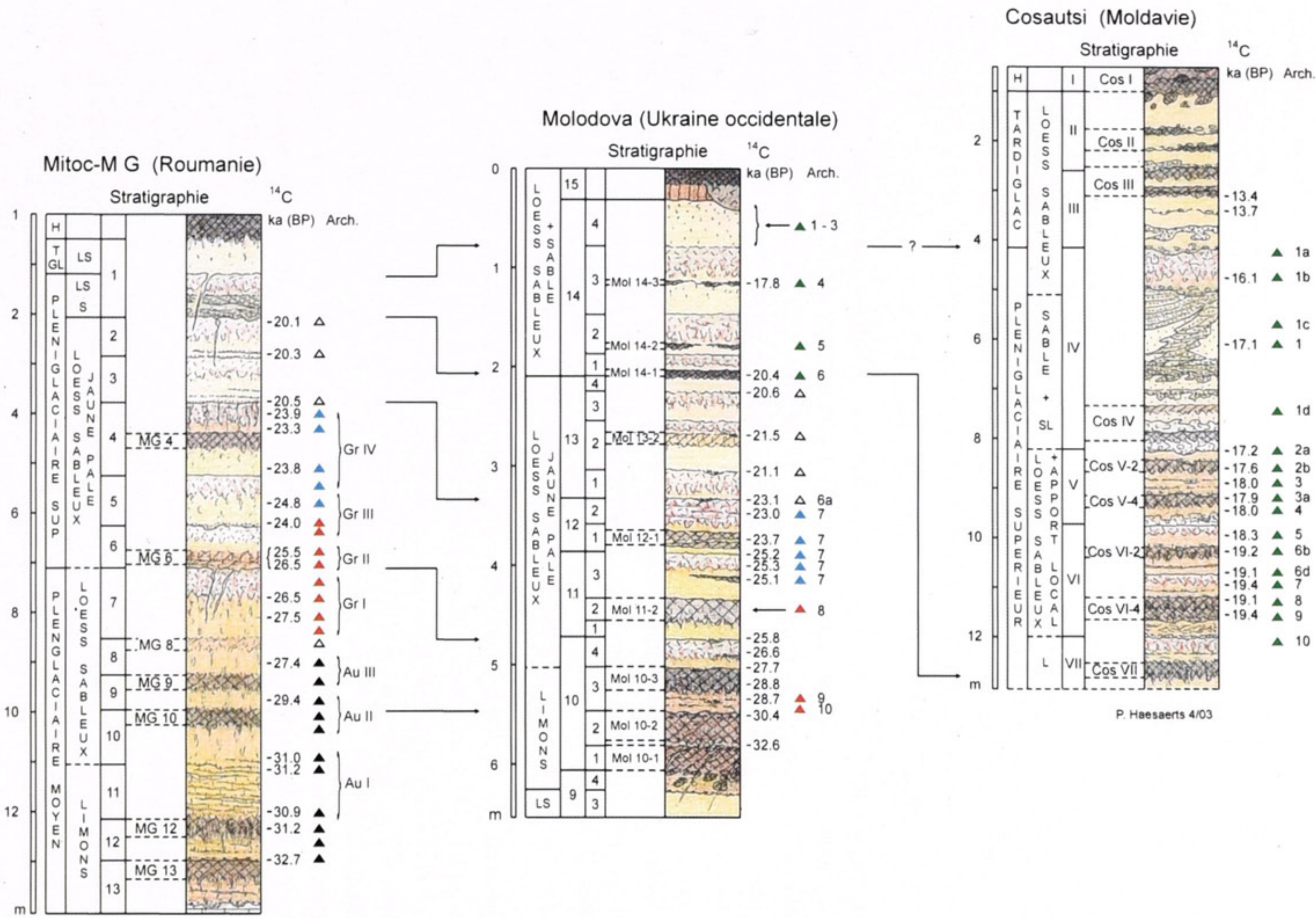

Figure 5. Séquences principales du domaine est-carpatique (symboles graphiques: voir figure 2). Abréviations. H: Holocène; TGL: Tardiglaciaire; L: loess; LS: loess sableux; Lm: limons; SL: sable limoneux; S: sable; hum: horizons humifères; gl t: gleys de toundra; MG: Malu Galben; Mol: Molodova; Cos: Cosautsi; Arch: archéologie.

En particulier, le développement du Gravettien à pointes à cran en Europe centrale paraît bien contemporain du dépôt de la première couverture loessique du pléniglaciaire supérieur dans un environnement froid mais encore légèrement humide, ce dont témoignent les gleys de toundra qui y sont associés. Les premiers témoins de cette industrie apparaissent vers 25.000 BP de manière quasi-synchrone de part et d'autre des Carpates. A Willendorf, la couche 9 fut datée 24.910 BP sur la partie centrale d'un os long, l'âge de 23.500 BP mentionné par J. Kozlowski (1998, 131) étant non valide car il se réfère à une date obtenue sur un fragment d'omoplate de mauvaise qualité (Haesaerts *et al.* 1996). A Molodova V, la partie principale de la couche 7 fouillée par A. Chernysh (1959), située avec précision sous le gley de toundra de l'unité 12 dans les profils ouverts en 1997-98 (Figure 4), a fourni trois dates sur charbon de bois entre 25.230 et 25.130 BP (Haesaerts *et al.* 2003); par contre, la partie supérieure de la couche 7 rencontrée par I. Ivanova (1987) dans l'horizon humifère sus-jacent (sous-unité 12-2) et dans le gley de toundra 12-2 fut datée respectivement 23.650 et 23.000 BP (Figures 4 et 5).

A Mitoc, mais aussi à Dolní Věstonice III, à Moravany-Lopata et à Spadzista, le Gravettien à pointes à cran est attesté entre 24.700 et 23.000 BP, les principales occupations de Spadzista datées vers 23.000 BP se situant juste en dessous et dans le sommet soliflué du gley de toundra principal (sous-unités 6a et 6b). A cet ensemble appartiennent également l'occupation de Petřkovice, dont la date 23.370 BP obtenue récemment apparaît plus fiable que celle de 20.790 BP issue des fouilles antérieures (Jarošová *et al.* 1996), et l'occupation de Nitra Čermáň dans la partie basale de la couverture loessique supérieure, datée 23.000 BP sur charbon de bois (Bárta 1980).

Seconde période (de 23.000 à ± 20.000 BP) - La mise en place de la couverture loessique supérieure dans un contexte froid mais surtout très sec, sur la base de la malacologie, a été datée à Molodova entre 23.000 et ± 20.000 BP (Haesaerts *et al.* 2003), ce qui correspond à l'âge du Stade de Brandenbourg-Lezsno dans la nord de l'Europe (Kozarski 1980). Les premiers apports éoliens de cette importante phase loessique ne furent certainement pas synchrones partout, comme cela semble être le cas à Spadzista, mais leur chronologie demeure imprécise en raison de la fiabilité aléatoire des âges sur os en milieu loessique, du moins à l'échelle du millénaire, et du manque de charbon de bois dans les dépôts de cette période à l'ouest des Carpates. Ces dépôts n'ont livré que de rares assemblages atypiques témoignant d'occupations occasionnelles et de courte durée. C'est le cas du niveau supérieur d'Aggsbach et de Milovice vers 22.500 BP, ou encore des ateliers de taille isolés comme ceux de la partie basale de la couche 5 à Spadzista C attribués à une phase tardive du Gravettien supérieur (Kozlowski et Sobczyk 1987, Kozlowski 1998, Escutenaire *et al.* 1999).

A l'est des Carpates, le long du Prut et du Dniestre, les occupations gravettiennes bien documentées font également défaut dans les loess de cette période; ceux-ci incorporent cependant un grand nombre de petites concentrations lithiques ou de pièces dispersées associées à des restes de renne et de cheval, avec localement présence de charbon de bois. A Molodova V par exemple, ces petites concentrations réparties sur plusieurs niveaux dans les loess de l'unité 13, furent datés respectivement 23.120 BP à la base, 21.500 BP dans la partie médiane et 20.600 BP vers le haut de l'unité (Figure 5). En d'autres termes, compte tenu de l'exceptionnel potentiel archéologique des vallées du Prut et du Dniestre dont seule une infime partie fut exploitée, ces quelques témoins attestent la présence répétée de petits groupes de chasseurs dans la région au cours de cette période froide mais surtout très sèche comprise entre 23.000 et ± 20.000 BP. Localement, des indices d'occupations plus importantes existent néanmoins dans les dépôts de cette période, par exemple dans la partie inférieure du loess poudreux de Crasnaleuca au nord de Mitoc mais celles-ci n'ont pas encore fait l'objet d'étude détaillée (Chirica 1989).

En conséquence, la période correspondant à la seconde génération loessique, que l'on a souvent associée à un vide d'occupation (Kozlowski 1996, 1998; Djindjian *et al.* 1999; Djindjian 2002) paraît surtout enregistrer un changement majeur du mode de subsistance des populations de chasseurs collecteurs après 23.000 BP; celui-ci s'accompagne, semble-t-il, d'une réorientation des pratiques cynégétiques vers la chasse saisonnière du renne et du cheval en réponse à une modification importante de l'environnement, suite à l'extension considérable des substrats xériques et de l'uniformisation des biotopes steppiques peu favorables à la grande faune autochtone (Haesaerts 1990b).

5.4. L'Epigravettien et les faciès associés

Première période (de ± 20.000 à ± 17.000 BP) - Les industries de cette période se réfèrent à deux groupes d'occupations distinctes, respectivement celles de Grubgraben (couches culturelles AL5 à AL1) en Basse Autriche et celles de Cosautsi (couches 10 à 2) et de Molodova (couches 6 à 4) sur le Dniestre (Figures 2, 5 et 7). Dans les deux régions, ces occupations accompagnent une succession de courtes oscillations interstadiaires et d'épisodes plus froids dans un contexte climatique relativement humide, succession qui constitue la signature de la seconde moitié du pléniglaciaire supérieur entre ± 20.000 et ± 17.000 BP.

A Grubgraben, les couches culturelles AL4 et AL3 datées 19.380 et 18.920 BP (non publié) et les deux petits horizons humifères attenants, ainsi que l'horizon humifère inférieur qui contient les éléments de la couche AL5, se rapportent à un épisode climatique complexe dénommé ici "oscillation de Grubgraben". Quant aux couches AL2a et AL2b datées 18.890 et 18.380 BP, elles accompagnent les loess sus-jacents tandis que la couche AL1 est associée à une phase d'arrêt des apports loessiques antérieure à 16.800 BP. L'industrie lithique des couches AL5 à AL1 constitue un ensemble cohérent rapporté par A. Montet-White (1990) à l'Epigravettien, auquel F. Brandtner (1996) attribue cependant un caractère "aurignacoïde". A cet ensemble appartiendraient également Langsmannersdorf et Rosenburg en Basse Autriche, deux gisements dépourvus de contexte stratigraphique, datés sur os entre 20.580 et 20.120 BP (Neugebauer-Maresch 1999), tandis que les occupations épigravettiennes, rapportées à la période 18.900 - 17.700 BP à Sagvar en Hongrie (Gabori 1965) et à Stránská Skála en Moravie (Svoboda 2001), sont probablement contemporaines des couches AL3, AL2 et AL1 de Grubgraben.

A l'est des Carpates, ce sont les séquences de Molodova V et surtout de Cosautsi qui sont les plus riches d'informations; elles intègrent un grand nombre de couches épigravettiennes, datées entre 20.400 et 17.200 BP, qui paraissent bien s'inscrire en continuité avec les occupations occasionnelles de la période antérieure. A Molodova V, où les Epigravettiens sont présents dès 20.400 BP, la couche 6 couvre une large superficie et se trouve associée à un horizon humifère interstadiaire bien exprimé qui établit la liaison avec la longue série d'occupations correspondant aux couches culturelles 10 à 1d de Cosautsi. Celles-ci se distribuent en semi-continuité autour d'une triple succession d'horizons humifères rapportés aux épisodes interstadiaires Cosautsi VI (entre 19.400 et 19.000 BP), Cosautsi V (entre 18.000 et 17.500 BP) et Cosautsi IV (vers 17.200 BP), lesquels sont séparés par deux préjorations climatiques situées vers 18.200 et 17.200 BP. D'autres témoins d'occupations épigravettiennes de cette période sont préservés à Molodova V (couches 5 et 4), à Korman IV (Ivanova 1977), à Podgor au voisinage de Cosautsi (Borziak 1994), mais aussi à Crasnaleuca le long du Prut (Chirica 1989).

En conclusion, en Europe centrale, la plupart des gisements de la période allant de ± 20.000 à ± 17.000 BP évoquent des campements récurrents à nouveau liés à des activités cynégétiques saisonnières; la grande densité des campements était probablement liée au caractère plus humide de cette période avec une couverture végétale qui demeure steppique car, comme pour la période précédente, la faune de chasse comporte esentiellement du renne et du cheval. En celà, elle se distingue des faunes antérieures à 23.000 BP qui sont nettement plus diversifiées et le plus souvent composées de grands herbivores autochtones. De fait, entre ± 20.000 à ± 17.000 BP, la plupart des gisements se situent le long des principales voies de migration du renne et du cheval. Grubgraben fait face à la vallée du Danube, à hauteur du débouché de la rivière Kamp, laquelle donne accès vers le nord au plateau morave et à la plaine baltique. De même, la vallée du Dniestre et ses abords constituaient un parcours de migration obligé entre les zones marécageuses du Pirpet au nord et les steppes méridionales à proximité de la Mer Noire actuelle.

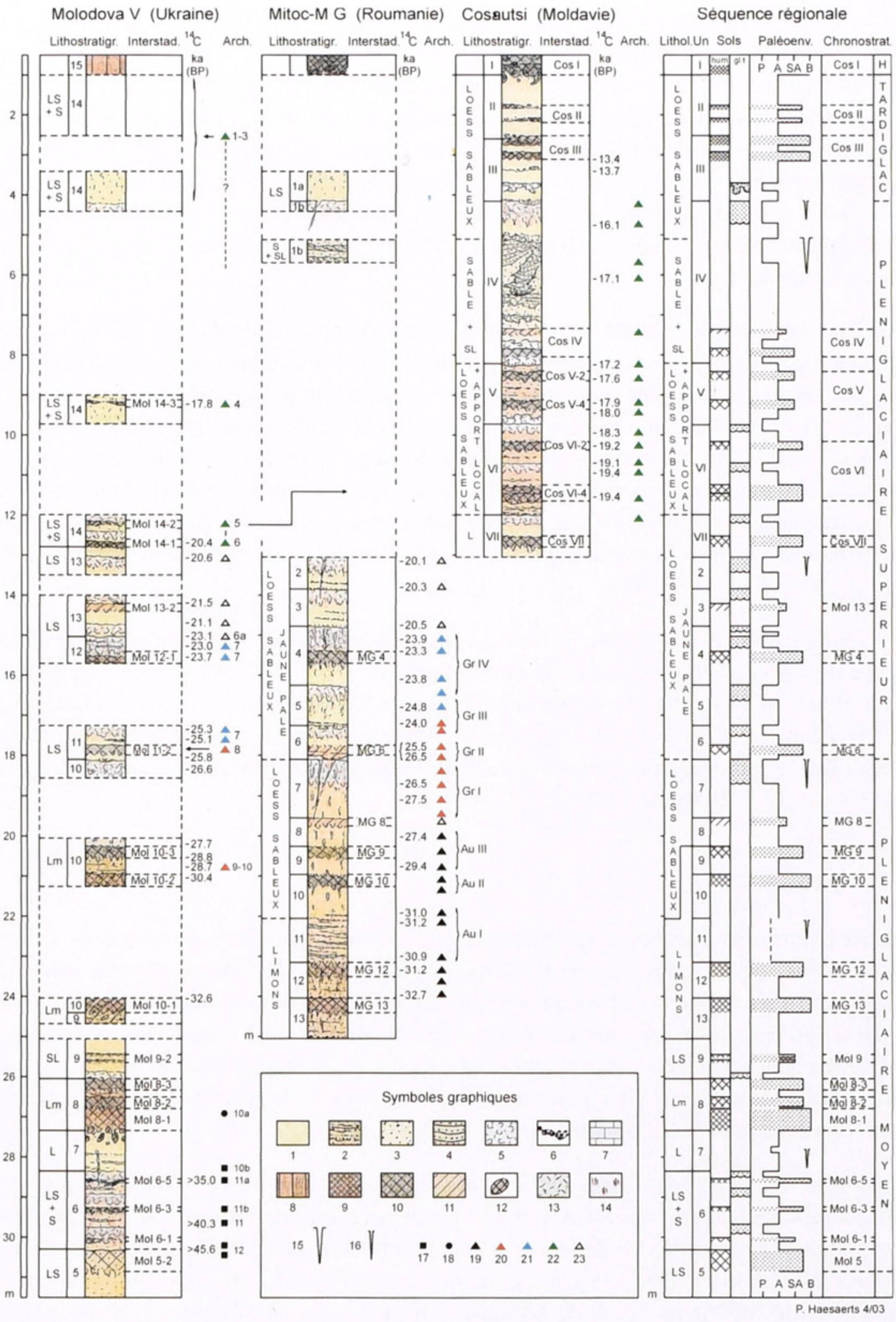

Figure 6. La séquence est-carpatique de ± 55.000 à 10.000 BP: schéma corrélatif (symboles graphiques: voir figure 2; abréviations: idem figure 5).

Deuxième période (de ± 17.200 à ± 14.500 BP) - En Europe centrale, la période comprise entre ± 17.000 et ± 14.500 BP se caractérise par des conditions climatiques extrêmes avec plusieurs épisodes de permafrost et une prédominance des faciès sableux souvent soufflés à partir des plaines alluviales avoisinantes. Cette période, qui correspond au Stade de Poméranie, s'accompagne d'une nouvelle césure dans la séquence du Paléolithique supérieur, les dépôts correspondant étant généralement stériles. Toutefois, le bassin du Dniestre fait à nouveau exception, principalement à Cosautsi (couches 1c à 1a) mais peut être aussi à Korman IV, avec de petites concentrations lithiques peu différenciées, datées entre 17.100 et 16.050 BP, encore attribuées à l'Epigravettien. Elles sont préservées dans les dépôts sableux et sablo-limoneux antérieurs à l'épisode rigoureux avec gley de toundra et fentes de gel qui termine le pléniglaciaire supérieur.

Troisième période (de ± 14.500 à ± 10.000 BP) - Le Tardiglaciaire est associé à la phase finale du Paléolithique supérieur dans un environnement climatique plus sec dont témoigne une double génération d'apports éoliens qui encadrent les sols humifères du complexe Bölling-Alleröd préservés dans les parties basses du paysage. Dans le domaine occidental, les rares gisements connus appartiennent au complexe magdalénien. C'est le cas de la couche culturelle de Kamegg dans la vallée de la Kamp, datée 14.100 BP sur os à la base d'un loess comparable à celui de la séquence supérieure de Grubgraben. De même, l'industrie magdalénienne de Brzoskwinia, dans le sud de la Pologne, présente dans les sables de couverture du Dryas le plus ancien, peut être mise en parallèle avec le Magdalénien supérieur de la grotte de Pekárna en Moravie (Svoboda *et al.* 1994).

Par contre, à l'est des Carpates, la situation est plus complexe. Alors qu'en Ukraine centrale, la présence de l'Epigravettien est attestée entre 15.000 et 13.500 BP, par les célèbres campements à structure d'habitat en ossements de mammouth (Soffer 1985, Iakovleva 2001), au contraire, dans les bassins du Dniestre et du Prut, l'attribution chronologique des petites concentrations épigravettiennes préservées dans la partie supérieure de la couverture loessique demeure problématique, en particulier pour les couches 3 à 1 de Molodova V.

6. Vue d'ensemble

La séquence interrégionale élaborée à l'échelle du domaine loessique d'Europe centrale pour la période 33.000 - 10.000 BP, associe les données pédostratigraphiques, les enregistrements paléoclimatiques et chronologiques et les données archéologiques. On dispose de la sorte d'un système bien documenté permettant de préciser les liens entre ces différentes composantes. Dans ce contexte, la chronologie des événements qui constituait un objectif prioritaire, repose sur une séquence complexe et reproductible de courts épisodes climatiques bien situés dans le temps à partir de longues séries de datations 14C cohérentes obtenues pour la plupart sur charbon de bois.

Par ailleurs, l'insertion dans ce système d'un grand nombre de sites et d'horizons d'occupations du Paléolithique supérieur bien positionnés en stratigraphie, a permis de démontrer le caractère synchrone de la distribution des principaux ensembles techno-culturels de part et d'autre des Carpates, compte tenu de la marge d'imprécision inhérente au schéma chronologique (Figure 7). Dès lors, cette approche s'inscrit en complément des différents essais de synthèse publiés ces dernières années pour le Paléolithique supérieur d'Europe centrale (Kozlowski 1996, 1998, Djindjian *et al.* 1999, Svoboda 2000, Djindjian 2002).

Un autre aspect spécifique de la séquence interrégionale concerne l'incidence des variations du climat et de l'environnement sur le schéma évolutif du Paléolithique supérieur dans le domaine loessique au cours de la période considérée, un thème qui n'a guère été développé dans les essais de synthèse précédents. De fait, le degré de résolution du système a permis de mettre en évidence un remarquable parallélisme

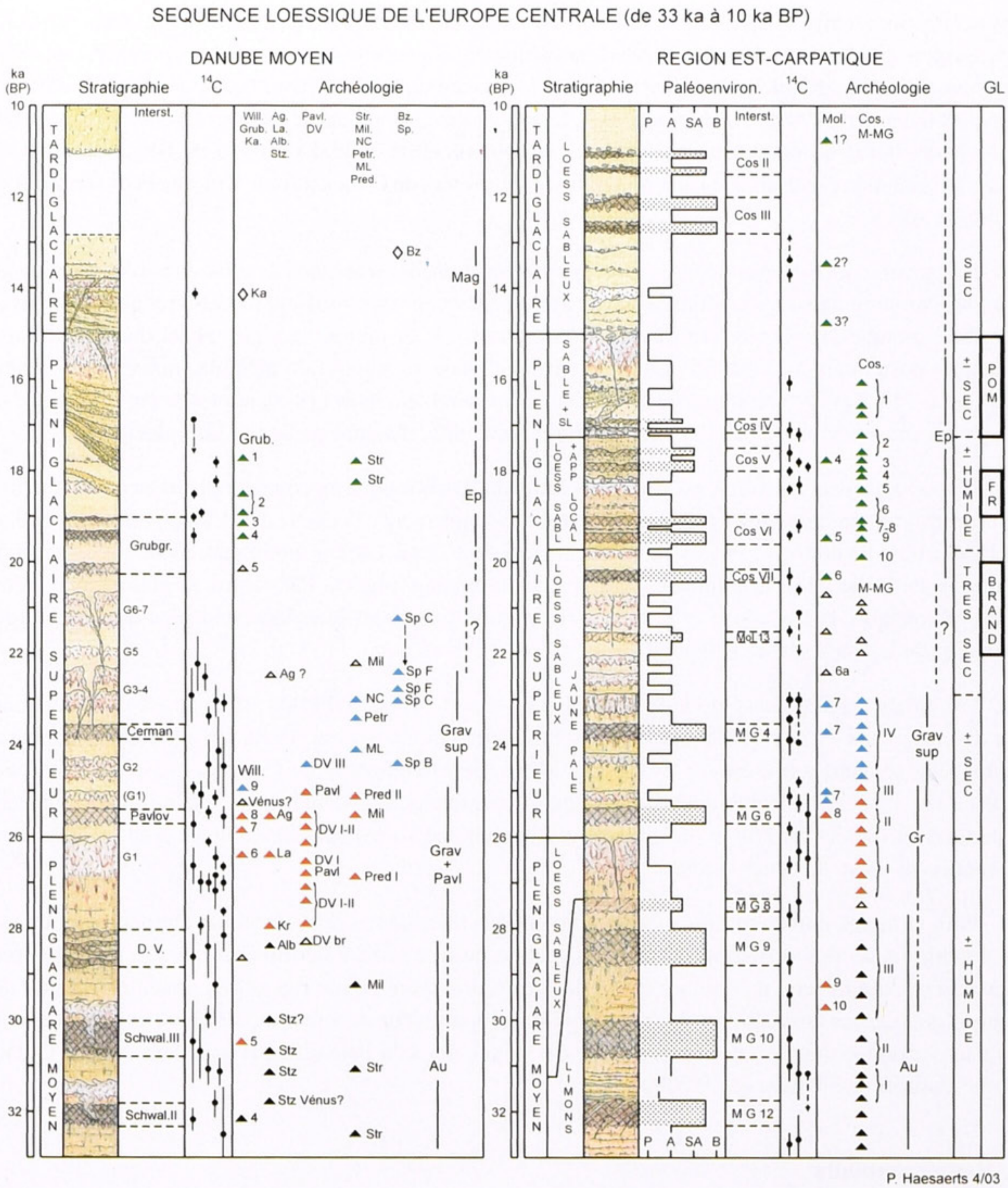

Figure 7. Schéma corrélatif des séquence loessiques du Danube moyen et du domaine est-carpatique (symboles graphiques: voir figure 2; abréviations: idem figures 4 et 5).

entre ces deux processus, lesquels traduisent une succession rythmique des événements selon une périodicité de l'ordre de ± 2.500 ans.

Cette dynamique se marque dès la fin du pléniglaciaire moyen avec la phase d'extension du Pavlovien et du Gravettien moyen entre 28.000 et 25.500 BP, dans un contexte climatique essentiellement rigoureux et humide. Elle se poursuit au pléniglaciaire supérieur avec la mise en place d'une première couverture loessique entre ± 25.500 et 23.000 BP dans un environnement encore relativement humide; c'est au cours de cette période que se développe le Gravettien supérieur à pointes à cran, et celà en continuité avec les occupations gravettiennes antérieures (Svoboda 2000). De même, la diminution considérable des occupations entre ± 23.000 et ± 20.000 BP au cours de la période extrêmement sèche associée à la seconde génération loessique, répond probablement à une uniformisation des biotopes steppiques peu favorables à la grande faune d'herbivores autochtones suite à l'extension considérable des substrats xériques (Haesaerts 1990b, Kozlowski 1996). Ce type d'environnement se maintient, semble-t-il, pendant la seconde moitié du pléniglaciaire supérieur, y compris entre ± 20.000 et 17.000 BP, au cours de la phase plus humide correspondant aux occupations récurrentes de Cosautsi sur le Dniestre et de Grubgraben en Basse Autriche.

L'extension des biotopes steppiques se répercute également sur le mode de subsistance des populations dont les comportements cynégétiques furent axés sur les migrations saisonnières du renne et du cheval, comme l'indique la composition des faunes de chasse de la plupart des gisements du Paléolithique supérieur postérieurs à 23.000 BP. Enfin, la dernière phase rigoureuse du pléniglaciaire supérieur entre 17.000 et ± 14.500 BP voit à nouveau diminuer considérablement les occupations de part et d'autre de Carpates, une situation qui semble bien perdurer pendant la majeure partie du Tardiglaciaire.

En conséquence, les différents stades évolutifs du Paléolithique au cours du pléniglaciaire supérieur semblent surtout induits par les modifications de l'environnement à l'échelle de l'Europe centrale résultant de l'extension des couvertures loessiques, mais aussi par l'impact de ces modifications sur la composition de la grande faune liée à la nature et à la diversité du paysage végétal. Par contre, au cours d'une même phase climatique, la fréquence et le type d'occupation paraissent bien indépendantes des oscillations climatiques de courte durée (Figure 7).

Par ailleurs, l'hypothèse de vide d'occupation entre 22.000 et 19.000 BP avancée précédemment par divers auteurs (Soffer 1985, Kozlowski 1996, 1998, Djindjian *et al.* 1999, Djindjian 2002), apparaît plutôt relative dans la mesure où les sites de Mitoc, de Molodova et de Cosautsi attestent la présence répétée des chasseurs paléolithiques dans la région est-carpatique pendant la quasi totalité du pléniglaciaire supérieur, les vallées du Prut et du Dniestre constituant une voie de passage obligée pour les troupeaux de rennes au cours de cette période.

Pour terminer, nous sommes conscients du fait que les schémas de distribution régionaux soulignant le synchronisme des différents ensembles techno-culturels du Paléolithique supérieur demeurent incomplets, compte tenu du nombre limité de sites pris en compte par rapport au potentiel supposé des régions concernées et de la part de hasard qui conditionne leur découverte. Dès lors, ceci confirme le caractère aléatoire des modèles de migration des populations du Paléolithique supérieur dans la Grande Plaine Européenne (Mussi *et al.* 2000).

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COPING WITH THE COLD:
ON THE CLIMATIC CONTEXT OF THE MORAVIAN MID UPPER PALAEOLITHIC

O. Jöris and B. Weninger

Abstract

The (post-Aurignacian) Moravian Mid Upper Palaeolithic can be subdivided into three stages, each reflecting new adaptations which seem to have developed largely in response to changes in palaeoclimate and environment. The present paper aims to establish a chronostratigraphic framework for a later evaluation in archaeological studies concerning the invention of new strategies to cope with climatic deterioration that may have been imported by early modern humans.

KEYWORDS: Moravia, Mid Upper Palaeolithic, radiocarbon calibration, palaeoclimate change

The Moravian Mid Upper Palaeolithic (MUP) record, well-dated by a series of radiocarbon measurements to between ca. 27,800 and 20,800 ^{14}C BP, comprises a broad set of archaeological data that characterize complex early modern human hunter-gatherer societies as most clearly indicated by the complex structure of the larger sites, by settlement stability, "*elaborate resource exploitation*" and land-use systems, innovations in technology and material culture as well as in ritual and ideology (Svoboda *et al.* 2000). Stratigraphically the Moravian MUP sites overlay *chernozems* and *pararendzines* of the so called Stránská skála soil formation, attributed to the regional pedocomplex I (BK I, Klíma 1994), and fall into an extended period of continual cooling with discontinuous or limited loess deposition, culminating in the climatic deterioration of the Last Glacial Maximum (LGM) (cf. Kozlowski 1996).

1. Chronology of the Moravian Mid Upper Palaeolithic record

Although lacking stratigraphical superpositions, the Moravian MUP is well-dated by some 84 radiocarbon measurements (Table 1) of which most have been obtained on charcoal[1]. Samples were measured in different laboratories, but the bulk of these were measured by conventional dating procedures in the radiocarbon laboratory of the Centre for Isotope Research at Groningen University[2] (cf. Vogel and Zagwijn 1967, Damblon *et al.* 1996, van der Plicht 1997), which allows for direct age-comparison between the different sites and archaeological units dated (Dolní Věstonice I and II, Jarošov II, Předmostí Ib, Pavlov I, Milovice, Boršice, Pod hradem, Brno II, Petřkovice Ia, Kůlna 6, Jaroslavice).

Based on the chronometric dates and on stratigraphical correlations, J. Svoboda (1996a, 1996b) divides the Moravian MUP into four main stages (Figure 1-2), starting with (1) an earlier phase of the Pavlovian between 30-27 ky ^{14}C BP (lower parts of the sites Dolní Věstonice I and II, and units 2 and 3 of the western

Footnote 1. cf. Jöris *et al.* (in press) on the reliability of radiocarbon measurements according to sample material.

Footnote 2. The Groningen radiocarbon measurements available for the Moravian MUP are often extremely precise with low standard deviations around 1.0 % of the total age, sometimes even as little as 0.5 %, and rarely as large as 3.0 % (cf. van der Plicht 1997).

Site	Loc.	Lab-no.	14C-Age [BP]	Material	Cal Age [cal BC] 68% (95%)
Pre-PAVLOVIAN (=Stránská skála) soil formation					
Dolní Věstonice I	lower part	GrN- 6858	32850 ± 660	charcoal	35389 ± 1707 (37929-32849)
Dolní Věstonice I	lower part	GrN-11189	31700 ± 1000	charcoal	34357 ± 1707 (37771-30943
Dolní Věstonice			31000 ± 300		32969 ± 536 (34041-31897
Pavlov I		KN - 286?	30010 ± 460	charcoal	31930 ± 540 (33010-30850)
Dolní Věstonice II	Brickyard	GrN-10525	29940 ± 300	charcoal	31888 ± 413 (32714-31062)
Dolní Věstonice I	lower part	GrN-18178	29300 ± $^{750}/_{690}$	charcoal	31140 ± 849 (32838-29442)
Milovice	trench D	GrN-14824	29200 ± 950	charcoal	31077 ± 979 (33035-29119)
Dolní Věstonice I	lower part	GrN- 6860	29180 ± 460	charcoal	31081 ± 673 (32427-29735)
Dolní Věstonice II	Brickyard	GrN- 2598	29000 ± 200	charcoal	30978 ± 558 (32094-29862)
Dolní Věstonice II	Brickyard	GrN- 2092	28300 ± 300	humus+charc.	30358 ± 565 (31488-29228)
Dolní Věstonice II	Brickyard	GrN-11196	28220 ± 370	charcoal	30311 ± 590 (31491-29131)
Dolní Věstonice II		GrN-15280	27900 ± 550	charcoal	30094 ± 669 (31432-28756)
Dolní Věstonice I	lower part	GrN-18188	27250 ± $^{590}/_{550}$	charcoal	29372 ± 644 (30660-28084)
Dolní Věstonice II		*CU - 749*	*24005 ± 2100*	*charcoal*	*25848 ± 2266 (30380-21316)*
PAVLOVIAN, earlier group					
Dolní Věstonice I	lower part	GrN- 6859	27790 ± 370	charcoal	29931 ± 524 (30979-28883)
Dolní Věstonice II	hearth A-C	GrN-13962	27660 ± 80	charcoal	29697 ± 329 (30355-29039)
Dolní Věstonice I	*lower part*	*GrN-11004*	*20270 ± 210*	*charcoal*	*21869 ± 379 (22627-21111)*
PAVLOVIAN, 26.8 horizon at Dolní Věstonice II					
Dolní Věstonice II	western hearth	GrN-15327	27080 ± 170	charcoal	29169 ± 273 (29715-28623)
Dolní Věstonice II	u.3, hearth 12/13	GrN-15278	27070 ± 300	charcoal	29147 ± 335 (29817-28477)
Dolní Věstonice II	southern hearth	GrN-15324	27070 ± 170	charcoal	29161 ± 274 (29709-28613)
Dolní Věstonice II	northern hearth	GrN-15326	26970 ± 160	charcoal	29087 ± 281 (29649-28525)
Dolní Věstonice II	u.4 sq. E3	GrN-21122	26970 ± 200	charcoal	29081 ± 295 (29671-28491)
Dolní Věstonice II	u.2, hearth 16/17	GrN-15279	26920 ± 250	charcoal	29035 ± 323 (29681-28389)
Dolní Věstonice II	triple burial	GrN-14831	26640 ± 110	charcoal	28849 ± 309 (29467-28231)
Dolní Věstonice II	eastern hearth	GrN-15325	26550 ± 160	charcoal	28768 ± 338 (29444-28092)
PAVLOVIAN, later group					
Jarošov II		GrN-17087	26950 ± 200		29066 ± 297 (29660-28472)
Předmostí Ib	1971, cemetry	GrN- 6801	26870 ± 250	ch. bone (ex)	28997 ± 329 (29655-28339)
Pavlov I	area 1956 (b)	GrN - 4812	26730 ± 250	charcoal	28889 ± 348 (29585-28193)
Pavlov I	area 1953 (b) East	GrN-19539	26650 ± 230	charcoal	28832 ± 351 (29534-28130)
Pavlov I	area 1956 (b)	GrN- 1272	26620 ± 230	charcoal	28807 ± 356 (29519-28095)
Pavlov I	area 1954 (b)	KN - 1286?	26580 ± 460	charcoal	28623 ± 565 (29753-27493)
Dolní Věstonice I	hearth 1, zone D	GrN-10524	26430 ± 190	charcoal	28652 ± 378 (29408-27896)
Pavlov I	area 1954 (b)	GrN-22303	26400 ± 310		28548 ± 480 (29508-27588)
Dolní Věstonice II	u. LP/1-4	GrN-21123	26390 ± 190	charcoal	28611 ± 390 (29391-27831)
Jarošov II		GrN-17191	26340 ± 180		28561 ± 402 (29365-27757)
Předmostí Ib	1971, cemetry	GrN- 6852	26320 ± 240	ch. bone (res)	28504 ± 453 (29410-27598)
Jarošov II		GrN-15137	26220 ± 390		28224 ± 677 (29578-26870)
Dolní Věstonice IIa	trench A	GrN-15132	26190 ± 390		28180 ± 694 (29568-26792)
Pavlov I	area 1957(a)West	GrN-20391	26170 ± 450	charcoal	28076 ± 790 (29656-26496)

Dolní Věstonice III	u.2	GrN-22307	26160 ± 770		27677 ± 1247 (30171-25183)
Dolní Věstonice II	mammoth deposit	GrN-14830	26100 ± 100	charcoal	28287 ± 464 (29215-27359)
Pavlov I	area 1961?(c)	GIN - 104	26000 ± 350	charcoal	27940 ± 749 (29438-26442)
Dolní Věstonice I	upper part	GrN-18189	$25950 \pm {}^{630}/_{580}$	charcoal	27528 ± 1161 (29850-25206)
Dolní Věstonice IIa	trench D	GrN-15147	25890 ± 370		27748 ± 827 (29402-26094)
Dolní Věstonice IIa	trench A	GrN-15134	25870 ± 370		27712 ± 840 (29392-26032)
Pavlov I	area 1954(b)	GrN-22305	25840 ± 290		27757 ± 744 (29245-26269)
Dolní Věstonice I	middle part	GrN - 1286	25820 ± 170	charcoal	27834 ± 620 (29074-26594)
Dolní Věstonice I	sample 1	GrN - 6857	25790 ± 320	charcoal	27630 ± 819 (29268-25992)
Jarošov II		GrN - 9604	25780 ± 250		27693 ± 729 (29151-26235)
Dolní Věstonice II	u.1, hearth D	GrN-15277	25740 ± 210	charcoal	27659 ± 705 (29069-26249)
Dolní Věstonice II	DV 16 burial	GrN-15276	25570 ± 280	charcoal	27250 ± 924 (29098-25402)
Pavlov I	area 1953(b)East	GrA - 192	25530 ± 110	charcoal	27309 ± 779 (28867-25751)
Milovice	feature G	GrN-14824	25220 ± 280	charcoal?	26751 ± 969 (28689-24813)
Pavlov I	area 1954(b)	GrN-22304	25160 ± 170		26671 ± 904 (28479-24863)
Jarošov II		GrN - 9613	25110 ± 240		26607 ± 913 (28433-24781)
Předmostí II	1992, burial 4	OxA - 5971	25040 ± 320	bone	26534 ± 948 (28430-24638)
Boršice		GrN - 11454	25040 ± 300		26530 ± 935 (28400-24660)
Pavlov I	area 1956(b)	GrN - 1325	25020 ± 150	charcoal	26469 ± 841 (28151-24787)
Dolní Věstonice II	*disturbed hearth*	*GrN - 11003*	*24470 ± 190*	*charcoal*	*25755 ± 729 (27213-24297)*
PAVLOVIAN, old measurements					
Dolní Věstonice II	u.1, hearth D	ISGS -1744	26390 ± 270	charcoal	28567 ± 448 (29463-27671)
Dolní Věstonice II	hearth	ISGS -1617	24970 ± 920	charcoal	26596 ± 1336 (29268-23924)
Dolní Věstonice II	*hearth*	*ISGS -1616*	*24000 ± 900*	*charcoal*	*25751 ± 1266 (28283-23219)*
Dolní Věstonice II	*u.3, hearth 12/13*	*CU - 747*	*23799 ± 870*	*charcoal*	*25526 ± 1217 (27960-23092)*
Dolní Věstonice II	*u.3, hearth 12/13*	*ISGS - 1899*	*22630 ± 420*	*charcoal*	*23921 ± 352 (24625-23217)*
Dolní Věstonice II	*mammoth deposit*	*CU - 715*	*22368 ± 749*	*charcoal*	*23658 ± 605 (24868-22448)*
Dolní Věstonice I	*middle part, C*	*Ly - 1303*	*22250 ± 570*	*charcoal*	*23615 ± 479 (24573-22657)*
Dolní Věstonice II	*u.2, hearth 16/17*	*CU - 748*	$21920 \pm {}^{743}/_{734}$	*charcoal*	*23276 ± 671 (24618-21934)*
Dolní Věstonice I	*middle part, C*	*Ly - 1999*	*19640 ± 540*	*charcoal*	*21076 ± 675 (22426-19726)*
WILLENDORF-KOSTENKIAN					
Dolní Věstonice III	u.1, hearth	GrN-20392	$24560 \pm {}^{660}/_{610}$	charcoal	26167 ± 1123 (28413-23921)
Milovice		ISGS-1690	22900 ± 490		24100 ± 379 (24858-23342)
Dolní Věstonice I	DV 35	OxA - 8292	22840 ± 200		24091 ± 233 (24557-23625)
Milovice	L mammoth deposit	GrN-14835	22100 ± 1100	bone	23344 ± 983 (25310-21378)
Milovice		ISGS-1691	21200 ± 1100		22514 ± 1074 (24662-20366)
LATE GRAVETTIAN					
Pod hradem	*E*	*GrN - 1981*	*26830 ± 300*	*ch.bone*	*28954 ± 360 (29674-28234)*
Brno II		OxA - 8293	23680 ± 200		24641 ± 238 (25117-24165)
Petřkovice Ia	1953	GrA - 891	23370 ± 160	charcoal	24428 ± 208 (24844-24012)
Kůlna	6	GrN - 6853	22990 ± 170		24188 ± 216 (24620-23756)
Kůlna	6	GrN - 5773	21750 ± 140		23311 ± 267 (23845-22777)
Kůlna	6	GrN - 6800	21630 ± 150		23212 ± 270 (23752-22672)
Pod hradem	E	GrN - 1734	21500 ± 100	ch.bone	23100 ± 264 (23628-22572)

Kůlna	*6a*	*GrN - 5774*	*21260 ± 140*		*22844 ± 322 (23488-22200)*
Petřkovice Ia	1994	GrN - 19540	20790 ± 270	charcoal	22398 ± 393 (23184-21612)
EPIAURIGNACIAN					
Dolní Věstonice IIa		GrN - 19498	23540 ± 180		24541 ± 221 (24983-24099)
EPIGRAVETTIAN					
Jaroslavice		GrA - 7574	19340 ± 100		20745 ± 363 (21471-20019)

Table 1: Moravian Mid Upper Palaeolithic radiocarbon data base. Data list supplied by J. Svoboda (cf. Davies 2000, online). Calibration of radiocarbon dates has been performed with the CALPAL-2003 (July) program (http://www.calpal.de). *Italic* – omitted dates; u. – unit; ch. (ex/res) – charred (extraction/residue)

slope of Dolní Věstonice II), followed by (2) a later phase characterized by a remarkably homogeneous group of 33 radiocarbon dates that fall between 27,000 and 25,000 ^{14}C BP (middle and upper parts of Dolní Věstonice I and some units of Dolní Věstonice II, Pavlov I and most of Předmostí). From the available radiocarbon dates and from spatial analyses and refittings it appears that at least some of the larger Moravian sites (e.g. Pavlov I and Dolní Věstonice I) have been occupied repeatedly and/or over longer time intervals, some probably all year-round (Svoboda *et al.* 2000, 197, 210-211). At Dolní Věstonice II, however, an extensive settlement phase – expected to be of shorter duration probably during the winter-term (Svoboda *et al.* 2000, 211) – can be fixed at around 26,800 ^{14}C BP (weighted mean of eight ^{14}C measurements: 26,842 ± 60 ^{14}C BP, including a date from the famous triple burial; cf.: Klíma 1987, 1995).

These large Pavlovian sites are then followed by (3) the "Upper Gravettian" Willendorf-Kostenkian (24-20 ky ^{14}C BP) of the Middle Danube region, as represented by the site of Petřkovice Ia (Jarošová *et al.* 1996) and – finally – by (4) "Epigravettian" industries post-dating the LGM (Svoboda *et al.* 2000, 201-202). Up to now, in Moravia, the site of Jaroslavice is the only dated "Epigravettian" site where a single, but old sample (GrA-7574) has produced a date of 19,340 ± 100 ^{14}C BP.

The oldest age-estimates for the onset of the Moravian MUP derive from charcoals of a partly disturbed find horizon below the main cultural layer at Dolní Věstonice I (GrN-6859, GrN-11004; Damblon *et al.* 1996, Klíma 1963) and from hearths A-C at Dolní Věstonice II (GrN-13962; Damblon *et al.* 1996, Klíma 1995; cf. Table 1). Other radiocarbon samples that are of unclear archaeological attribution and – by their greater age – form Svobodas "earlier group" of Pavlovian dates, come from interpleniglacial soils or "brown horizons" immediately below the MUP cultural layers (Table 1: pre-Pavlovian; cf. Klíma 1963, 1995). Their omission from the archaeological data base results in a marked chronometrical division between the Moravian MUP and the preceding Aurignacian.

2. Calibration of the radiocarbon time-scale between 20,000 and 30,000 ^{14}C BP

Radiocarbon "age"-estimates are measured on the conventional ^{14}C-scale, which is very precisely defined as a dimensionless logarithmic ratio (Mook 1983). Due to variations in natural (atmospheric) ^{14}C concentrations, the radiocarbon scale requires calibration to allow for transferral of (uncalibrated) radiocarbon dates into the calendric time-scale (de Vries 1958). For the entire Holocene period and parts of the Late Glacial radiocarbon calibration is best performed by dendrochronology (Stuiver and van der Plicht 1998, cf. van der Plicht 2002), but calibration is even more important for the glacial periods in order to contribute to our understanding of Palaeolithic archaeology (Jöris and Weninger 1999a, 1999b, 2000).

Within the last decade intensive progress has been made to extend the radiocarbon calibration record back into the glacial periods[3], using (1) ^{14}C samples obtained from laminated sediments (Kitagawa and van der Plicht 2000), (2) couplets of U/Th-ages *vs.* ^{14}C-measurements from corals (Bard *et al.* 1998) and (3) speleothems (Beck *et al.* 2001), and (4) ^{14}C-dated foraminifera from marine cores that have been reliably synchronized with the high-resolution Greenland ice core time-scales (Bond *et al* 1993, Jöris and Weninger 1998, Voelker *et al.* 1998, 2000), linking ^{14}C-dates with palaeoclimate signatures.

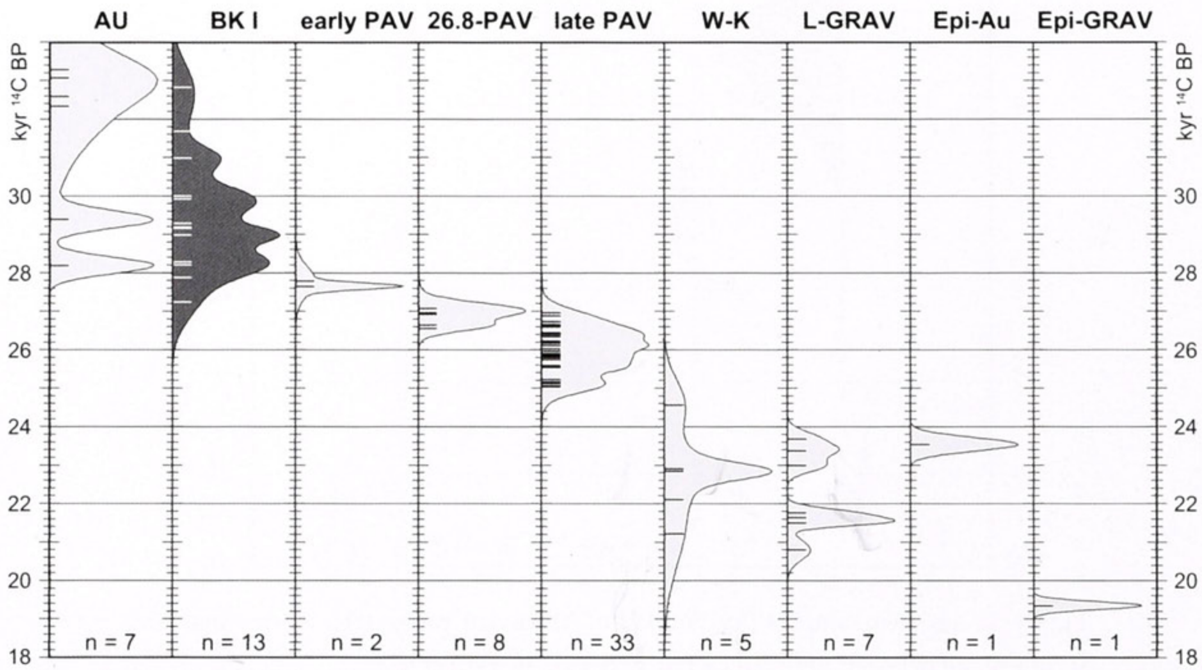

Figure 1: Age-distributions [ky ^{14}C BP] of Moravian radiocarbon-dates spanning from the Aurignacian until the "Epigravettian" of Jaroslavice.
AU – Aurignacian; BK I – pedocomplex I; PAV – Pavlovian (earlier; 26.8; later); W-K – Willendorf-Kostenkian; L-GRAV – Late Gravettian; Epi-AU – "Epiaurignacian"; Epi-GRAV – "Epigravettian".
In the construction method applied to the resulting ^{14}C-dispersion graphs, each individual radiocarbon date has been defined by its given median value and standard deviation. The corresponding individual Gaussian curves have been added, to give a curve of the summed ^{14}C dating probability (Geyh 1969). Because each Gaussian curve is normalised with equal area, each date/sample is given equal weight, independent of dating precision.

Although their underlying age-models may strongly diverge, the GRIP and GISP2 Greenland ice cores record essentially identical relative sequences of rapid fluctuations between stadial (GS) and interstadial (GI) conditions (Figure 3; Björck *et al.* 1998, Walker *et al.* 1999, cf. Johnsen *et al.* 1992). For a variety of reasons, (1) namely the fact that annual layer counts in GISP2 have been established further back in time than in GRIP (Meese *et al.* 1994, Sowers *et al.* 1993), (2) for the calibration of the GISP2 record against the orbitally-tuned Vostok chronology (Petit *et al.* 1999), (3) for its synchronisms with a U/Th-based speleothem chronology established in the southern Chinese Hulu Cave (Wang *et al.* 2001) as well as (4) for its calibration against important volcanic markers (e.g. Fedele *et al.* 2002, Westgate *et al.* 1998, Zielinski *et al.* 1996), a GISP2-based time-scale seems to be most reliable and is in overall agreement with the above mentioned data-pairs obtained from Suigetsu varves and from U/Th-dated coral samples.

Footnote 3. Against the background of the history of research on the calibration of the radiocarbon time-scale with its innumerable extensions, revisions, and corrections and its major inputs from archaeology, it is most of all a semantic question to distinguish between „calibration" and „comparison" (cf. van der Plicht 2002), and to refrain from glacial calibration until a number of issues, most of all concerning the underlying time-scales, have been resolved (van der Plicht 1999; for response see: http://www.calpal.de./calpal/library.htm; for the possibility of glacial calibration: cf. Bard 2001, Beck et al. 2001).

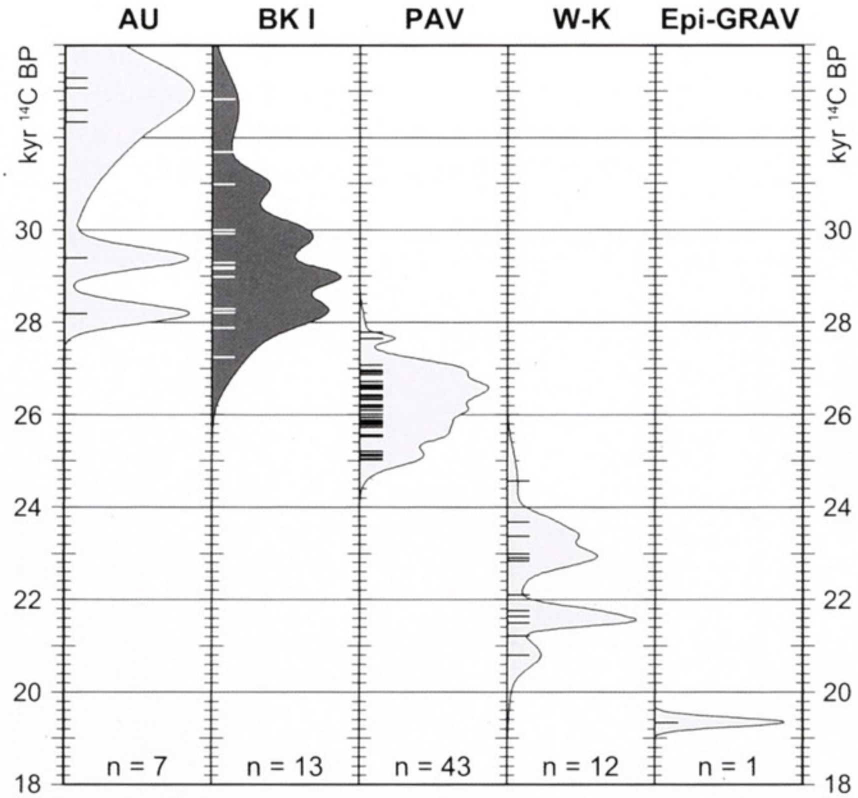

Figure 2: Age-distributions [ky ^{14}C BP] of Moravian radiocarbon-dates spanning from the Aurignacian until the "Epigravettian" of Jaroslavice.
AU – Aurignacian; BK I – pedocomplex I; PAV – Pavlovian; W-K – Willendorf-Kostenkian and Late Gravettian; Epi-GRAV – "Epigravettian".
In the construction method applied to the resulting ^{14}C-dispersion graphs, each individual radiocarbon date has been defined by its given median value and standard deviation. The corresponding individual Gaussian curves have been added, to give a curve of the summed ^{14}C dating probability (Geyh 1969). Because each Gaussian curve is normalised with equal area, each date/sample is given equal weight, independent of dating precision.

Over the period between 30.0 and 20.0 ky ^{14}C BP (ca. 32.0-21.5 ky cal BC) the CALPAL-2003 data set (Figure 3; up-date of Jöris and Weninger 1999a; 1999b; 2000; http://www.calpal.de) combines the atmospheric calibration record from the Japanese lake Suigetsu (Kitagawa and van der Plicht 2000) with the coral data of Bard *et al.* (1998) and those from the North Atlantic core PS2644 (Voelker *et al.* 2000). Although the period at stake is only poorly covered by these records, it displays a complex pattern of highly fluctuating ^{14}C levels, with periods of extremely high rates of production of radiocarbon (steep parts in the calibration curve), i.e. during the cold period GS 5 between 28.0 and 26.0 ky or after 24.5 ky ^{14}C BP, and others of limited ^{14}C-production, resulting in long *plateaux* in the calibration curve, i.e. between 25.5 and 24.5 ky cal BC (~ GI 4-3).

3. Results

Calibrated medians (68 % probability) and ranges (95 %) for the Moravian MUP radiocarbon measurements are given in Table 1 and presented as line graphs in figures 4-5, relative to the Greenland GISP2 record of palaeoclimatic change. Based on these calibrated dates, the Moravian MUP is subdivided

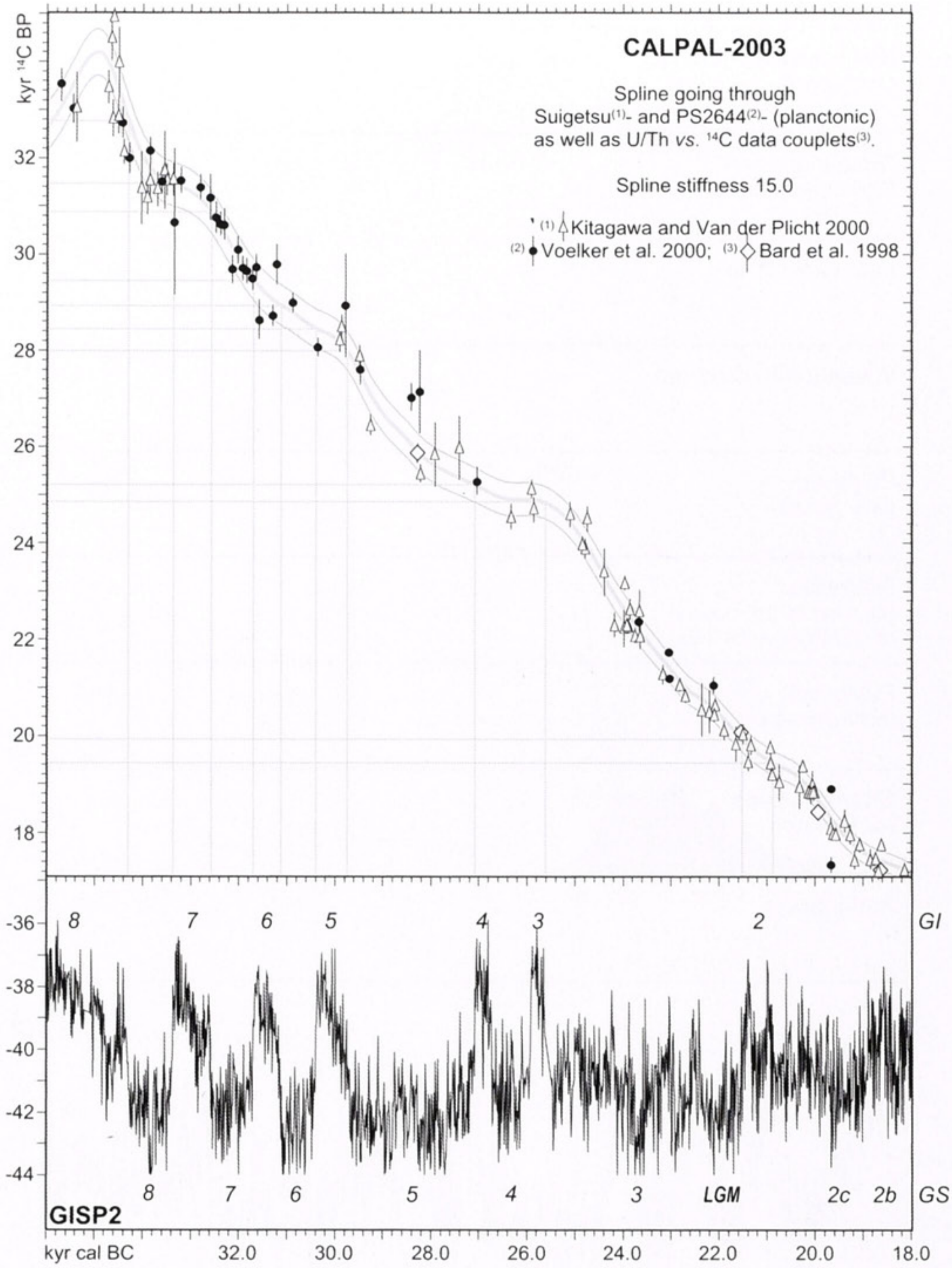

Figure 3: Calibration of the radiocarbon scale [ky ^{14}C BP] between 35,000 and 17,000 ^{14}C BP (Jöris and Weninger 1999a, 1999b, 2000, up-dated) in relation to the Greenland GISP2 ice core record (‰ PDB d^{18}O after: Stuiver and Grootes 2000), in the time-window 36.0 – 18.0 ky cal BC.
Interstadials are highlighted in both scales: cal BC as well as ^{14}C BP.
GI – Greenland interstadial; GS – Greenland stadial; LGM – Last Glacial Maximum.

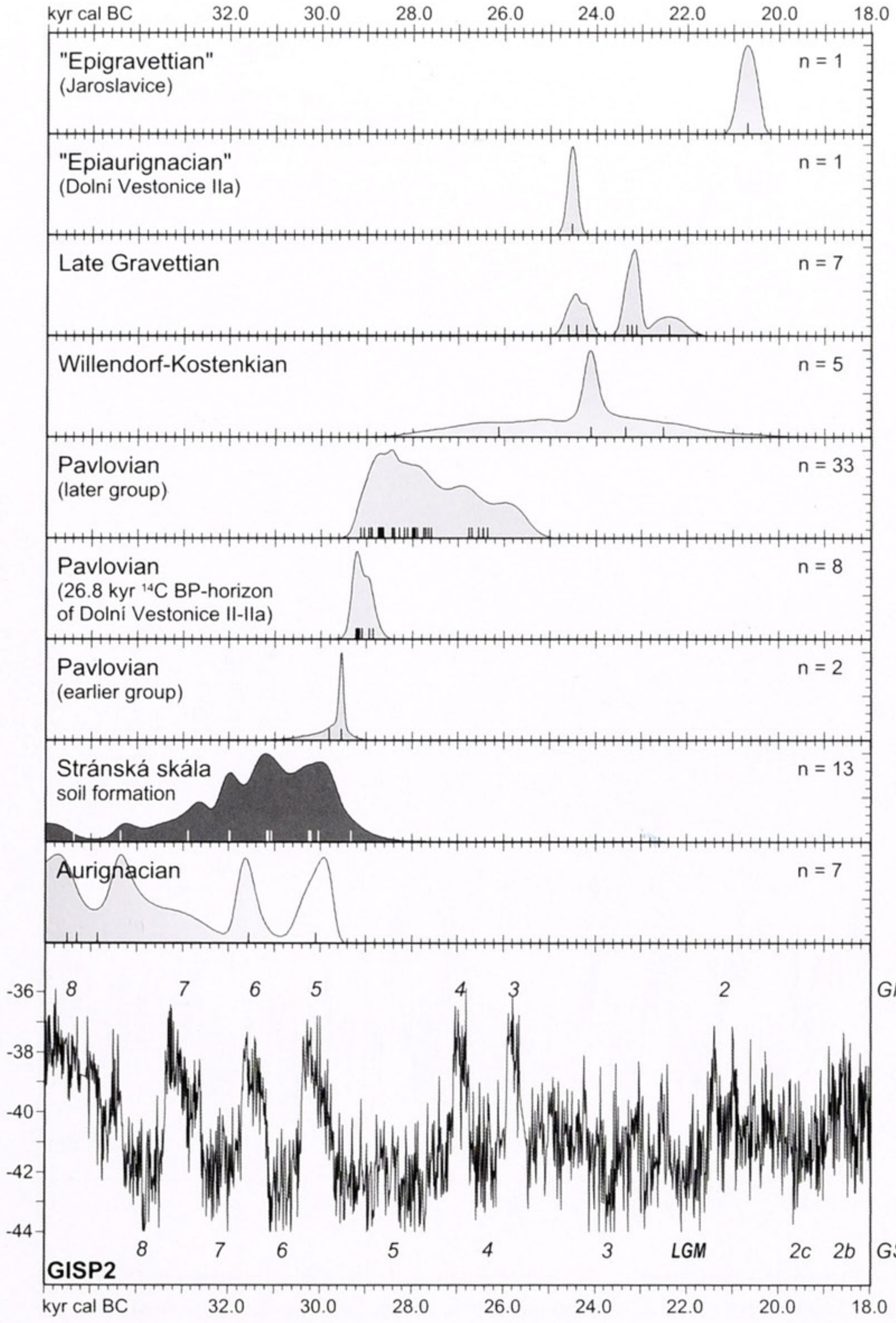

Figure 4: Calibrated radiocarbon age-dispersions for the Moravian Aurignacian and MUP (see Figure 1) in relation to the Greenland GISP2 ice core record (‰ PDB d^{18}O after: Stuiver and Grootes 2000), in the time-window 36.0 – 18.0 ky cal BC. GI – Greenland interstadial; GS – Greenland stadial; LGM – Last Glacial Maximum.

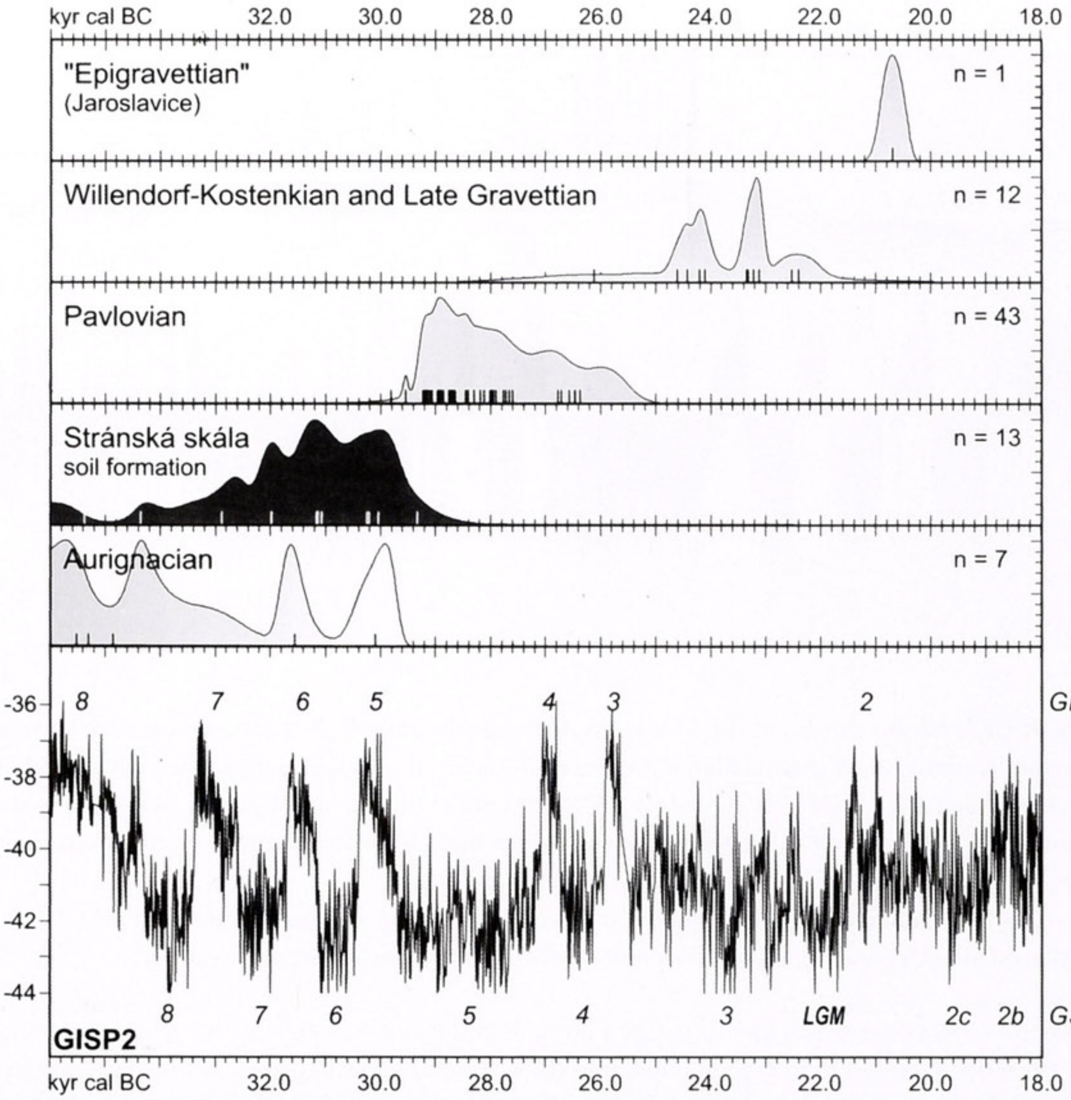

Figure 5: Calibrated radiocarbon age-dispersions for the Moravian Aurignacian and MUP (see Figure 2) in relation to the Greenland GISP2 ice core record (‰ PDB d^{18}O after: Stuiver and Grootes 2000), in the time-window 36.0 – 18.0 ky cal BC. GI – Greenland interstadial; GS – Greenland stadial; LGM – Last Glacial Maximum.

here into three periods, i.e. (1) the Pavlovian of GS 5 and 4, (2) the Willendorf-Kostienkian and Late Gravettian of GS 3, and (3) the "Epigravettian" of GS 2c (Figure 6).

Calibrated radiocarbon ages of samples deriving from BK I (Stránská skála soil formation), which represents the base of the Moravian MUP record (Klíma 1994), fall into a sequence of interstadials that covers the entire period from GI 8 until GI 5 in GISP2 and ends shortly after 30.0 ky cal BC (ca. 28,000 ^{14}C BP). This observation is largely in agreement with micromorphological analyses by L. Smolíková (1991), who has emphasized that the sediment matrix of the MUP cultural layers to be found on top of BK I, regularly contains older soil particles (Svoboda *et al.* 2000). A similar age for the top of BK I (~ 29.5 ± 1.6 ky BP), has been obtained *via* TL- and IRSL-methods, dating a loess layer that immediately follows a marked erosional plane on top of the BK (=PK) I soil (Frechen *et al.* 1999).

The following Pavlovian levels all fall into the extended cold period GS 5 and into GS 4 of the GISP2 record (Figures 4-5). Human presence during GI 4, i.e. around 25,500-25,250 ^{14}C BP, and during GI 3 cannot be traced. However, one has to consider that the calibration record presented above shows

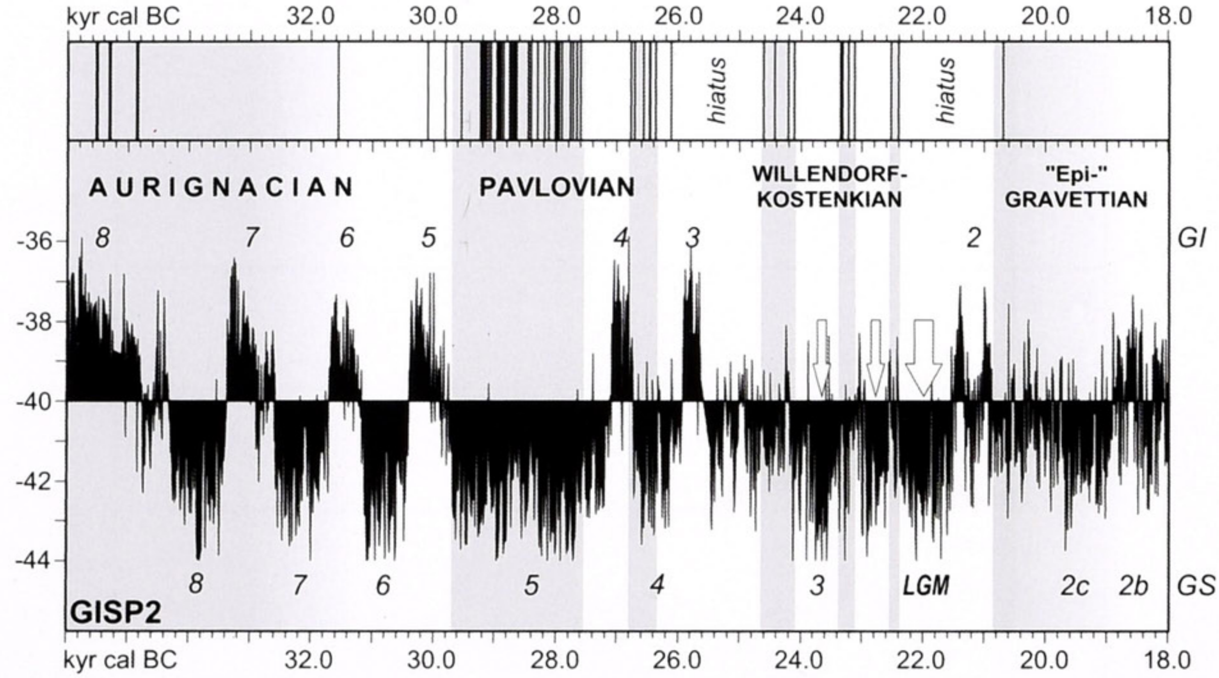

Figure 6: Calibrated medians of the Moravian Aurignacian and MUP technocomplexes (Pavlovian, Willendorf-Kostenkian, "Epigravettian": just one radiocarbon date) expressed as 'bar-codes' in relation to the Greenland GISP2 ice core record (‰ PDB d^{18}O after: Stuiver and Grootes 2000), in the time-window 36.0 – 18.0 ky cal BC, showing relations between human presence / absence and palaeoclimatic 'stages'.
For better visualisation the GISP2 record is divided into a stadial and an interstadial half.
GI – Greenland interstadial; GS – Greenland stadial; LGM – Last Glacial Maximum.

an extended ^{14}C-*plateau* around that time (see Figure 3) and is thus responsible for a far less precise age-transfer from uncalibrated radiocarbon dates into the calendric scale. Against this background even the youngest Pavlovian sites of GS 4 could, alternatively, also date into GS 5. With regard to these correlations the Pavlov soil formation would correspond to GI 4 and GI 3. Sites belonging to the Willendorf-Kostenkian, or other Late Gravettian sites of Moravia, seem to date exclusively into GS 3, whereas in the coldest phases, including the LGM, Moravia appears void of humans (Figure 6: arrows). Proof of human presence during GI 2 is also lacking. The "Epigravettian" sites – post-dating the LGM – in general fall into the succeeding cold interval of GS 2c (cf. Kozlowski 1996), even though in Moravia only the site of Jaroslavice has been radiocarbon-dated.

4. Discussion

Whereas Middle and Late Middle Palaeolithic as well as most Aurignacian sites in Central Europe fall into interstadial periods (Böttcher *et al.* 2000, Jöris, in press), adaptational patterns appear to have changed drastically with the onset of the European MUP.

From the radiocarbon-dated record between ca. 27,800 ^{14}C BP (~ 29.8 ky cal BC) and ca. 17,000 ^{14}C BP (~ 18.0 ky cal BC) it seems that humans avoided Moravia during the interstadials (Figure 6), while the stable cold conditions of GS 5 may have been most favourable for humans and may have allowed for more stable settlements, combined with exploitation of extended territories (Svoboda *et al.* 2000, 211; cf. Oliva 2000). Moravia was also frequented by groups of hunter-gatherers during the moderate cold conditions of GS 3, but no human presence is documented during the coldest intervals of this period

(Figure 6: arrows). Svoboda *et al.* (2000, 211) argue that *the "long-distance exploitation network"* from the earlier Gravettian (*Pavlovian) "became a solid pre-adaptation for population movements before the LGM"*, which is indicated by the archaeological record of the Willendorf-Kostenkian and Late Gravettian groups of Moravia that were connected with Eastern European population centres. Probably deteriorating climatic conditions forced these groups towards higher mobility that may finally have made it possible to leave Moravia during the most severe cold spells of GS 3 (Figure 6: arrows).

Later, when populations returned after the LGM, new strategies in animal exploitation emerged with the "Epigravettian" (West 1996; cf. Svoboda *et al.* 2000, 211).

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SUBSISTENCE PATTERNS IN THE GRAVETTIAN OF THE ACH VALLEY, A FORMER TRIBUTARY OF THE DANUBE IN THE SWABIAN JURA

S. C. Münzel

Abstract

The Ach Valley has a long history of research conducted by the Institute of Prehistory and Archaeology of the Middle Ages at the University of Tübingen. During the last decades, this research focused on Geißenklösterle and Hohle Fels sites. Other important cave sites in the Ach Valley with Gravettian occupation are Brillenhöhle and Sirgenstein (Schmidt 1912).

The faunal analysis of the Geißenklösterle was recently completed (Münzel 1999) and an analysis of the Hohle Fels fauna is still in process (Münzel *et al.* 2001, Münzel 2002).

This paper will focus on the cave sites Geißenklösterle, Hohle Fels and Brillenhöhle. All three caves revealed several Gravettian layers and stone artifact refittings between the three caves (Scheer 1986, 2000) document a contemporaneous horizon, radiocarbon dated by around 29,000 BP. The correlation of the refittings (Table 1) shows that stratigraphically younger as well as older Gravettian layers are present in the Ach Valley, but not recognizable in the radiocarbon dating (Conard and Bolus 2003).

The exploitation of the largest herbivore species, the mammoth (*Mammuthus primigenius*) and the largest carnivore species, the cave bear (*Ursus spelaeus*) and the seasonal aspects of subsistence in the Ach Valley will be discussed.

KEYWORDS: Southwestern Germany, Ach Valley, cave sites, mammoth exploitation, cave bear hunting, season of occupation.

1. Introduction

1.1. Geißenklösterle

Geißenklösterle cave is part of a limestone massive called the 'Bruckfelsen', a rock formation which rises 60 m above the valley bottom. Excavations at Geißenklösterle were initiated in 1973 when Eberhard Wagner (Landesdenkmalamt) opened up a test-ditch, and were continued from 1974 until 1991 by Joachim Hahn (1988). The site has provided a stratigraphic sequence from at least 50,000 to 10,000 BP. The deepest layers exposed so far (Conard and Malina 2002, 2003) contain finds from the Middle Palaeolithic (AH IV-VIII). Stratified above this is a lower Aurignacian (AH III) layer (dated to ca. 38,000 BP - ^{14}C-accelerator method (AMS) and ca. 40,000 BP - thermoluminescence (TL), Richter *et al.* 2000; Conard and Bolus 2003), followed by the upper Aurignacian (AH II, with split based points), which was dated by ^{14}C-AMS to ca. 33,500 BP and with TL to ca. 37,000 BP (Richter *et al.* 2000, Conard and Bolus 2003). The upper Aurignacian layer (AH II) has produced four carved ivory figurines depicting a human, a mammoth, a bear and a bison. A limestone pebble painted with three colours, as well as ivory beads, perforated and dyed fish vertebrae and ornamental objects of antler and ivory have also been found. More recently,

Geißenklösterle		Brillenhöhle		Hohle Fels
(after Hahn 1988)		(after Riek 1973)		(Conard *et al*. 2001)
GH 5 / AH Ir		AH V		
GH 6 / AH Is		AH VI		
GH 7 / AH It		**AH VII**		**GH 3b / AH IIb**
GH 8 / AH Ia				GH 3c / AH IIc
GH 9 / AH Ib				GH 3cf / AH IIcf
GH 10 / AH Ic				

Table 1. Archaeological layers (AH) in the Gravettian of the Ach Valley. The grey marked beam indicates the horizon of refitted stone artifacts by Scheer (1986).

fragments of two flutes made from bird bones were recovered in wet-sieved samples and could be reconstructed. The more intact flute was manufactured from the radius of a swan, probably a whooping swan (*Cygnus cygnus*) (Hahn and Münzel 1995, Münzel *et al.* in press).

The horizon above the upper Aurignacian contains a Gravettian (AH I) occupation with several living floors (^{14}C AMS date ca. 27-29,000 BP). After the Gravettian there appears to have been a hiatus in the occupation of Southwestern Germany, probably caused by the Last Glacial Maximum. A small fireplace (^{14}C AMS date ca. 13,000 BP) is the only evidence of a Magdalenian occupation of the cave.

1.2. Hohle Fels

The Hohle Fels, located some 2 kms from the Geißenklösterle, lies 7 m above the valley bottom. It is one of the largest caves in the Swabian Alb, with a size of 500 m^2 and more than a 6000 m^3.

As early as 1870/71, Oscar Fraas (1872), head of the "Königliche Naturalienkabinett in Stuttgart", and Johannes Hartmann excavated the huge hall of the Hohle Fels searching for Pleistocene animal bones and human artifacts.

In 1977 Joachim Hahn started his research in Hohle Fels (Hahn and Waiblinger 1997), and after Hahn's death in 1997 these investigations were continued by Nicholas Conard and Hans-Peter Uerpmann (Conard and Uerpmann 1999, Conard *et al.* 2000, 2001, 2002, 2003).

The Palaeolithic stratigraphy begins with the Magdalenian (AH I), dated to around 13,000 BP, followed by three Gravettian horizons (AH IIb, IIc, IIcf), dated to between 25-29,000 BP. Rich Aurignacian deposits (AH III-V, 30-35,000 BP) were recovered, as well as Middle Palaeolithic strata. Excavations in 1997-2002 recovered a stone fragment decorated with red dotted lines from the Magdalenian (Conard and Floss 1999, Conard and Uerpmann 1999) as well as a small head of a horse which was part of an ivory figurine and dates to around 30,000 BP (Conard and Floss 2000), and two very small ivory figurines (Conard *et al.* in press) found in 2002.

1.3. Brillenhöhle

The cave lies close to Blaubeuren, 80m above the valley bottom. Excavations were conducted by Gustav Riek from 1956-1963 (Riek 1973). He separated 22 layers starting with the Neolithic, Bronze and Iron Age finds. The Palaeolithic layers consist of a Magdalenian (AH IV) and three Gravettian layers (AH V-VII), as well as a small Aurignacian event (AH XIV) with two points with split base. The fauna was analysed by Boessneck and von den Driesch (1973). The Gravettian layer VII was radiocarbon dated to >25,000 and >29,000 BP (Riek 1973, 157).

Industry	**Magdalénian**	**Gravettian**	**upper Aurignacian**	**lower Aurignacian**	**Middle Palaeolithic**
Archaeological layers	**AH Io**	**AH I**	**AH II**	**AH III**	**AH IV-VIII**
Dating (BP)	**13.000**	**27-29.000**	**34-36.000**	**40.000**	**43.000**
Brown/Arctic Hare (*Lepus* sp.)	*	*	*	*	*
Marmot (*M. marmota*)					*
Wolf (*Canis lupus*)		*	*	*	*
Red/Arctic Fox (*Vulpes vel Alopex*)	V+A	A+V	V+A	V+A	A
Cave Bear (*Ursus spelaeus*)	*	*	*	*	*
Brown Bear (*Ursus arctos*)	*	* ?			
Wild-/Domestic Cat (*Felis* sp.)	*				
Lion (*Panthera leo spelaea*)				*	*
Lynx (*Felis lynx*)	*	*	*		*
Polecat (*Mustela putorius*)	*		*		
Marten (*M. martes*)					
indet. Marten (*Martes* sp.)			*		*
Stoat/ Weasel		*		*	
Wolverine (*G. gulo*)		*	*	*	
Badger (*M. meles*)					
Otter (*Lutra lutra*)	*				
Hyaena (*Crocuta spelaea*)		*	*	*	*
Mammoth (*M. primigenius*)		*	*	*	*
Wild Horse (*Equus* sp.)	*	*	*	*	*
Woolly Rhino (*Coelodonta antiq.*)		*	*	*	*
Giant Deer (*Megaloceros giganteus*)			*		*
Red Deer (*Cervus elaphus*)		*	*	*	*
Row Deer (*C. capreolus*)	*			*	*
Reindeer (*Rangifer tarandus*)	*	*	*	*	*
Bovid (*Bos vel Bison*)	*			*	
Ibex (*Capra ibex*)	*	*	*	*	*
Chamois (*R. rupicapra*)		*	*	*	*

Table 2. Spieces list of Geißenklösterle (layers Io - VIII).

2. Material and method

2.1. Faunal record

The large mammal species in the upper Danube area represent a diverse faunal spectrum, which is indicative of the "Mammoth steppe environment" (Table 2). Typical species are mammoth, horse, reindeer and woolly rhino, which are present in nearly all horizons prior to the Last Glacial Maximum. During this time a climatic deterioration from the Middle Palaeolithic and Aurignacian layers to the Gravettian is recognizable. While the Middle Palaeolithic layers of Geißenklösterle yielded four cervid species with very different ecological requests such as giant deer (*Megaloceros giganteus*), red deer (*Cervus elaphus*), row deer (*Capreolus capreolus*) and reindeer (*Rangifer tarandus*), this diversity disappears during the Gravettian. Just two cervid species, reindeer and red deer are present in the Gravettian, and additionally saiga (*Saiga tatarica*) appears in two Gravettian layers of Brillenhöhle, in layer V with a horn core and in layer VII with two other remains (Boessneck and von den Driesch 1973). Saiga is characteristic for dry and steppe environment, but saiga bucks are known to undertake long distance migrations (Bannikov 1963, 67 pp), so that one saiga buck is no evidence of a climatic change. But the tendency of a climatic deterioration during the Gravettian is also supported by the avian fauna. Forest indicating birds like jay (*Garrulus glandarius*, Eichelhäher) and hawfinch (*Coccothraustes coccothraustes*, Kernbeisser) are present in the Aurignacian layers of Geißenklösterle, but absent in the Gravettian of Geißenklösterle (Krönneck in prep.) and Brillenhöhle (Boessneck and von den Driesch 1973). In conclusion the climate during the Gravettian is cooler and probably also dryer than in the earlier periods of Aurignacian and Middle Palaeolithic.

The quantitative analysis was conducted using bone weight (Uerpmann 1973, Münzel 1988), as an approximation of the biomass that was brought to -or- was left in the cave.

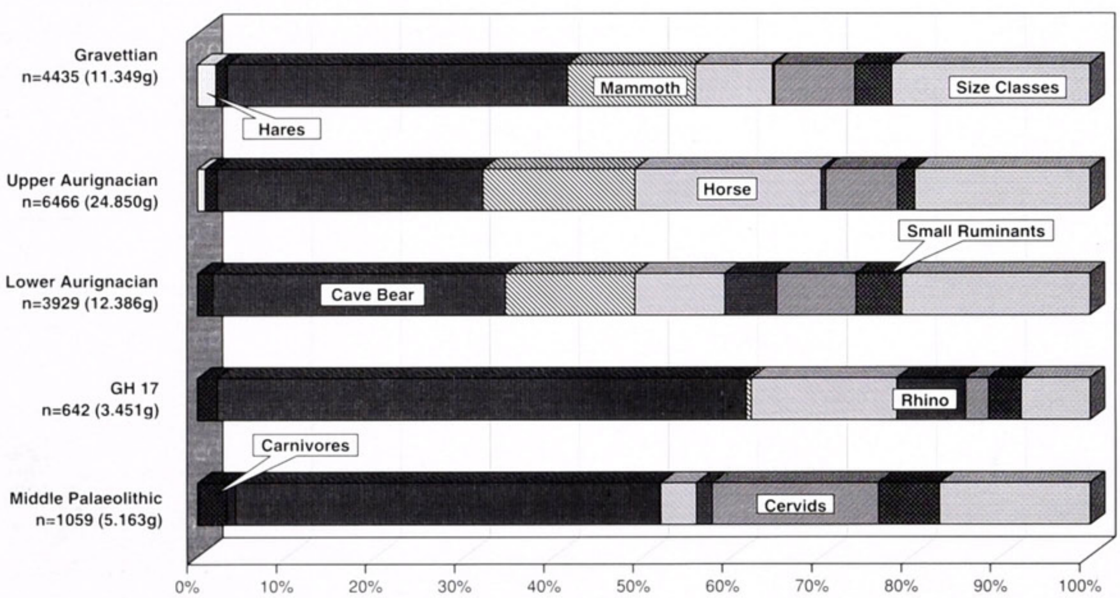

Figure 1. Geißenklösterle - bone weight of large mammal species.

Alongside with the cave bear, which is the best represented species in nearly all the caves in the Swabian Alb, the most frequent game animals in the Gravettian layers are mammoth, horse and reindeer (Figure 1). The quantitative composition changes from Middle to Upper Palaeolithic layers, the abundance of mammoth increases and the percentages of cave bear, cervids and small ruminants declines, as well as the percentage of the middle-sized carnivores. The same tendency is recognizable in the unidentifiable bones: the bone fragments in mammoth- to rhino-size increase and the fragments in bear- to horse-size diminish in the Upper Palaeolithic layers (Figure 2).

For this contribution I will concentrate on the exploitation of the largest herbivore, the mammoth, and the largest carnivore species, the cave bear, during the Gravettian. These two species are of special interest because they have very different taphonomies.

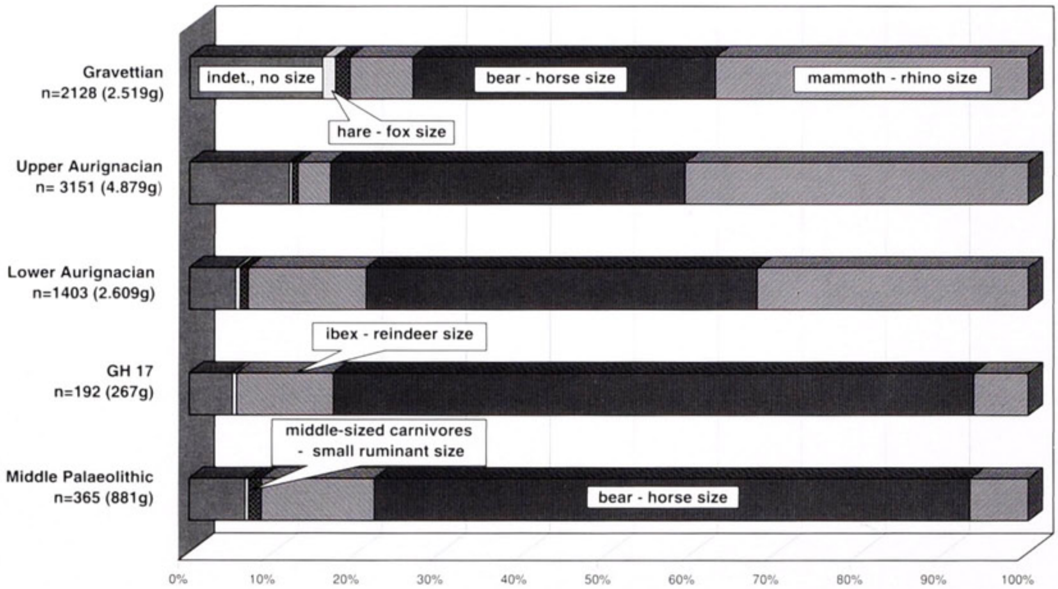

Figure 2. Geißenklösterle - bone weight of unidentified bone fragments in size

2.2. Exploitation of the mammoth

The role of mammoth is often underestimated in West-Central European sites, simply because its remains are less abundant than at Upper Paleolithic sites in East-Central Europe and Russia. One reason for the underestimation of mammoth remains is their fragmentary condition and the difficulty in identifying those fragments. But preferences of mammoth raw material for the tool production demonstrate the importance of this species in the Upper Danube area.

The analysis of the skeletal elements of mammoth is highly biased. Figure 3 shows the skeletal element representation of mammoth at Geißenklösterle by bone weight from the head down to the ribs. Instead of limb bones, which are the heaviest parts in a mammoth skeleton, ivory and ribs are the predominant elements, as well as ribs in the category of unidentified bone fragments in mammoth- to rhino-size (Figure 4).

In terms of identification, ribs and ivory are the best recognizable elements if one deals with small fragments. On the other hand, ivory and ribs were the preferred raw material for tools and this coincidence of specific elements and their use for tools implies a selection by humans.

An interesting change in the use of mammoth raw material within the Early Upper Palaeolithic is recognizable (Münzel 2001b). During the Gravettian, mammoth ribs were preferred for the production of bone points, and this is a characteristic feature in the Gravettian layers of Geißenklösterle, Hohle Fels and Brillenhöhle. According to Heidi Knecht (1991) the distribution of these "mammoth rib points" is temporally and regionally limited to Gravettian sites in South Germany.

During the Gravettian the ribs were processed in a standardized fashion. First they were notched along the edges on both sides to facilitate splitting (Figure 5). After splitting, the ribs were either used as skin smoothers or manufactured into points (Figure 6).

The raw material of the bone points is recognizable by rib spongiosa on one side of the tool and by the typical spongy structure of the compacta that mammoth ribs and bone points have in common. To thin the split rib halves, they were planed along the edges and smoothed on both dorsal and ventral sides until they developed a typical circular or oval cross-section.

At Geißenklösterle all stages of this 'chain operatoire' were found, but examples from the Brillenhöhle show the same pattern, notched and split mammoth ribs (Riek 1973, 105) and also mammoth rib points (Riek 1973, 107). The length of the mammoth ribs and their straightness is an important pre-requisite for the production of points and lances.

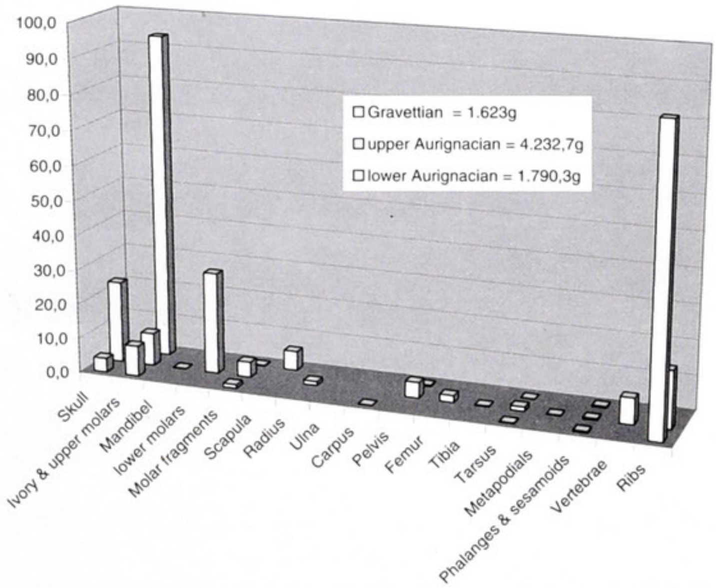

Figure 3. Bone weight for mammoth elements in Geißenklösterle.

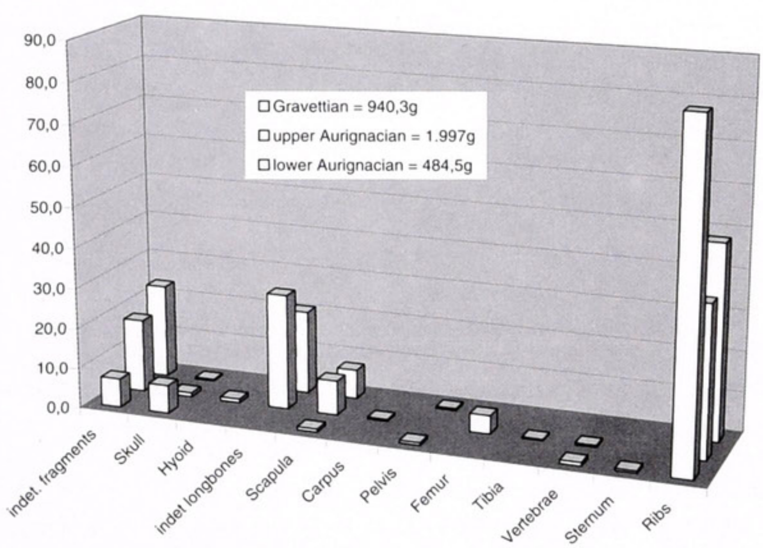

Figure 4. Bone weight of unidentermined fragments of mammoth- to rhino-size in Geißenklösterle.

During the upper Aurignacian layer (AH II) at Geißenklösterle, however, we mainly have two groups of organic points: First, the typical Aurignacian points with split bases, fairly small and made from reindeer antler (Hahn 1988, 205) and a group of ivory points, of which at least one is up to 35 cm long (Hahn 1988, 209). Obviously mammoth ribs were not favored for these purposes in the Aurignacian,

Figure 5. Rib fragments from the Gravettian layer (AH I) in Geißenklösterle, notched along the edges and split.

Figure 6. Mammoth rib point, refused base part and bone spalls from Gravettian layer (AH I) in Geißenklösterle.

Figure 7. Mammoth milk tusks from the upper Aurignacian layer (AH II) in Geißenklösterle.

even if the splitting of ribs is a much easier task than the (technically more complicated) sectioning of tusks into segments and baguettes and the shaping of ivory points.

Why did this change in the use of the raw material for long projectile points occur? Is it a change in weapon technology or was it simply due to a shortage of ivory in the Gravettian or of mammoth ribs in the Aurignacian respectively?

Judging from the faunal analysis a shortage in either mammoth ribs or ivory is unlikely. Because in all three Upper Palaeolithic layers as well as in the Middle Palaeolithic of Geißenklösterle remains of infant mammoths were found (Figure 7) (Münzel 2001a), which at that very young age are still

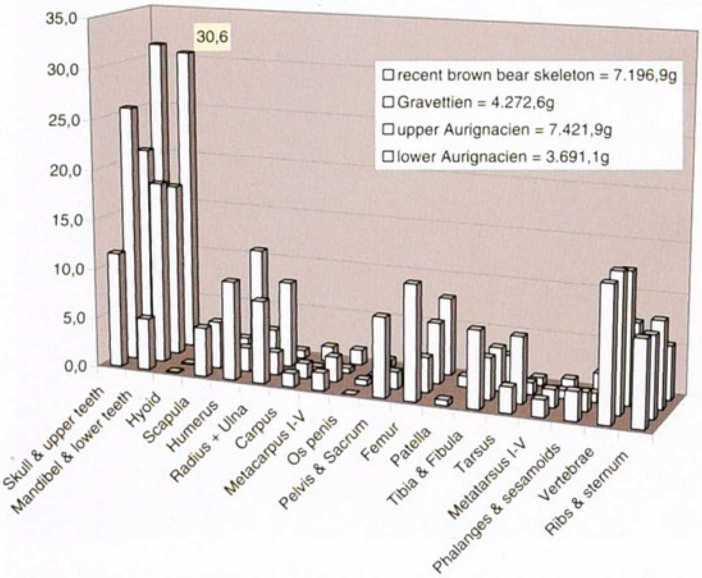

Figure 8. Bone weight for cave bear elements in Geißenklösterle.

Figure 9. Cave bear vertebra with rest of flint projectile.

Figure 10. Fetal horse bones from Geißenklösterle and Hohle Fels, age: 6th -7th month of gestation.

protected by their mothers or other adults of the herd. So, hunting an infant mammoth would have implied the hunting of the mother[1].

Thus the raw material situation was probably the same during the whole time of occupation in Geißenklösterle from at least 50.000 years ago until 24.000 BP[2].

So, I think, this shift in raw material from ivory in the Aurignacian to mammoth ribs in the Gravettian is more likely a change in weapon technology than a shortage in either ivory or ribs.

Footnote 1. Repeated hunting of cows and calves might have endangered the local mammoth population in this area where mammoths were not as frequent as in the eastern European areas of its distribution.

Footnote 2. After the Last Glacial Maximum the presence of mammoth in the Ach Valley is questionable.

In conclusion, the quantitative presence of mammoth in the archaeological deposits of Geißenklösterle depends very much on its use as raw material for the tool production and different skeletal elements were preferably brought to the site for the manufacture of the long projectile points or lances.

2.3. Exploitation of the cave bear

Exploitation of the cave bear was first observed in the material from Geißenklösterle (Münzel 1997) but a more interesting material comes from Hohle Fels, since here the traces of human modifications on cave bear bones are more frequent and better preserved.

The skeletal element composition of the cave bear is very different compared to mammoth, since cave bears hibernated in the caves of the Ach Valley. Thus their skeletal elements are not selected by human choice nor transport, but by other taphonomic processes such as carnivore gnawing etc. In contrast to mammoth all skeletal elements of cave bear are present in the caves (Figure 8). The dominance of teeth is caused by a generally better presupposition of teeth for preservation in archaeological deposits.

Human modifications on cave bear bones from Hohle Fels evidence all steps of the butchering process, as known on ‚ordinary' game (Münzel *et al.* 2001, Münzel 2002). Cut marks on skull fragments indicate skinning, as well as on metapodials. A cut mark on the dens of the epistropheus (second cervical vertebra) was placed to disarticulate the head from the body (ventral). Evidence of defleshing is given by cut marks on meat bearing bones like pelvis and humerus. Additionally some bones are highly polished, and these were probably used as tools or as tooth pendants. Finally, impact marks document marrow extraction and burnt bones of cave bear prove that these have been used as fuel as well.

During the excavation in Hohle Fels in 2000, a cave bear vertebra with an embedded fragment of a flint was recovered from the burnt bone layer AH IIcf (Figure 9), dated to 29.000 BP, and provides an indisputable proof of the hunting of cave bears in the caves of the Swabian Alb (Münzel *et al.* 2001, Münzel 2002). The vertebra comes from a relatively small but adult individual, since all epiphyses are

Figure 11. Cave bear canine with cut marks from Gravettian layer (AH IIc) from Hohle Fels.

closed. It lies within the size range of cave bear, but brown bear can not be excluded. Morphological differences between cave and brown bear are known for the neck but not for the thoracic vertebrae (Bürgl 1934).

The flint projectile hit the lateral process (*Processus transversus*) of the vertebra in the area between 4th – 9th thoracic vertebra. The raw material of the embedded flint point can be identified as ‚Jurahornstein', a local flint, which makes up roughly 80% of the lithic raw material in the Gravettian of the Hohle Fels.

The vertebra was x-rayed conventionally and studied using computer tomography. These studies determined the shape of the artifact to be triangular with dimensions of 5 mm in length, 2 mm in breath and 2 mm in thickness. The angle of the flint armature has an inclination of 45° degree (ventro-lateral) related to the axes of the vertebral column.

Bow and arrow is unknown during the Gravettian, and little data about the methods used for hafting lithic artifacts are available for this period. We assume that the weapon was a spear or lance with a hafted flint tip. The projectile hit the cave bear on his right flank, got stuck in the bone and broke off. This injury alone would not have killed the bear, but cut marks on the spinal process of the vertebra show that finally the hunt was successful. The position of the wound in an area behind the scapula indicates a shoulder shot intended to injure the lungs. This kind of wound into the transversal process at this angle would most likely occur if the bear were attacked while in a lying position, for example during hibernation.

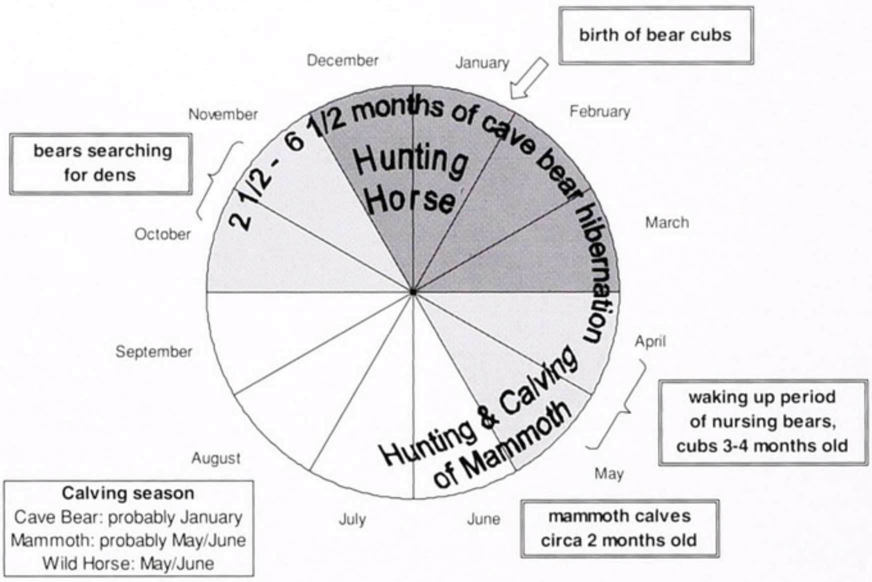

Figure 12. Seasonal activities of bears and humans during the Upper Palaeolithic in the Ach Valley.

2.4. Season of occupation

In several archaeological layers at Geißenklösterle, Hohle Fels, Sirgenstein and Brillenhöhle, fetal horse bones were found in the age of 6th - 7th month of gestation (Figure 10) indicating that Palaeolithic people visited the Ach Valley during winter. In addition, layers with fetal horse bones contain thick burnt bone ash lenses, fitting also to winter occupation.

Remains of infant mammoths occur in the Gravettian and Aurignacian of Geißenklösterle (Münzel 1997), as well as in the Gravettian of Hohle Fels. These young mammoths must have been hunted together with their mothers in spring/early summer.

Techno-komplex	C-14	Chrono-stratigraphy	Cave sites	Layer	% of Bears	Winter	Burnt Bone Ash Lenses	Man/ Bear Interaction	Spring/ Early Summer
			Geißenklösterle	Io	4%				
Magdalénien	13 000	Dryas I	Hohle Fels	Ia-c		Fetal Horse			
			Brillenhöhle	IV	3%	Fetal Horse	Small Hearth		
			Hohle Fels	II a?					
Hiatus	Last Glacial	Maximum							
			Hohle Fels	II b				Cut marks	
			Brillenhöhle	V	30%	Fetal Horse	Small Hearths		
			Brillenhöhle	VI	42%	Fetal Horse	Small Hearths		
Gravettien	>25 & >29.000		Brillenhöhle	VII	32%	Fetal Horse	Large Hearth	Cut marks	"Juvenile" Mammoth
	27-29.000	Denekamp	Geißenklösterle	I	38%			Cut marks	Mammoth Infants
	29 000		Hohle Fels	II c		Tooth Eruption & Isotops	Large Hearth	Cut marks & Projectile	Mammoth Infants
	29-33.000		Hohle Fels	III-IV					
	33-35.000		Hohle Fels	V					
Aurignacien	33-36.000		Geißenklösterle	II	30%	Fetal Horse& Foal	Large Hearth		Mammoth Infants
			Brillenhöhle	XIV	78%				
	38-40.000	Hengelo	Geißenklösterle	III	33%		Small Hearth	Cut marks	Mammoth Infants
			Geißenklösterle	GH 17	65%			Cut marks	
Middle Palaeolithic	43.000 (ESR) and older		Geißenklösterle	IV-VIII	58%			Cut marks	Mammoth Infant

Table 3. Chronology and Season of Occupation in the Ach Valley.

Cut marks on skull fragments of cave bear cubs in the age of 3-4 months in Geißenklösterle (Münzel 1997) provide a link between horse and mammoth hunting season, and suggest that cave bear hunting probably took place during the transition from winter to spring.

One piece of a young cave bear provides a direct evidence of the hunting season. It is a canine of a juvenile cave bear with heavy cut marks found in Hohle Fels (Figure 11). The tooth crown is almost complete and the root is developing. This tooth belongs to the age group of cave bears in their second winter and was taken out as a trophy after the hunt.

Compiling this seasonal information of the hunted game (Figure 12) with data on seasonal activities of recent brown bear populations (Heptner and Naumov 1974), an occupation during winter and spring in the Ach Valley becomes obvious.

Summarizing the observations such as fetal horse bones, burnt bone ash lenses, cut marks on cave bear remains and mammoth infants for the three caves under consideration in the Ach Valley (Table 3), the data show a consistent seasonal pattern for winter and spring occupation during the Upper Palaeolithic.

3. Conclusions

Until recently there was a consensus that the valleys of the Swabian Alb were only visited during the warm seasons of the year by grazing game and their hunters (Boessneck and von den Driesch 1973, 53; Hahn 1988, 252). New archaeozoological results from the Ach Valley, however, document repeated winter use of the region, as indicated by wild horse and cave bear hunting, and spring occupations, as indicated by the mammoth hunting.

The data show a consistent subsistence pattern of winter and spring occupation in the Ach Valley during the Gravettian. This seasonal pattern, however, is not exclusive for the Gravettian, and it seems to be typical for the Ach Valley area during Upper Palaeolithic, and probably also during Middle Palaeolithic times (Münzel in prep.).

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FIRST RAW MATERIAL ANALYSIS AT THE UPPER PALEOLITHIC SITE KREMS/HUNDSSTEIG (2000-2002) COMPARED TO THE MATERIAL OF THE EXCAVATION OF JOSEF BAYER AT KREMS/WACHTBERG (1930)

T. Einwögerer

Abstract

At the well known site of Krems-Hundssteig, extensive middle Upper Paleolithic features have been exposed in the years 2000 to 2002, in the course of five salvage excavation campaigns. The excavation was carried out by the Prehistoric Commission of the Austrian Academy of Sciences by order of the Federal Office for the Protection of Ancient Monuments. Beside numerous faunal remains, about 1000 lithic artefacts were recovered. A majority of the artefacts was concentrated around four hearths. Also, in a part of the excavated area, a find scatter of lithics has been identified in a layer above the hearths. First raw material analysis of the lithic material imposes that mostly local raw materials had been used, a majority of which are calcareous hornstones and silicious limestones. Artefacts made of a range of different radiolarites which can be found in nearby Danube gravel, were recovered in smaller numbers. Qualitatively high ranging raw material is rather scarce. Whereas three of the hearths, as well as the find scatter above them, show a similar raw material distribution, the find concentration around hearth X/55-56 includes a small amount of raw materials beyond the local varieties mentioned above. These materials have so far been unknown in the context of Krems-Hundssteig. The range of raw materials is well comparable to the one of the almost contemporaneous site of Krems-Wachtberg, which was excavated by Josef Bayer in 1930. Here, the material is also dominated by calcareous hornstones and various radiolarites. Exceptional is the occurance of a very homogeneous red radiolarite, which is nearly missing at Krems-Hundssteig.

KEYWORDS: lithic raw material, Gravettian, Krems, Austria

1. Introduction

At the well known site of Krems/Hundssteig, extensive middle Upper Paleolithic features were exposed in the years 2000 to 2002 in the course of five salvage excavation campaigns (Figure 1). The excavation was carried out by the Prehistoric Commission of the Austrian Academy of Sciences, research program: "*Paleolithic industries before the last glacial maximum, between 32.000 and 20.000 BP – archeological and paleoecological aspects*" (P-13.780SPR)(Neugebauer-Maresch 2000), by order of the Federal Office for the Protection of Ancient Monuments.

The works were financed mostly by the building contractor GEDESAG (Gemeinnützige Donau-Ennstaler SiedlungsAG). In 12 months, about 250 square metres were excavated. Already during the first sondages in the year 2000, several cultural layers could be documented. AMS-dates from various layers indicated a time range between 28.000 and 35.000 BP. Apart from numerous bone remains and other organic material, about 1000 lithic artefacts were also recovered and documented during the excavations at the middle Upper Paleolithic site of Krems/Hundssteig (2000-2002).

A majority of the artefacts was concentrated around four hearths (hearth: V-X/38-44 (Figure 2), V-W/90-91 (Figure 3), S-U/40-43 (Figure 4) and R-Y/55-58 (Figure 5)). Also, in a part of the excavated area, a find scatter of lithics has been identified in a layer above the hearths.

2. Raw material

Up to date, the raw material of the lithics was examined macroscopically. Thin sections were not produced. Chips have not yet been considered.

The raw material can be distinguished in: (Figure 6)
- hornstone,
- radiolarite,
- calcareous hornstone/radiolarite,
- chalcedony,
- and siliceous limestone.

The entire material is dominated by biogene raw materials: hornstone, radiolarite, calcareous hornstone/radiolarite and siliceous limestone (Figure 7, 8, 9 and 10). Chalcedony is rarely found. A calcareous raw material with transitions to hornstone or radiolarite occurs especially frequently. This material is also found often at the nearby Upper Paleolithic site Krems/Wachtberg (Figure 7).

Hornstones of high quality are also found frequently. The different types of radiolarites occuring at the site mostly contain many joints. Radiolarites of high quality, as found frequently at Krems/Wachtberg, especially a very homogeneous, reddish brown variant (Figure 21), barely occur at Krems/Hundssteig.

Chalcedony of excellent quality, and often very colorful, can be found at many locations in the northern part of Lower Austria (Waldviertel). Rich deposits are located only some kilometers away from Krems in Schiltern near Langenlois.

Almost all the identified raw materials - calcareous hornstones/radiolarites, hornstones, radiolarites and siliceous limestones, can be found in the nearby Danube gravel. Only the raw material source of a few artefacts could not be determined as local – these pieces have probably been imported from elsewhere.

3. Hearth V-X/38-44 (Figure 2)

This hearth has a diameter of 1m. Its find scatter extends over an area of about 20 m². Unfortunately, only about half of it had been preserved. More than 500 lithic artefacts make this structure the richest at the site.

Qualitatively high-ranging types of hornstones are dominating, but calcareous hornstones/radiolarites occur as well. More rarely found are radiolarites, and chalcedony is hardly found. Siliceous limestones were not used (Figure 11). A lot of blades were found near this hearth.

4. Hearth V-W/90-91 (Figure 3) and S-U/40-43 (Figure 4)

Hearth V-W/90-91 is a smaller one with less lithic finds. Approximately 50 stone artefacts have been recovered from an area of about 4 m². Due to a disturbance, the original extent of the find scatter cannot be determined.

Hearth S-U/40-43 is rather small, with a diameter of under 0.5 m. Unfortunately, the original extent of the find scatter could not be documented any more, either. 24 m^2 containing only about 50 lithic artefacts were examined.

Calcareous hornstone/radiolarite is the dominating raw material at these hearths. Around hearth V-W/90-91, this material was exclusively found (Figure 12). At this hearth, one gets the impression that it was used as a temporary fireplace, in order to split one or a few nodules. Around hearth S-U/40-43, also hornstones and radiolarites have been used. Chalcedony and fine siliceous limestones were found rarely (Figure 13).

5. Hearth R-Y/55-58 (Figure 5)

Possibly this structure contains the remains of a dislocated hearth. Nevertheless almost 300 stone artefacts were recovered in an area of approximately 10 m^2. Due to several disturbances, only a small part of the find scatter could be documented. Radiolarites dominate, and chalcedony occurs more often than at the other hearths (Figure 14).

6. Find layer above the hearths

Beside nearly 100 lithic artefacts, this find layer includes primarily animal bones. It extends over nearly half of the excavated area. Calcareous hornstones/radiolarites dominate in this layer. Chalcedony was rarely used. The wide range of different types of hornstones und radiolarites is remarkable (Figure 15).

7. Krems/Wachtberg (Einwögerer 2000)

This middle Upper Paleolithic site is situated about 100 metres northwest of the excavation site Krems/Hundssteig (2000-2002), at 255 metres above sea level (Figure 16 and 17). During one-week excavation, J. Bayer documented structures that clearly indicate a settlement, numerous bones and over 2000 silices in an area of only 15 square metres. The most important findings at this site, however, are the oldest burned clay figurines ever found in Austria (Figure 18).

In summary, one can say that the majority of facts such as the typology and composition of the stone tools, the typical microsaws, the clay figurines and especially the durable settlement structures, leads to the conclusion that the site of Krems/Wachtberg is another Pavlovian site like the already well-known Moravian sites Dolní Věstonice I and II as well as Pavlov I and II.

1581 stone artefacts from the middle Upper Paleolithic site of Krems/Wachtberg (J. Bayer 1930) were analysed (Figure 19). It is noticeable that the most frequent raw materials from Krems/Wachtberg such as radiolarite (Figure 20) and calcareous hornstone/radiolarite, are also found at Krems/Hundssteig.

A special type of red brown high quality radiolarite that is frequently found here (Krems/Wachtberg) was not found at Krems/Hundssteig excavation (2000-2002), except of a few pieces (Figure 21).

Hornstones (Figure 22) are seldom found. All other raw materials are extremely rare (Figure 19).

8. Conclusion

The main source of raw material for the Upper Paleolithic sites at Krems (Krems/Wachtberg, 1930 and Krems/Hundssteig, 2000-2002) is the nearby Danube gravel. Materials of low quality occur in considerable quantity.

Nearly no raw material can be found from more distant deposits. It is remarkable that chalcedony was rarely used, given the small distance to the outcrops in the Waldviertel. Other Upper Paleolithic sites in the Middle Danube region (Aggsbach (Felgenhauer 1951), Willendorf (Zirkel 1956-1959), Langenlois) show a much higher percentage of chalcedony.

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Figure 1. Krems/Hundssteig, excavation area (2001). Photo: PK, ÖAW.

Figure 2. Krems/Hundssteig, hearth V-X/38-44. Photo: PK, ÖAW.

Figure 3. Krems/Hundssteig, hearth V-W/90-91. Photo: PK, ÖAW.

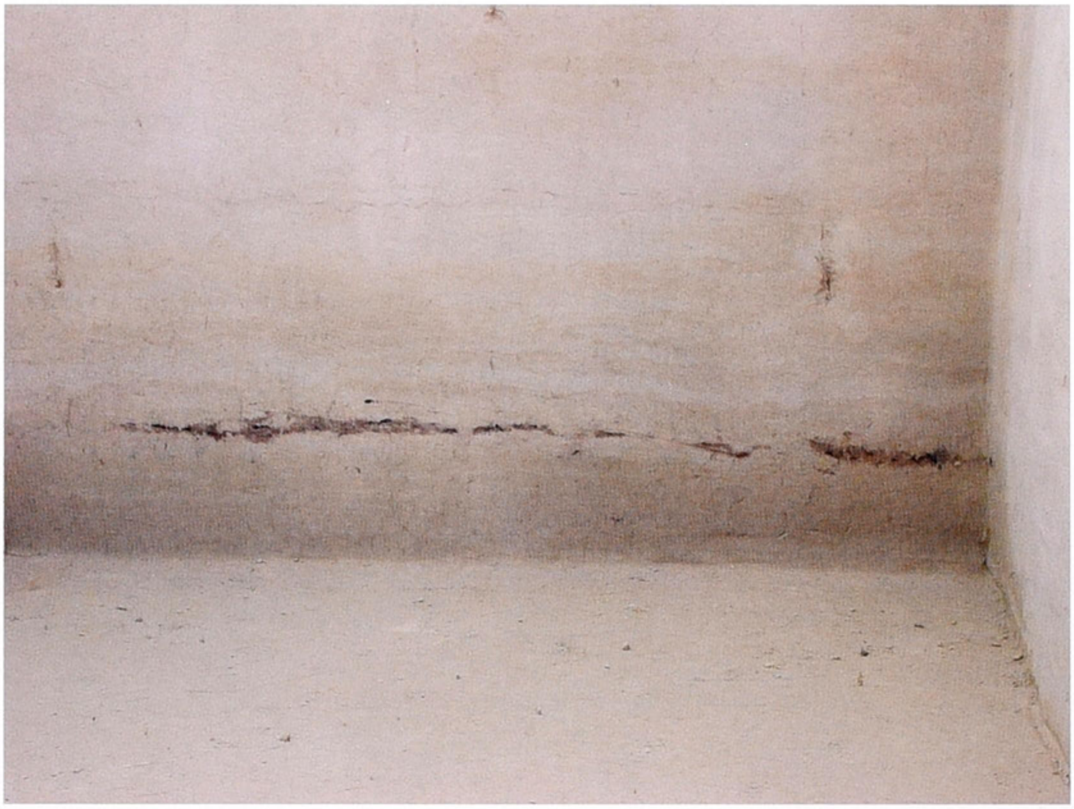

Figure 4. Krems/Hundssteig, hearth S-U/40-43. Photo: PK, ÖAW.

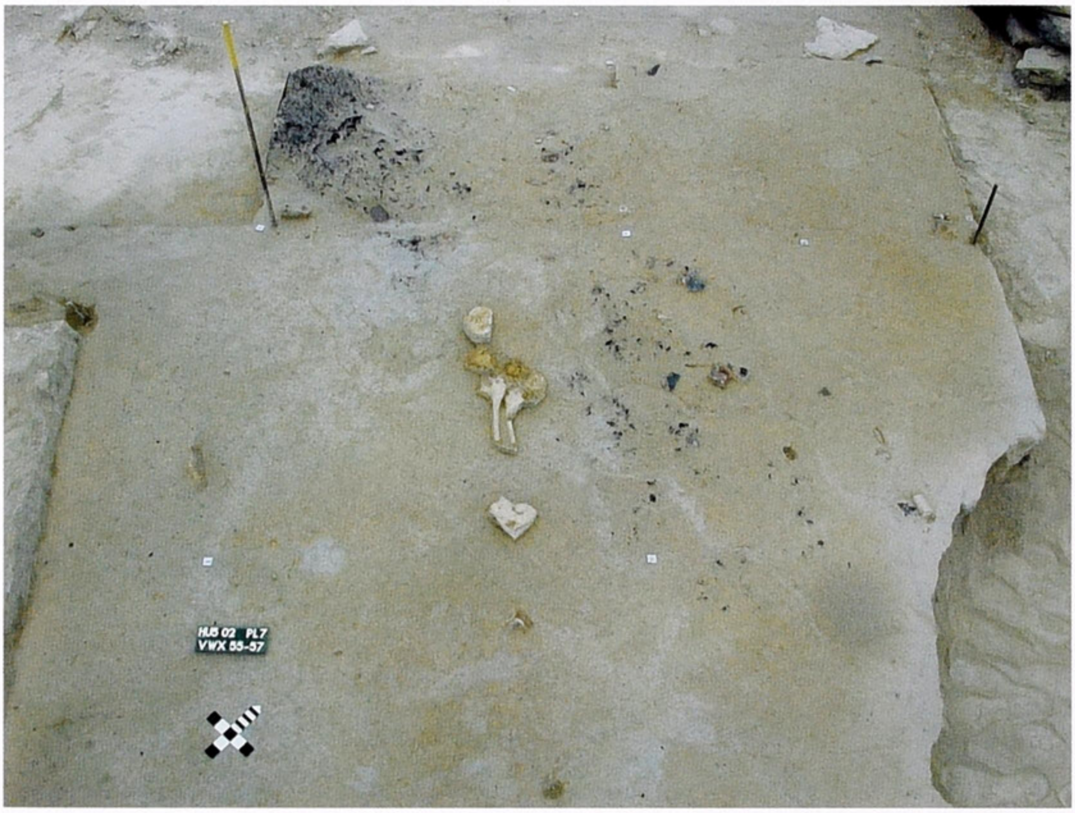

Figure 5. Krems/Hundssteig, hearth R-Y/55-58. Photo: PK, ÖAW.

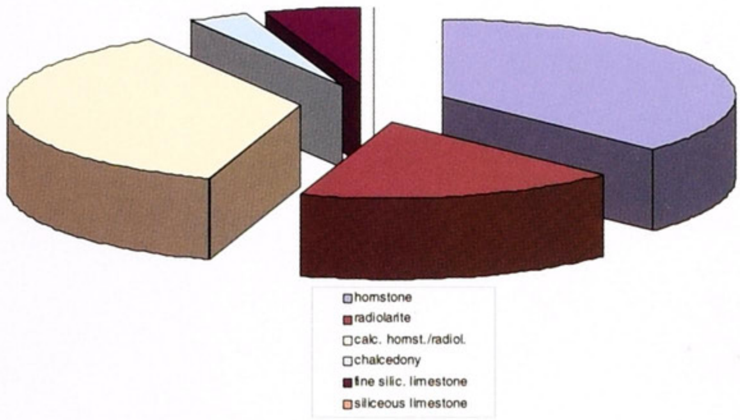

Figure 6. Krems/Hundssteig, raw material distribution.

Figure 7. Krems/Hundssteig, calcareous hornstone/radiolarite. Photo: PK, ÖAW.

Figure 8. Krems/Hundssteig, patinated radiolarite. Photo: PK,

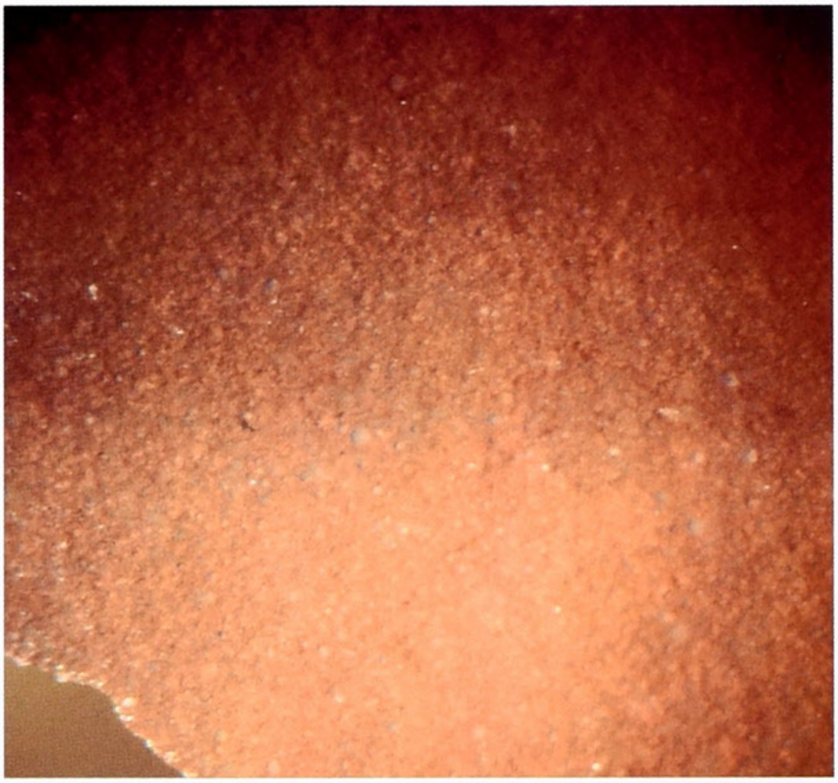

Figure 9. Krems/Hundssteig, red radiolarite. Photo: PK, ÖAW.

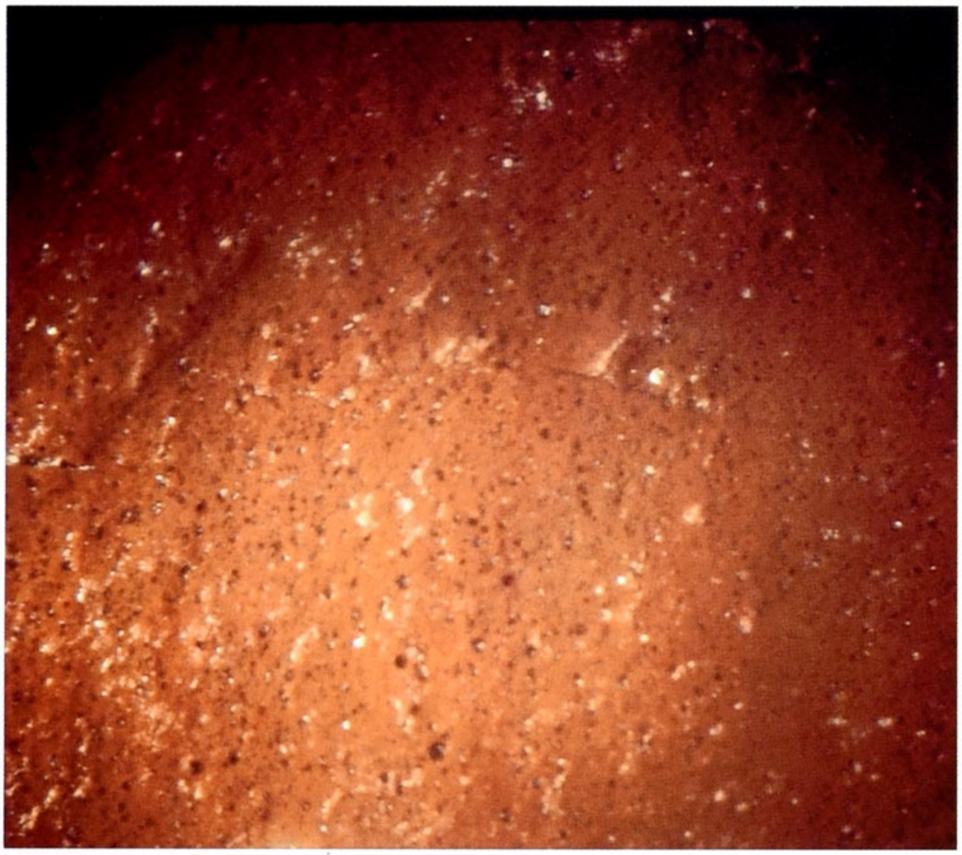

Figure 10. Krems/Hundssteig, red radiolarite. Photo: PK, ÖAW.

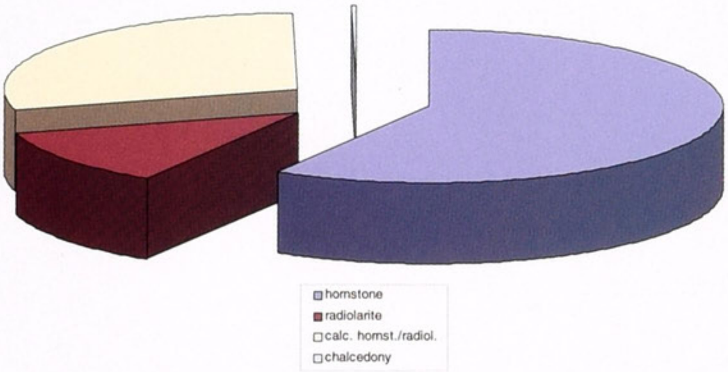

Figure 11. Krems/Hundssteig, hearth V-X/38-44, raw material distribution.

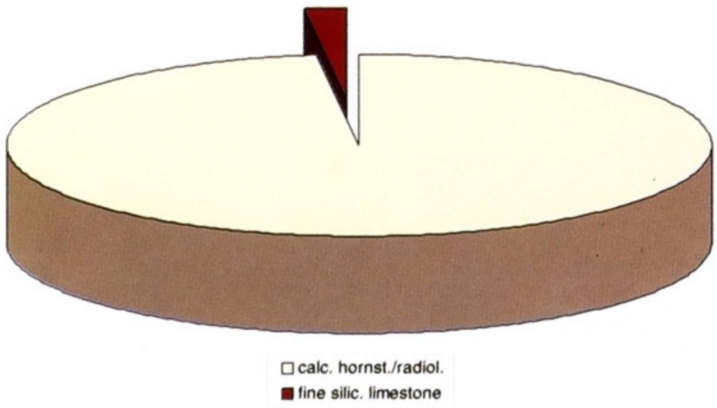

Figure 12. Krems/Hundssteig, hearth V-W/90-91, raw material distribution.

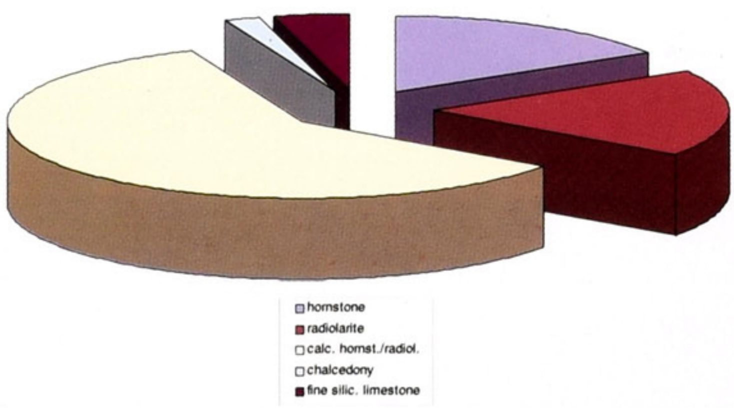

Figure 13. Krems/Hundssteig, hearth S-U/40-43, raw material distribution.

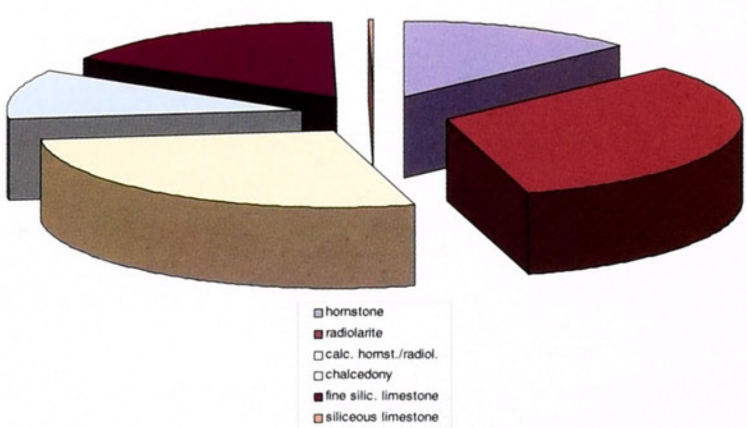

Figure 14. Krems/Hundssteig, hearth R-Y/55-58, raw material distribution.

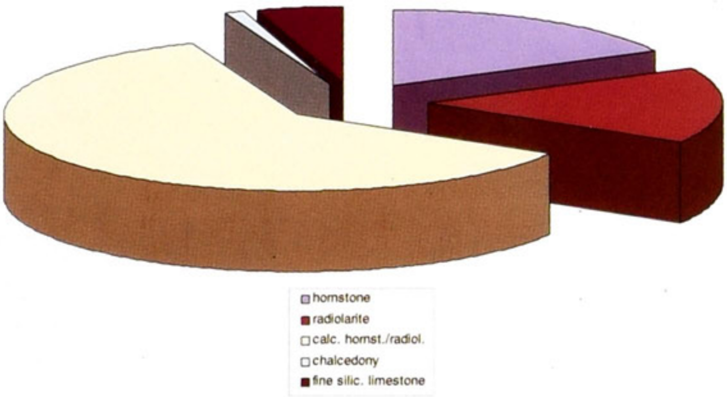

Figure 15. Krems/Hundssteig, Find layer above the hearths, raw material distribution.

Figure 16. Krems/Wachtberg, excavation by J.Bayer 1930, Photo: Naturhistorisches Museum Wien.

Figure 17. Krems/Wachtberg, excavation by J.Bayer 1930, Photo: Naturhistorisches Museum Wien.

Figure 18. Krems/Wachtberg, fired clay figurines, excavated by J. Bayer 1930.

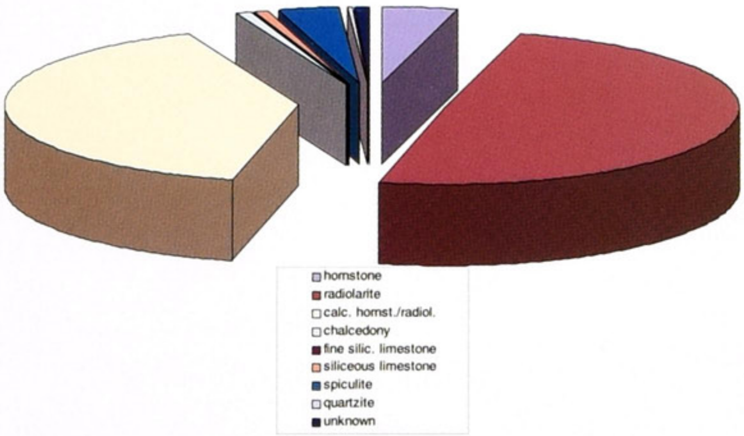

Figure 19. Krems/Wachtberg, raw material distribution.

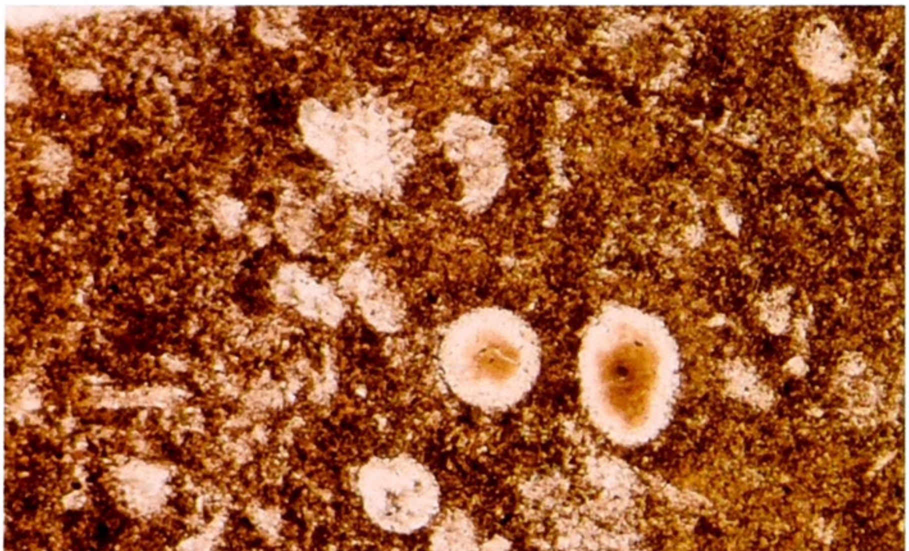

Figure 20. Krems/Wachtberg, radiolarite, thin section. Photo: R.Sauer, OMV.

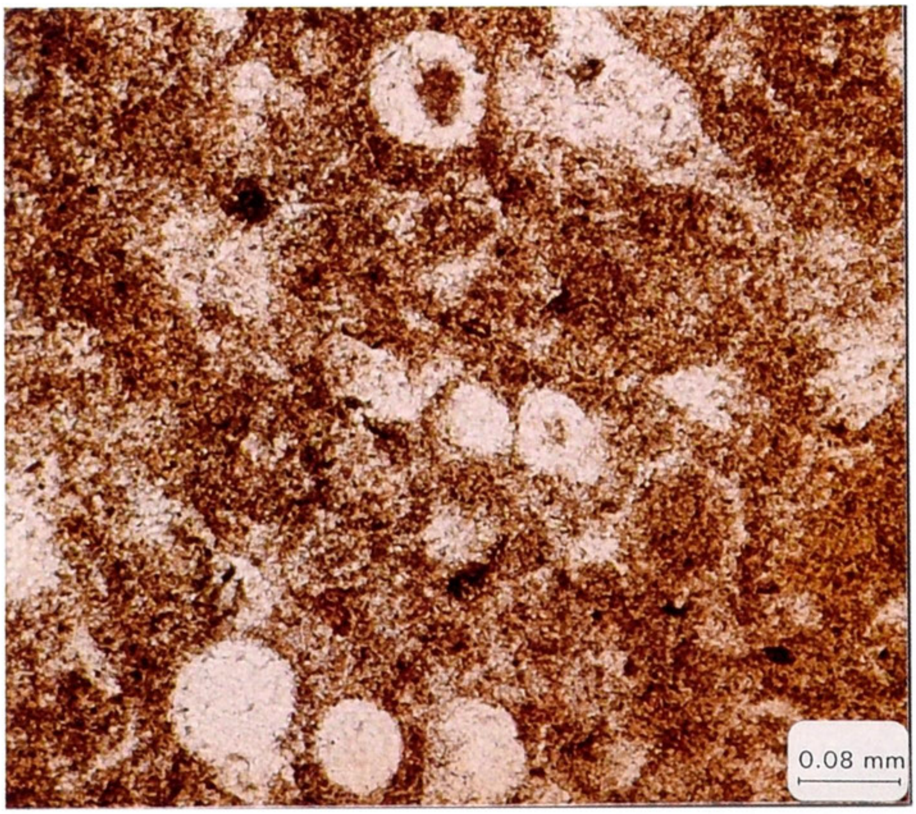

Figure 21. Krems/Wachtberg, reddish brown radiolarite, thin section. Photo: R.Sauer, OMV.

Figure 22. Krems/Wachtberg, hornstone, thin section. Photo: R.Sauer, OMV.

FAUNAL REMAINS FROM THE KREMS-HUNDSSTEIG/WACHTBERG GRAVETTIAN SITE COMPLEX - A DIFFERENCE IN RESEARCH TECHNIQUES AND/OR SITE FUNCTION?

F. A. Fladerer and T. Salcher

Abstract

The salvage excavation Hundssteig 2000/03 within the Upper Palaeolithic Krems-Hundssteig/Wachtberg site cluster yielded a 2,000-bone assemblage, with mammoth as the dominant species. Mammoth is represented by a minimum of 8 individuals, including two suckling calves. The next most common herbivore species is reindeer (MNI 6), followed by red deer, ibex, horse, and rhino, which are each represented by a single individual. Carnivore bones are fewer in number, and include 2 wolves, 2 Arctic foxes, and one stoat. The patterns of all three groups are compared to the small Wachtberg assemblage excavated in 1930, a site that is hypothesized to be chronologically and typologically very similar. This upslope-situated area within the site cluster displayed a thick ashy layer, a high bone and stone artefact density in space, bone artefacts, carnivore carcass burials, and it appears to be part of an interior camp zone. Whereas the downslope Hundssteig 2000/02 site represents a peripheral area with scattered large bones interpreted as waste disposal, cortical bone flakes and articulated limb units indicate green bone processing activities that are left as a primary refuse of later stage butchery activities within the site complex. Indications of carnivore scavenging are more frequent here. A synthesis of local and regional mammoth record patterns, including (1) an abundance of transported cancellous calf bones, axial parts as well as foot parts, and (2) less numerous ungulates agree with mammoth being the main species of human subsistence.

KEYWORDS: Upper Palaeolithic, Gravettian, archaeozoology, mammoth hunting, Lower Austria

1. Introduction

The region of Krems an der Donau is regarded as the Austrian Palaeolithic research core area. In the upper located part of the city close to the actual excavation, mammoth bones were being discovered at least since the first half of the 17^{th} century (Strobl and Obermaier 1909). From the end of the 19^{th} century, discoveries of bones of ice-age animals, charcoal, hearths and artefacts were reported from cellars within this area, and from the nearby shooting range. These structures were built on Pleistocene loess. The first (salvage) excavations within Palaeolithic layers at this locality were conducted in 1893 during strip-mining of the loess sediments for the purpose of levelling and dam construction on the Danube. In 1904, a Palaeolithic site complex over a quarry area of at least 5,200 square metres was discovered. Some professional documentation is available from that time, and it mentions several cultural layers from the Aurignacian and Gravettian, with at least 70,000 stone artefacts and large quantities of bones, with mammoth bones dominating (Neugebauer-Maresch 2001). Only a small part of the faunal material is preserved and it is stored at the communal museum in Krems for future research. One hundred metres above the steep quarry slope from 1904, a 15-m² salvage excavation yielded the Gravettian 27 ky BP "Krems Wachtberg 1930" occupation floor sample with burnt clay figurines (Einwögerer 2000, Fladerer

2001). Between 2000 and 2002, a housing construction project necessitated a salvage excavation of an area of over 250 square metres (Figure 1). Field work and subsequent research are parts of the Austrian Science Foundation (FWF) Project P13780, *Palaeolithic Industries before the Last Glacial Maximum, between 32,000 and 20,000 BP – Archaeological and Palaeoecological Aspects*, directed by H. Friesinger, Prehistorical Commission, Austrian Academy of Science.

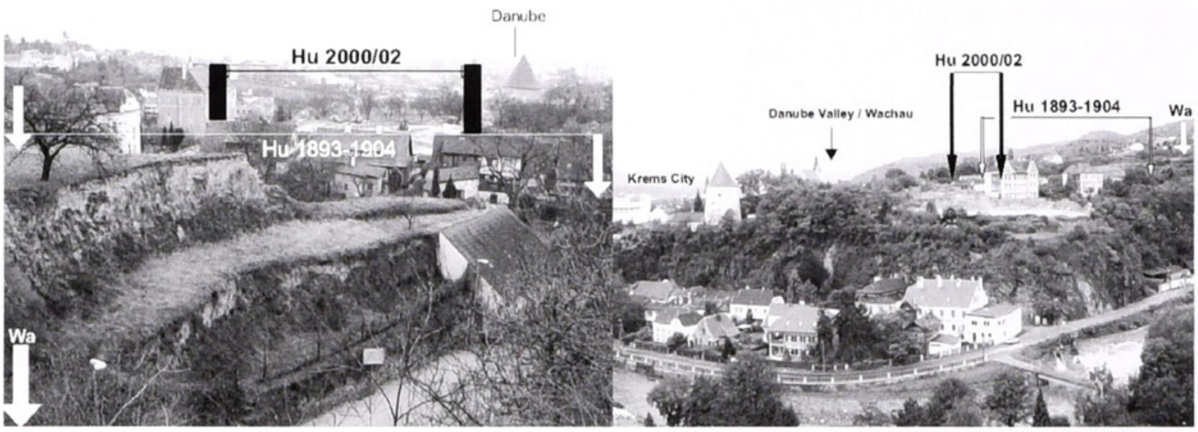

Figure 1. Morphological setting of Gravettian sites within the Krems Wachtberg/Hundssteig city quarter. 1A: View from the Wachtberg site towards SE, over the actual Hundssteig excavation, and the Danube Valley floor. 1B: View from SE towards site cluster, highland edge to the NW and the elevated parts of the Wachau river line landscape in the W during recent excavation; former sites are overbuilt. The photo was taken during the August 2002 flood event with the flushing Krems River in the foreground. Abbreviations: Wa – Krems-Wachtberg, Hu – Krems-Hundssteig, excavation years (photos by Christine Neugebauer-Maresch).

2. Materials and methods

2.1. Topography

The sites are close to each other and are geomorphologically situated on a SE facing slope which connects the Waldviertel highland edge at 350-440 m a.s.l. with the Danube valley at 200 m a.s.l. The bone producing horizons within the actual Hundssteig 2000/02 excavation are at ca. 235 m a.s.l. The Krems-Wachtberg 1930 site 150 m uphill is at an elevation of ca. 255 m a.s.l. The area to the NE is confined by the 30-60 m steep Krems River Gorge (Figure 1). The area exhibits a unique setting as a strategic location for observing animal herd movements along the rivers, as well as a central gathering location within a diversity of hunting grounds and hospitable environments (Fladerer 2001).

2.2. Occupation evidence

It appears that Pleistocene humans have settled at this location during the Early Upper Palaeolithic and the Gravettian periods. 70,000 lithic artefacts collected during the Hundssteig 1893-1904 strip-mining have been attributed mostly to the Aurignacian culture, but there is also clear evidence of Gravettian artefacts (Hahn 1977). The typology and a radiocarbon date of ca. 35 ky BP argue for a certain percentage of the faunal remains (within the collection stored at the communal museum in Krems) to be of an Early Upper Palaeolithic age. At least three further small Upper Palaeolithic stone artefact assemblages from the Hundssteig/Wachtberg area are known (Neugebauer-Maresch 2000). The actual excavation yielded a date of 32.8 ± 0.4 ky BP (VERA 2289) from a deeper layer. A detailed stratigraphy, as well as any synchronicity data over the site cluster area is not available at this moment, but a discussion which includes the results of this paper will follow later.

2.3. Sample bias

The excavations between 2000 and 2002 comprised three campaigns over a total period of 50 weeks. The documentation is 3D-based, and 2,500 photographs were taken. The two authors were regularly present at the excavation and consecutively carried out the cleaning and conservation. From a total of over 2,200 labelled bones, 170 could not be conserved so the archaeozoological analysis started already during the excavation. This publication is based on the accurate species determination and the approximate identification of skeletal elements. Precise age-at-death analysis of the individuals, the spatial distribution, and refitting and conjoining results will be published later. One group of the contextual radiocarbon dates of the faunal remains is between 27/28 ky BP: 27.9 ± 0.2 (VERA 1615), 27.2 ± 0.2 (VERA 2291), and 27.0 ± 0.15 (VERA 670). The other is 28.8 ± 0.3 (VERA-2292) and 28.6 ± 0.2 (VERA-2293).

We compare this new sample with the Wachtberg sample and question to establish a topographic and functional relationship (Table 1). This sample was generated during a 6 days salvage excavation in 1930. Its written and figured documentation consists of several hundred manuscript lines, a few sketches, and 22 photographs. The detailed analysis of the documentation was not published until 70 years later (Einwögerer 2000). The main results of the archaeozoological investigation (Fladerer 2001, 2003) are recounted here briefly in order to highlight the differences between the Hundssteig sample. It has been acknowledged that the present-day museum sample does not contain the whole assemblage originally excavated, however after consulting the original documentation the number of missing bones appears negligible: The taphonomy results are deduced in a comprehensive mode. The radiocarbon dates are 27.7 ± 0.2 (VERA 669), 27.4 ± 0.3 (GrN-3011), and 27.1 ± 0.2 (VERA 671). Based on the close chronological, topographic, and typological affinity of the two sites, the specific content, or form, is compared in order to discuss different sets of human activities that have co-produced the two assemblages.

	Hundssteig 2000/02	Wachtberg 1930
Excavation area	250 m²	15 m²
Stratigraphy	Complex of "open" horizons ,one main horizon Vertical distribution of finds >1.2m*	One thick main cultural horizon <05m (habitation?)* Vertical distribution of finds >1m, lower and upper thin horizons
Stone artefact counts	>1,000 + screened specimens Raw materials from local Danube gravels dominate (Einwögerer, this volume)	2,300 Raw materials from local Danube gravels dominate (Einwögerer 2000)
Other artefact categories	Only few dye fragments	3 zoomorphic figurines from burnt clay, dye, worm- tubes "jewellery", 6 bone tools
Bone counts, identified bones (NISP)	2,222 (1,877**) in 250m²	340 (219) in 15m²
Spatial density	89/ m²	22,7/m²
Missing bones	170	Several figured bones are missing

Table 1. Comparison of two Gravettian samples within the Krems-Hundssteig/Wachtberg site complex. * The two samples are treated as entities within this paper, although strict synchronicity has not been demonstrated. **Total identified specimen counts include questionable attributations (e.g. *Mammuthus?*).

2.4. Hundssteig 1893-1904

The area between the two studied sites changed remarkably one hundred years ago (Figure 1). During strip-mining, mainly for dam construction and levelling, loess was removed over an area of ca 5,000 square metres and a height difference of up to 12 metres. The archaeological documentation is very poor because it has been seriously obstructed (Obermaier and Strobl 1909, Neugebauer-Maresch 2000). The reports vary, mentioning from one thick main cultural horizon to several horizons, that cover a distance of up to 4 metres. The assemblage, comprising of an ivory point, a bone point, and pierced molluscs, has been assigned for the most part to the Aurignacian (see Neugebauer-Maresch 1999, 2000). This is supported by a 35.5 ky radiocarbon date. Later authors described a distinct Gravettian provenance of an unknown proportion of the 70,000 lithic artefacts (Hahn 1977). K. Maška, who is regarded as the most experienced palaeontologist of the time, has determined the faunal remains (Strobl and Obermaier 1909, zoological names updated by the authors) to be: *Mammuthus primigenius* (very abundant), *Rangifer tarandus* (very abundant), *Equus* sp. (very abundant), *Cervus elaphus* (abundant), *Bos primigenius*, *Bison priscus*, *Ovibos moschatus*, *Capra ibex*, *Rupicapra rupicapra*, *Coelodonta antiquitatis* (all rare), *Canis lupus*, *Vulpes vulpes*, *Alopex lagopus* (the last three species are abundant), *Panthera spelaea* (rare), a felid "larger than panther" [Comment by the authors: *Panthera pardus* is most likely correct; its large size is well known, e.g. Kurtén 1968] and *Gulo gulo* (both very rare), *Spermophilus citellus*, *Lepus timidus*, and *Lagopus lagopus* (all three are rare). Around 1,250 specimens of the faunal remains are stored in the communal 'Weinstadtmuseum Krems'. The first author supervised the restoration and conservation between 1994 and 1996. During decades of inappropriate storage, an unknown part of the originally recovered collection has been apparently destroyed; modern breakages without fitting parts indicate this.

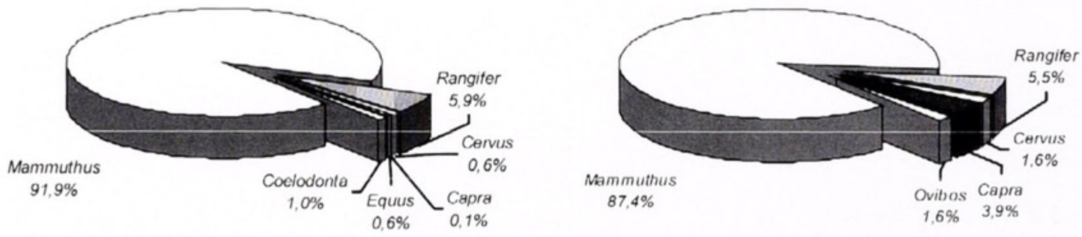

Figure 2. Gravettian Krems sites. Diagrammatic sketch of percentage of large herbivores number of identified specimens. 2A/left: Hundssteig. 2B/right: Wachtberg.

3. Results

3.1. All species bone counts

16 vertebrate species from the Palaeolithic horizons have been identified (Table 2). The mammoth bone count dominates the large mammals, with 92 percent of the identified specimens (Figure 2). The reindeer follows with 6 percent. Horse and woolly rhinoceros are next, but both do not exceed ibex and red deer in the individual counts. The carnivores are less numerous. Arctic hare and beaver are included in the prey spectrum. The suslik remains are probably also part of the archaeological assemblage. The bird carcass parts and the eggshells originate from one or more layers 0.5 – 0.7 m below the main Gravettian horizon. During water sieving more microrodents were found. Their preservation state argues for a Pleistocene origin: *Arvicola terrestris* 1, *Microtus gregalis* 8, *Microtus gregalis/oeconomus* 1, *Microtus nivalis* 1, *Microtus* sp. 5 (each species with the number of identified specimens as determined by G. Rabeder). Their state of preservation does not allow attributing them to the Palaeolithic 'event'.

Compared to the Wachtberg sample the proportion of *Mammuthus* to the medium-sized herbivore group is very similar (87 percent), and the same holds true for *Rangifer* (5.5 percent to 5.9 percent within the Hundssteig sample; Figures 2-3). *Capra* is a little bit more conspicuous, and the *Ovibos* evidence broadens the prey range (it is also known from the 1893-1904 collections). Horse and rhino were not recorded at the upslope site.

	Hundssteig		Wachtberg	
Bone counts, identified bones	2,043		340	
NISP	1,876*		219	
	NISP	MNI	NISP	MNI
Mammuthus primigenius (Woolly mammoth)	1664	8	111	8
Rangifer tarandus (Reindeer)	88	6	7	2
Cervus elaphus (Red deer)	11	1	2	1
Capra ibex (Ibex)	1	1	5	2
Ovibos moschatus (Musk ox)	-	-	2	1
Equus sp. (Wild horse)	10	1	-	-
Coelodonta antiquitatis (Woolly rhinoceros)	18	1	-	-
Canis lupus (Wolf)	11	2	49	6
Alopex lagopus (Arctic fox)	6	2	**	1
Vulpes vulpes (Red fox)	-	-	**22	4
Gulo gulo (Wolverine)	-	-	21	3
Mustela erminea (Stoat)	1	1	-	-
Lepus timidus (Blue hare)	12	2	-	-
Castor fiber (Beaver)	1	1	-	-
Spermophilus citellus (Suslik)	5	1	-	-
Lagopus lagopus (Willow grouse)	23	2	-	-
Tetrao urogallus (Capercaillie)	1	1	-	-
Branta (cf.) *bernicla* (Brent goose or Barnacle goose)	3	1	-	-
Turdus cf. *philomenos* (Song thrush)	1	1	-	-

Table 2. Krems-Hundssteig and Krems-Wachtberg: bone counts NISP (MNI), all species excl. microrodents. Only the boxed part of the assemblage originates from the main Gravettian horizon. *Total identified specimen counts include cf.-attributions (e.g. cf. *Mammuthus*). **postcranial specimens are not separated into the two fox species.

3.2. Mammoth skeletal elements

Mammuthus strongly dominates the bone count (Table 2, Figure 2). From a generalized point of view all parts of the skeleton are present (Figure 3): Vertebrae as well as ribs are frequent, and thus head and axial elements seem to be slightly more frequent when compared to the limb elements. In contrast, adult shoulder blades and pelvis parts are rare. Within the small Wachtberg sample, no girdle fragments and no large complete adult limb bones could be observed at all (Figure 3: The indicated femur diaphysis is from a calf).

From the present state of analysis of the Hundssteig sample, at least eight individuals can be identified. The minimum number of individuals has been computed by the tarsalia and limb long bones elements. Tarsals and metatarsals represent a minimum of two different suckling age individuals (younger than two years), one 2-4 years old, two juveniles to subadults, and two adults. One left and one right astragal

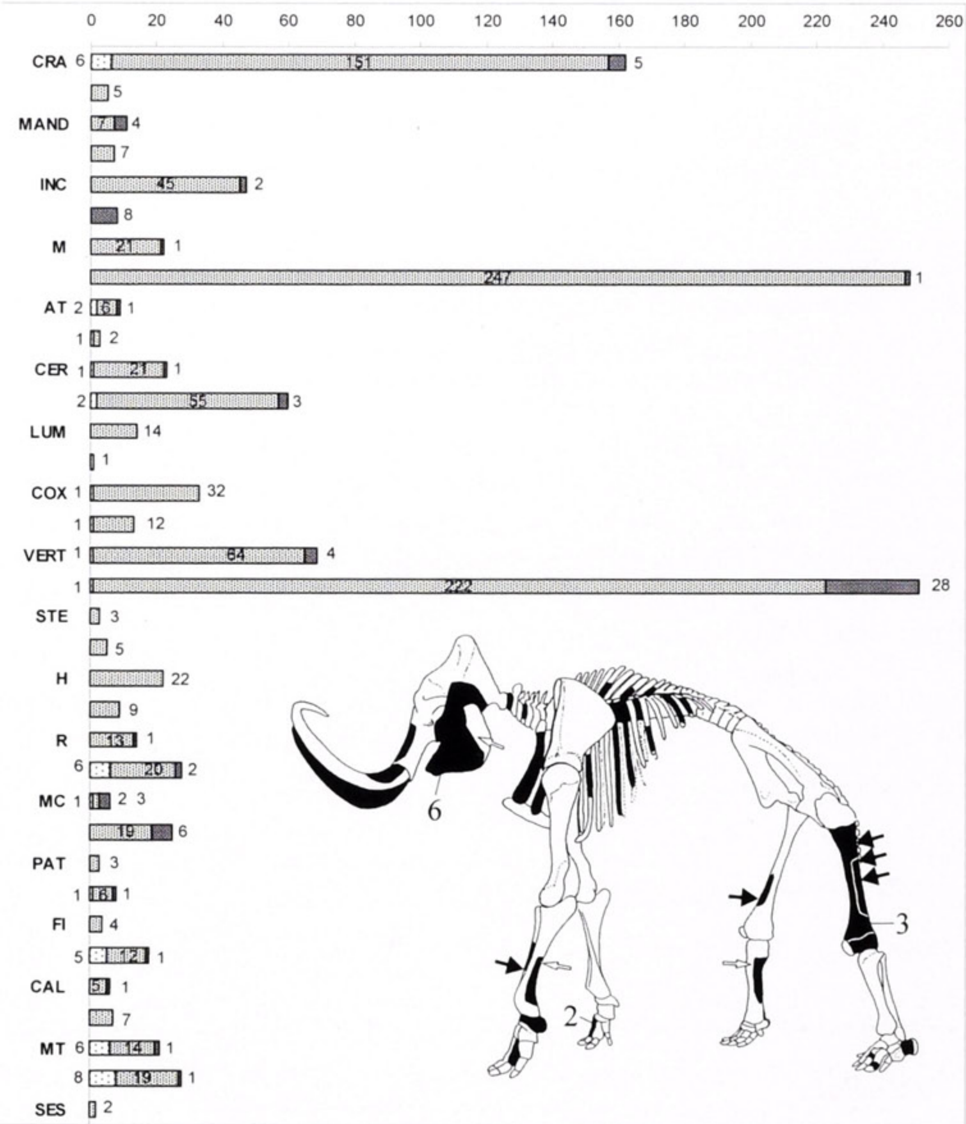

Figure 3. Krems-Hundssteig/Wachtberg sites: Mammoth body-part representation based on number of identified specimens (NISP). Left side of bars: Hundssteig 2000/02, juvenile specimens blank, postjuvenile specimens light shaded. Right extreme bar side: Wachtberg 1930. Inserted skeleton: Mammoth body-part representation within the Wachtberg sample (MNI, modifications). Bold arrows: impact marks, including impact zones (Fladerer 2000, modified).

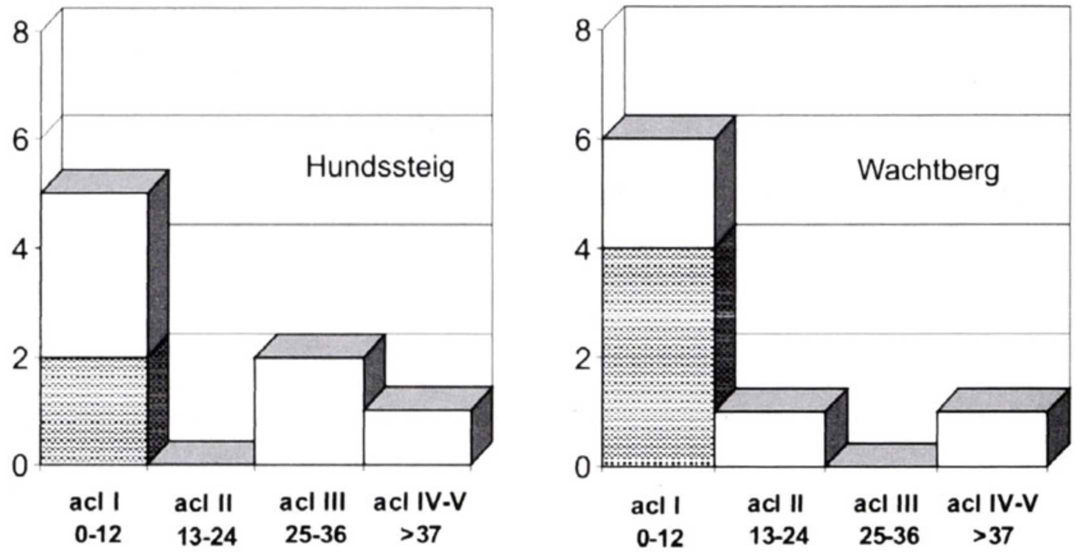

Figure 4. Mammoth individuals age-at-death profiles (age classes, the African Elephant equivalent years). Left: Hundssteig 2000/02, preliminary; right: Wachtberg 1930 (from Fladerer 2003).

belong to one individual. At least one articulated tarsal unit (represented by three elements) of one suckling calf was observed. The humerus as well as femur minimal number of elements raise the minimum count to 3 adult individuals. Thus, the Hundssteig mammoth sample represents a minimum of 8 individuals comprising at least 4 calves, two of them in suckling age (Figure 4).

Within the Wachtberg sample, four suckling calves were identified. One calf was 4-8 months old, two calves 6-12 months old, and a yearling 18-24 months old (Figure 5). Based on a strict minimal count there is evidence for two additional subadults, one early adult and one old individual (Fladerer 2000). If the calves' bones within the Wachtberg sample originate from one archaeological horizon – this most important question is answered by the site catchment analysis (Einwögerer 2000) – a common death season during the winter months seems possible (Figure 5).

255 specimens from Hundssteig are green bone modified, spiral fractures, stepped breaks, and impact zones are counted, and that means 1.4 percentages. No unquestionable cut mark could be observed.

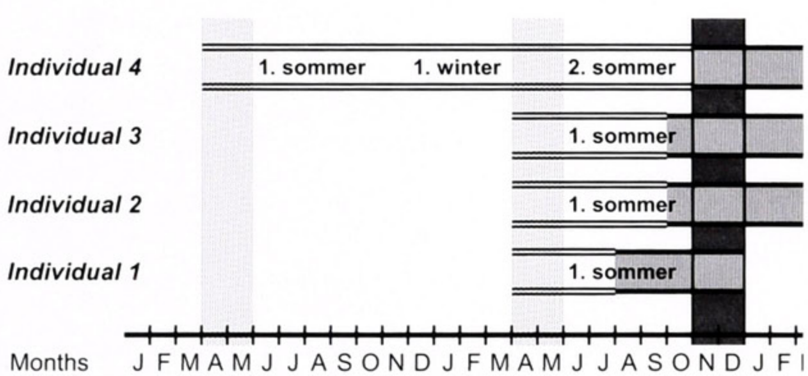

Figure 5. Age-at-death identification of four suckling mammoth calves from Wachtberg 1930 and possibly same death season during late year and early year months. The bold time span indicates a narrower period of events or one hypothetical single hunting event.

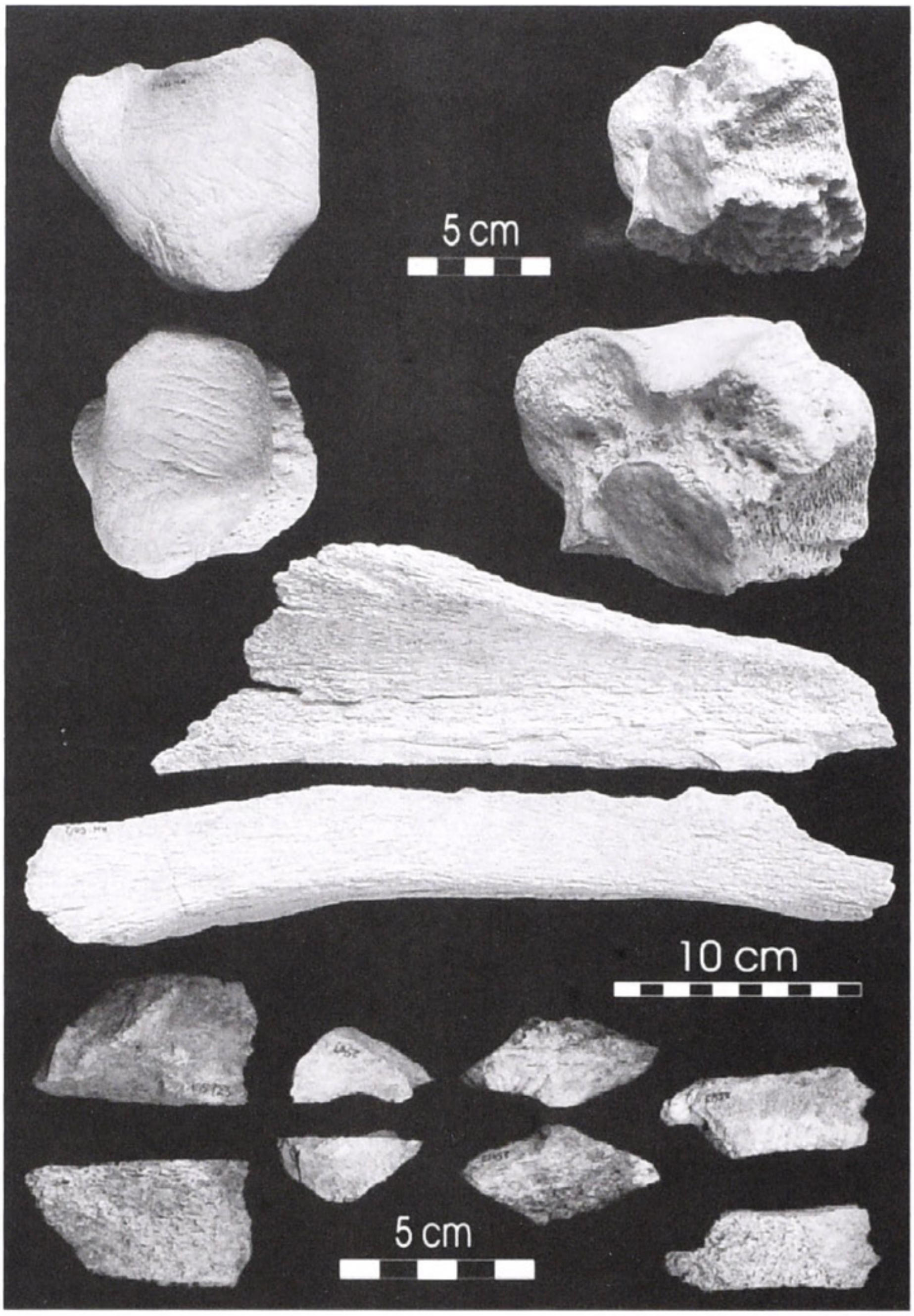

Figure 6. Hundssteig 2000/02: Carnivore and human generated modifications. On top, left: Claw marks on mammoth left distal radius epiphysis (KH 124/3). On top, right: Same mammoth distal radius with carnivore tooth marks (furrowing). Centre: Mammoth left ulna diaphysis (KH 50/2) with multiple impacts and with flake scar negatives. Below: Cortical flakes from limb long bones.

Impact zones are evident on 5 specimens (Figure 6). 51 cortical bone flakes that are surrounded by spiral fractures indicate fresh/green bone processing at the site (Figure 6). The inferred cleaving of marrowbones need previous separating and further fleshing the bones within a hypothetical chain of operations. Gnawing and claw marks on a minimum of 28 specimens indicate carnivore activities on the downslope Hundssteig sample (Figure 6). Within the upslope Wachtberg sample only two elements clearly show gnawing, they are a *Mammuthus* tarsal and a metacarpal.

3.3. Ungulates and small herbivores

The reindeer (*Rangifer tarandus*) bone count lags distinctly behind the mammoth. The specimens represent a similar minimum number of six individuals (Table 2, Figure 2). Articulated anatomical units, e.g. a complete elbow joint with distal humerus and proximal ulna and radius, indicate an advanced butchery phase that followed skinning, filleting, and fleshing. 54 bones from 88, that are a high frequency of 62 percent, are modified by green bone modifications (spiral fractures, transverse stepped breaks, impact zones, cuts). Cuts could be observed on only one scapula (KH 226/1) and one distal humerus (KH 176/3). 15 specimens show impact zones. Gnawing is documented on 12 bones.

Red deer (*Cervus elaphus*) and ibex (*Capra ibex*) are represented by only a few specimens. The wild horse (*Equus* sp.) sample is characterised by associated limb bones from a front leg, which do not show any carnivore gnawing. An early burial seems to be likely in this case. No anthropogenic green bone manipulations could be observed. From the woolly rhinoceros (*Coelodonta antiquitatis*) 13 bones form part of the Hundssteig sample: isolated teeth, one innominate fragment, and one distal phalanx.

At least two bue hare individuals (*Lepus timidus*) are represented: One almost complete cranium, one maxillary fragment, one mandible, isolated teeth, two shoulder blade fragments, one coxa, one sacrum, and two tibiae form part of discarded carcass parts, as indicated by green bone modifications. Only one beaver (*Castor fiber*) upper premolar was found. Several specimens of suslik (*Spermophilus citellus*) within the main Gravettian horizon question this large rodent species as a prey item.

In contrast, ungulates in the Wachtberg 1930 sample are definitely very few in number (Table 2, Figure 2, Figure 7). Only a few bones represent the medium-sized ungulates. The mammoth:ungulates ratio is very similar to the ratio within the Hundssteig sample (Figure 2), but the ungulates are definitely underrepresented compared to the carnivores. Two reindeer, two ibex, one musk ox, and one red deer seem a fairly low representation. Within the Wachtberg sample no small herbivores are reported. Remains of a hare within the primary collection were determined to be the result of recent admixing during the later detailed study (Fladerer 2000). The absence of small species within the Wachtberg sample should not be emphasized because the excavation method was crude and it did not include sieving.

3.4. Carnivores

Across the Hundssteig 2000/02 area bones from carnivores are very rare (Table 2). One juvenile and one adult wolf (*Canis lupus*) individual are represented by one juvenile fragmented cranium, one thoracic

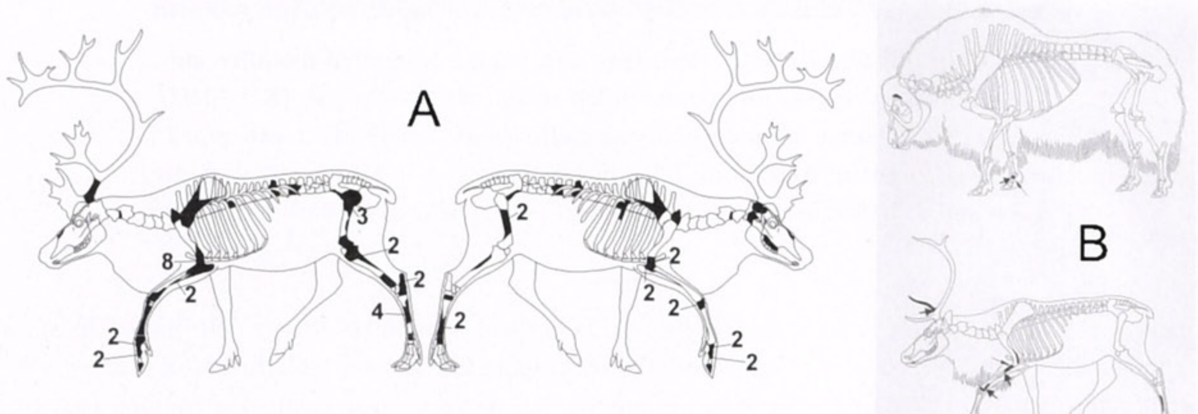

Figure 7. Body-part representation (number of identified specimens, left and right side separated) of reindeer within the Hundssteig sample (A) and Wachtberg sample inserted, musk ox representation added (B, from Fladerer 2001).

vertebra, one articulated anatomical unit including right tarsals and metatarsals, and isolated distal limb bones. Few cranial and only one isolated humerus fragment document at least two specimens of Arctic fox (*Alopex lagopus*). Stoat (*Mustela erminea*) was represented by only one left ulna.

This low frequency of carnivore finds in the Hundssteig location (19 percent of total MNI at the present state of research), contrasts an abundance of finds from within the Wachtberg location, where 14 of 28 (50 percent) of the total individual count are carnivores (Table 2, Figure 2). Although the evident bone counts distinctly lag behind the expected number, bones from each body part are preserved. The comparison of the four carnivore species, wolf, wolverine, and both fox species do not show significant differences. When the collection bias towards larger elements (Figure 8) is considered, no special role can be attributed to the wolf. The carnivore sample contains several rearticulated bones of anatomical units, and the photographs which show articulated finds support the reconstruction of buried carcasses (Fladerer 2001). Cut marks, impact zones, and transverse stepped breaks on wolf and wolverine bones indicate skinning, separating and filleting activities.

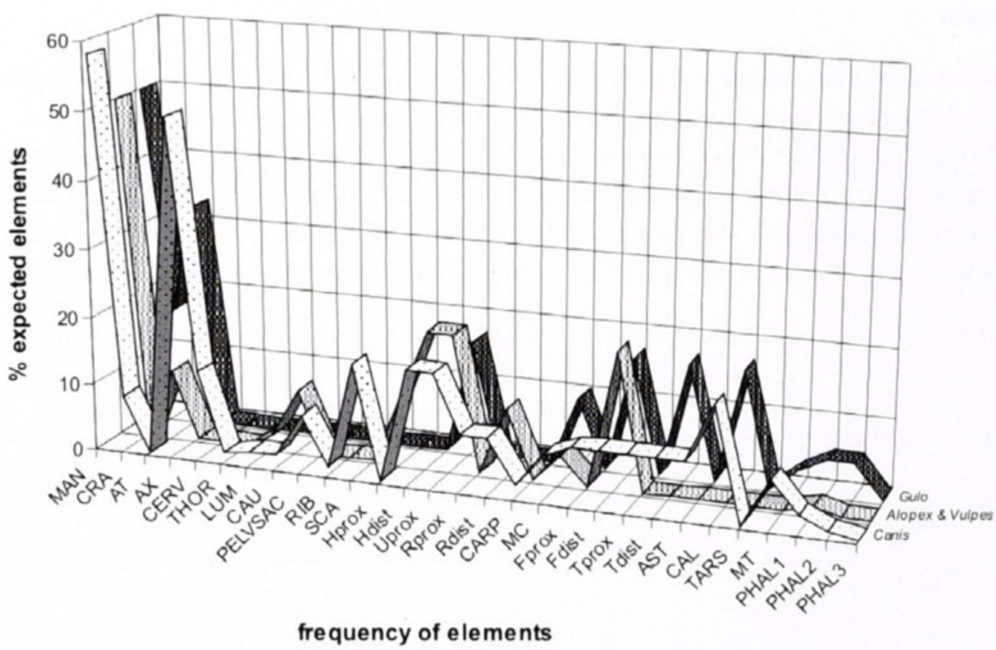

Figure 8. Krems-Wachtberg: Human-influenced body-part frequencies of wolves (in front), foxes (in the centre) and wolverines (rear). Taken into account the excavation method bias, in a general view all body parts are represented, and no significant difference between the species can be observed.

3.5. Birds

The Hundssteig 2000/02 area has become a most interesting Late Pleistocene open-air site in Austria because of its bird species sample and the evidence of eggs (Table 2). All of them were found in deeper levels under the main Gravettian horizon and the evidence for archaeology in this horizon is unclear. The assemblage comprises of articulated wing parts of two carcasses of the willow grouse (*Lagopus lagopus*), one humerus of the capercaillie (*Tetrao urogallus*), associated anterior girdle parts of a Brent or barnacle goose (*Branta* [cf.] *bernicla*), and one ulna of a song thrush (*Turdus* cf. *philomenos*). Within a layer 0.5 - 0.7 m below the main Gravettian horizon, 'articulated' Galliformes or Anseriformes eggshells were found.

3.6. Size distribution

The bone spatial densities markedly differ between the two areas. There are only 8.9 specimens per one square metre within the Hundssteig site, whereas reconstructions suggest a density of 22.7 specimens per square metre within the Wachtberg site (Table 1). This indicates a 250 percent greater density.

The small-in-area but high bone density Wachtberg site yielded only three bones larger than 300 mm: An 1870 mm long tusk, a 380 mm juvenile femur diaphysis, and a 480 mm juvenile lower jaw. This size class is 1.8 times better represented within the Hundssteig sample (Figure 9): 55 specimens of the Hundssteig 2000/03 assemblage are within the 300 mm or larger size class. Among these are 28 ribs, 11 long bones, and 6 tusks from mammoth, bones from the rhinoceros and the horse, and antlers. 21 specimens would fall into a supplementary size class of 450-800 mm. The size class smaller than 30 mm is 1.7 times better represented at the new site (Figure 9). We attribute this fact to the more refined excavation and preservation techniques.

4. Discussion

A synthesized view of the sample content of the two locations within the Krems-Hundssteig/Wachtberg site cluster, which are a minimum 150 m distant apart, emphasizes the data listed below. The results are understood to be preliminary since a detailed age analysis of individuals from all relevant taxa, and the spatial analysis of refitting or conjoining bones has not yet been completed. It is expected that these subsequent analyses will increase the minimum individual count, and that they will provide more insight into human activities, as well as the non-human taphonomic agents at the site.

- In terms of numbers of specimens and individual counts, mammoth remains dominate in both sites.

- Mammoth calf remains are frequent, and they are only rarely modified by carnivore activities.

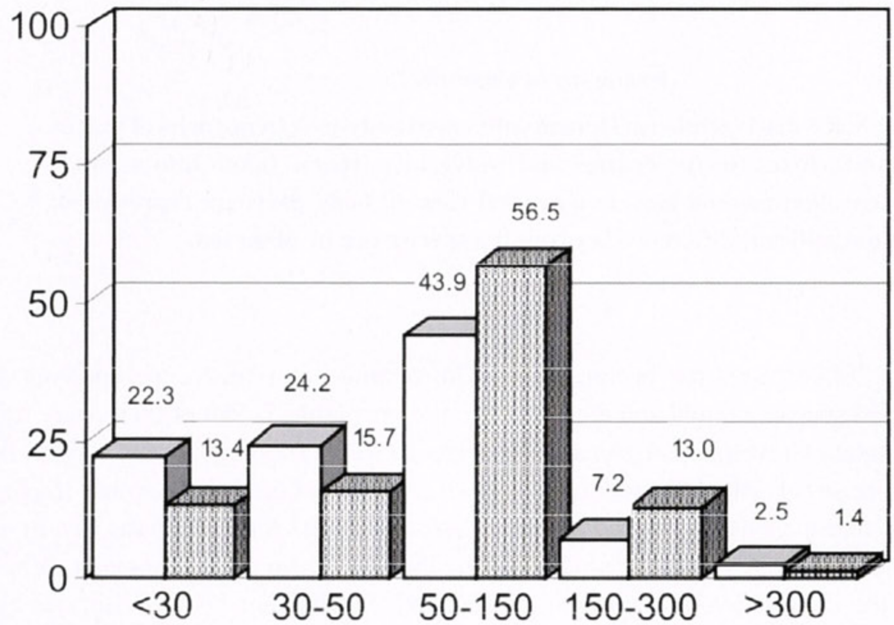

Figure 9. Bone size frequencies of Hundssteig 2000/02 sample (blank) and Wachtberg 1930 (shaded). Size classes are in millimetres.

- The presence of mammoth calf bones with only slight carnivore influence in both sites parallels the situation in other loess environments, especially in open-air Gravettian sites in Moravia (e.g. Musil 1994: Pavlov), as well as in cave sites (Münzel 2001), where cut marks have also been reported.

- The medium-sized ungulates (mainly herd species such as reindeer, ibex and horse) are less numerous (Figure 10).

- In proboscideans and ungulates, all skeletal elements are represented, at least, and articulated units are present. In mammoths, the largest and heaviest skeletal elements such as the skull, scapula, and innominates are evident only as fragments; vertebrae and ribs are abundant in the peripheral downslope Hundssteig area.

- Breakage patterns are similar within the two groups. The scarcity of cut marks on mammoth bones from loess sites is not stressed because the periosteum or the cartilage, which cover the bone shafts and epiphyses are quite thick, and even deep cuts would rarely penetrate to the cortical bone surface. Even if they did, root etching and corrosion may mask them (e.g. Crader 1983, Haynes 1991).

- The abundance of rib fragments, vertebrae and distal foot bones clarifies the dichotomy of transported assemblages like the Krems sites, and death sites like the 25 ky Gravettian Milovice G site: Low proportions of axial bones and distal limb bones against a high frequency of mandibles and girdle elements, shoulder blades and hip bones. This is interpreted as being a result of human activities (Péan and Patou-Mathis 2003). The same seems to be true for the Kraków Spadzista Street (B) site (Wojtal and Sobczyk 2003), and for some of the Dolní Věstonice site cluster areas (e.g. Absolon 1938b, Klíma 2001). In large mammal carcasses, ribs and distal foot parts are generally underneath the first elements that are removed from the death sites, either for their nutritional value or because it is relatively easy to remove them from the carcass (e.g. Bunn *et al.* 1991). Ribs and rib fragments (more than 140 specimens) are also a dominant element in the Hundssteig 1893-1904 sample.

- The patterning of body parts of all large taxa within the Krems site cluster documents the carcasses as having been transported to the site. This fact distinguishes this site complex distinctly from the "bone heap sites" at Předmostí (Absolon and Klíma 1977), Dolní Věstonice I (Absolon 1938ab, Péan 2001), Milovice (Péan and Patou-Mathis 2003), Kraków Spadzista Street B (Wojtal 2001), and Ruppersthal (Kubiak 1990, Fladerer 1997), which appear to be death sites. These assemblages are generally characterised by a distinctly greater spatial density of large bones, and a better preservation of mandibles, shoulder blades, and hipbones.

- Judging by the gnawed and scratched specimen counts, carnivore activity is more intense in the downslope Hundssteig sample than in the Wachtberg sample. This difference may be due to the fact that the large discarded primary refuse bones are more attractive. The time of exposure as attractive specimen should also be taken into consideration, as the Wachtberg area may have been a living area.

- The Wachtberg high-density carnivore zone, indicating burials of articulated carcass parts and/or sorting bones within or very close to dwelling structures or hearths, parallels other Gravettian site complexes like Dolní Věstonice (Absolon 1938a) and Pavlov (Svoboda 1994). Articulated carnivore parts are more rarely found within the peripheral discard zones.

- The carnivore carcasses were apparently skinned and filleted; some marrowbones may be crushed; bones were used for handicraft artefacts. Mandible breakage patterns indicate the utilisation of canine teeth (Fladerer 2000). They were probably used as pendants; they are frequently found in other Gravettian sites, together with burnt clay figurines. This emphasises the role of carnivores in the belief system (e.g. Absolon and Klíma 1977, Svoboda 1994, Klíma 1995). On a hypothetic level of interpretation, the old idea about the carnivores as emergency or late winter fresh meat resource that is baited notably by the proboscidean carcass parts does make sense.

- This study does not counter the modern taphonomy study results of Upper Palaeolithic mammoth sites within the Middle Danube region, named as "bone heap sites" or simply "mammoth deposits" (Svoboda 2001, Péan and Mathis 2003, Wojtal and Sobczyk 2003). Natural mass death sites apparently occurred in the Late Pleistocene, and they probably occurred more frequently than during more stable climatic conditions (e.g. Haynes 1991). As in Předmostí which is chronologically situated close to the Krems-Hundssteig/Wachtberg horizon (or horizons), humans have exploited this situation. The actual taphonomic study supports the long standing interpretation (e.g. Much 1881, Absolon 1938, Klíma 2001, Haynes 1999), that the majority of Central European early to middle Upper Palaeolithic mammoth sites are evidence of a hunting based culture with a certain emphasis on mammoths.

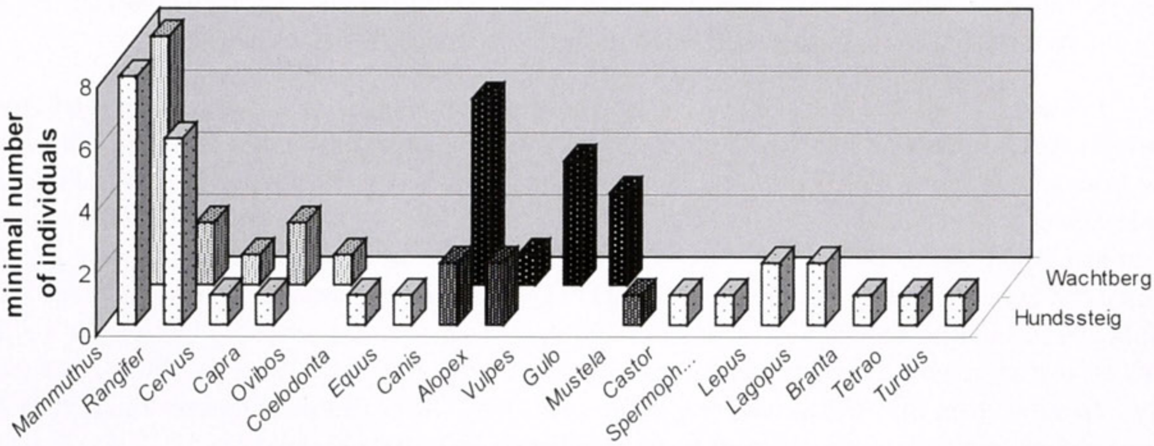

Figure 10. Minimum number of individuals (only genus name quoted). Hundssteig 2000/02 sample in the front, Wachtberg 1930 in the back.). Carnivore guild individuals see shaded data points.

5. Conclusion

The bone assemblages from the two sites within the Krems-Hundssteig/Wachtberg area are interpreted as being the result of a consistent set of subsistence practices. As long there is no evidence of synchronicity, a time gap of several hundred years cannot be excluded. But the very similar radiometric data and the raw material analysis (Einwögerer, this volume) do not distinguish the Wachtberg 'event' from the Hundssteig main horizon. The overrepresentation of mammoths over other herbivores, including a high percentage of calf bones without carnivore scavenging modifications, speaks clearly in favour of the hunting hypothesis. In the case of a multitude of Central European sites with mammoth remains, the likewise hypothetical scavenging or 'bone quarrying' idea about the generation of mammoth bone assemblages until now has not been able to explain the high frequency of transported calf bones within residential sites, that do not seem to be of any use as a raw material for artefacts or ornament production. The faunal assemblages from Krems, as well as the environmentally diverse landscapes in the Krems-Wachau region, support the reconstruction of a wide variety of foraging grounds and thus a stable subsistence base. The season of occupation at the Wachtberg site, as interpreted from mammoth calf ages, was probably the first months of winter. The presence of musk ox indicates continental stadial climate with pronounced dry and cold winters during the period of occupation. In terms of modelling regional Gravettian subsistence-settlement practices under these harsh climatical conditions, we suggest a mammoth hunting based economy that necessitated aggregating camps - these with pronounced and defined activity zones and corporate hunting, as well as facilitated handcrafting, social, and intellectual skills. We favour the idea that carnivores were opportunistically exploited as a food resource similar to the ungulates and small herbivores, at least during the harsh winter months.

6. Acknowledgements

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OUTLOOK TO THE EAST: THE 25 KY BP GRAVETTIAN GRUB/ KRANAWETBERG CAMPSITE (LOWER AUSTRIA)

W. Antl, F. A. Fladerer

Abstract

Excavations at the Gravettian 25 ky BP site Grub/Kranawetberg in the March valley near Stillfried in the northeast Lower Austria from 1993 to 2002 over app. 250 square metres exposed a multilayered encampment area with an adjacent refuse disposal area with partly articulated large remains from mammoths and one rhino besides few specimens from wild horse, reindeer, giant deer, and wolf. About 20 m from this refuse disposal to the east the encampment area with hearths and pits yielded thousands of lithic artefacts, over 90 ivory beads and fragments, more than 50 molluscs used as adornment, and remains of dye. Thousands of small primary refuse bone specimens within the ashy horizons display the dwelling character of the area. Settlement structures with two hearths show that the site was used repeatedly. Bone counts and body part frequencies document the mammoth as main nutritional resource. Articulated limb bones, mainly from reindeer and horse, and mandible fragments document advanced butchery activities. Next to the Mammoth these two species are the most important prey. The artefacts and the possible provenience of raw materials from Grub/Kranawetberg reflect the contacts of the site to the North and the East.

KEYWORDS: Gravettian, settlement structures, ivory beads, microgravettes

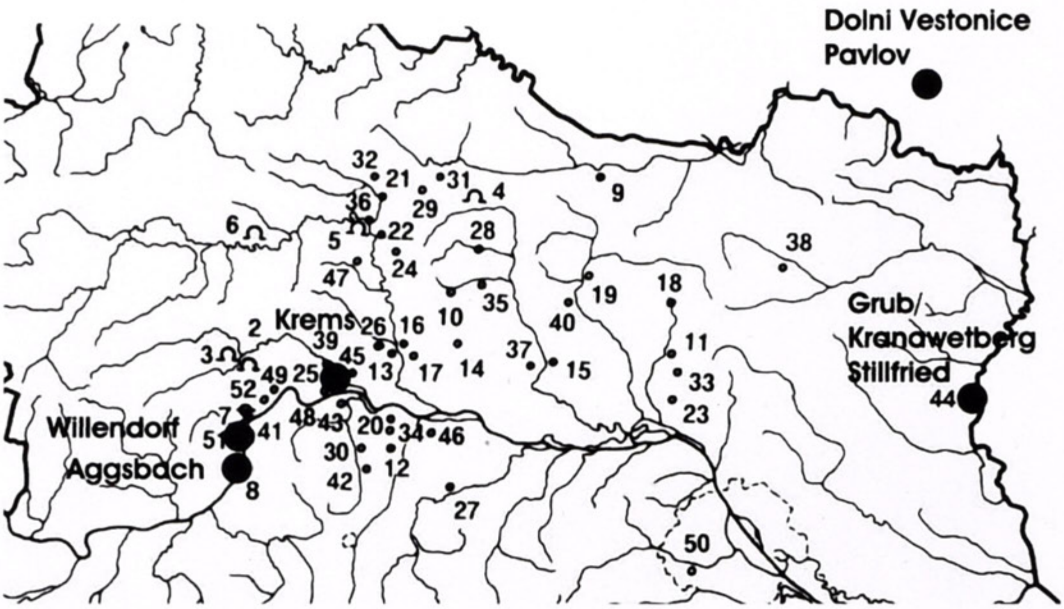
1. Introduction

The Gravettian site Grub Kranawetberg is situated in the March/Morava valley near Stillfried at the border to Slovakia on a south-facing slope with a view to the Carpathian Mountains in the East. This position may be regarded as a strategic outlook over animal migrations along the river plain which is typical for camp sites of this period. The geographical position between the Southern Moravian sites in the north, Moravany in Slovakia in the East and the Gravettian sites in the Wachau valley is important when we try to see the structures of the site in a greater regional context (Figure 1).

Grub/Kranawetberg is one of 13 Palaeolithic sites near Grub and Stillfried. Most of them are situated in this area with soft hills on points with good to excellent view to the plain lying ahead. Three of them have been at least partly excavated: the so-called Gravettian workshop beneath the western rampart of the Urn field fortification of Stillfried, Grub/Kranawetberg and Ollersdorf/Heidenberg.

Palaeolithic remains of the area around Stillfried have been known for more than hundred years. In 1879 M. Much published first Palaeolithic finds from Stillfried which is also mentioned in Hoernes „*Der diluviale Mensch in Europa*" (1903, 98ff.) and Menghin „*Weltgeschichte der Steinzeit*" (1931). The number of Palaeolithic sites in the area shows an intensive use of this region during the ice age. Grub/Kranawetberg itself has been known as a site since the 1930ies from surface collections. As the inclination of the Palaeolithic layer does not follow today's inclination of the slope parts of the deposits in the south have already been disturbed by ploughing whereas the north-eastern parts are covered by layers of loess which are up to 2 m thick.

The Natural History Museum Vienna started archaeological investigations with a trial trench in 1993, after a vineyard had been rooted out and a local collector detected mammoth bones. Two years later the western part of a dwelling structure was found.



Selon Ch. Neugebauer-Maresch, Le paléolithique en Autriche, Grenoble 1999

Figure 1. Map showing the geographical position of Grub/Kranawetberg.

2. Materials and methods

At present around 200 to 250m² of the site have been excavated. All objects bigger than 0.5 cm have been recorded three-dimensionally. Most of them have been mapped 1:10 or 1:5 with the z-coordinate next to the object. For the excavation campaign in 2002 Ph. Nigst and Th. B. Viola developed with GRUPS and ArcGRIMP a new system for recording the finds and stratigraphic units, consisting of a tachymeter for recording the 3D coordinates, the database software GRUPS by Th. B. Viola (Institute of Anthropology, University Vienna, running on a standard Palm® handheld for recording artefact information in the field, and ArcGRIMP by Ph. R. Nigst (Institute of Prehistory, University of Vienna) based on the ArcDig-extension by M. Doneus (Institute of Prehistory, University of Vienna) for importing data to ArcView® GIS. Due to the high density of artefacts (app. 1000 finds per m²) conventional documentation is rather time consuming. This new system increased the speed of documentation considerably.

This recording method enables the plotting of spatial data right after the daily task. The digital photograph can be overlapped by the distribution of objects. The final map consists of the digital photograph with all measures and numbers of the finds of a traditional map. During ten years of excavation approximately 42,000 objects have been documented. The cultural layer contains several hundred stone tools, thousands of flakes and uncountable chips smaller than 1 cm.

All removed sediment from the cultural layers including 5 cm above and below has been wet sieved. The residues of this process are being separated into silex, stone, charcoal, bone, red ochre, ochre and graphite as well as special materials like crystal rock, ivory beads and fragments of mollusc shells.

Excavation area (Relative location)	Year	Size frequencies (Classes in cm) Burnt bones most conspicuous pattern	Cl	Species genus name	MNI (NISP)	Representation Carnivore gnawing	Conspicuous patterns Interpretation
"Bone clusters"	1993 -	>30 many 15-30 abundant 5-15 abundant	(L) (R)	*Mammuthus*	5 (294)	Fetal/neonate tusk, four crania, adult tusk fragments, mandibles, molars, spine segments with articulated vertebra, ribs, coxa fragments, limb bones	Bones >5 cm dominate the bone count Complete and/or conjoin able bones, associated as well as articulated anatomical units from large herbivores dominate *Disposal of refuse from transported carcasses after an advanced butchering phase (filleting, sectioning)*
(In the West)	1995	5-3 few <3 very rare	(A) (C)	*Equus*	2 (7)	Cranium fragment, teeth, limb bones	Burned bones
		Several large burnt bones that are partly dislocated		*Coelodonta*	1 (9)	Cranium, articulated and disarticulated associated pelvis parts, vertebra	*? For final filleting in-situ, or ?extended refuse disposal, or ?for telecommunication (smoke signals)*
				Rangifer	1 (1)	Antler	**Secondary refuse disposal**
				Megaloceros	1 (1)	Fragmented cranium	***"Dump zone"***
				Canis	1 (2)	Teeth, limb bone	
"Area with only few finds"	1994 1995	>15 few <15 few	(L)	*Mammuthus*	1	Molar fragments	Probably originally dump-poor zone or zone with very poor bone preservation

Abbreviations: Cl - further find classes density: L - lithic industries, C - charcoal, R - red ochre, A - adornments s.l. (ivory beads, pierced molluscs), in () – rare/ low density, !! – Abundant/high density; question marks (?) indicate presumed activities without any taphonomical data. MNI – minimum number of individuals, NISP – number of identifies specimens; © 2003 F. A. Fladerer, Department of Palaeontology, University of Vienna.

Table 1. Animal bones at the 25 ky Grub/Kranawetberg Gravettian camp site near Stillfried an der March.

First conservational procedures on bone and ivory specimens, and preliminary determinations accompanied the excavation campaigns. Preliminary results are included in the next chapter. Systematic samples for malacological and sediment studies were taken from each sector within a distinct area and from the stratigraphical sequence. Some of the profiles were enlarged by auger drilling up to a depth of seven meters. A network of percussion and auger drillings and electromagnetic investigations (Antl Weiser and Verginis 1999) was applied in order to reconstruct the palaeosurface and to check whether the excavated area has been affected by solifluidal processes.

Few samples have been submitted to botanical analysis so far, mainly samples that were taken for radiocarbon dating. From the main layer a series of radiocarbon analyses were made in Groningen and the Viennese laboratory VERA.

M. Teschler-Nicola (Natural History Museum, Department of Anthropology) studied two human deciduous teeth from the vicinity of the western hearth.

3. Results

The cultural layers contain several hundred stone tools, thousands of flakes and an uncountable number of chips smaller than 1 cm. The western part of the excavated area is characterised by clusters of predominantly large bones, a small part of them in anatomical order. Remains from mammoth are predominating but there are also some specimens representing woolly rhino, reindeer, wild horse, giant deer, and wolf. Many of the faunal remains in this area are longer than 30 cm; most of them are between 5 and 30 cm (Table1). There are only few small bone fragments, a small series of lithic artefacts and a perforated snail shell. An analysis of use wear traces made by Silvia Tomášková (California University, Berkeley) mainly showed traces of scraping and piercing soft material and also traces of hafting.

As a preliminary result of the study of the body part distribution patterns two hypotheses arose: The frequency of large bones, including four larger tusk fragments, fragmented crania from at least three juvenile to early adult animals, one more or less complete innominate, and several fragments, articulated vertebrae (Figure 2) could be interpreted either as primary butchery area at the death locations or as transported parts of carcass. We favour the second hypothesis that all carcass parts were transported. Thus we interpret this area as a dump zone, where the carcass parts were deposited *after* advanced butchering. The paucity of stone artefacts within this zone speaks against substantial butchery activities

Figure 2. Grub/Kranawetberg, vertebrae of mammoth [94/522]. Dorsal parts are preserved but not figured. Scale is 100mm.

(Table 1). The crania of mammoths and woolly rhino and the pelvis parts indicate a near death location of these animals. Adjacent there is a zone with only few finds in the north. It is up to further analysis if this results from an original dump-free area or if also erosive processes took place.

Two years later the western part of a dwelling structure was found approximately 20 m east of the dump zone. The cultural layers in this area and the layers of both trough-shaped hearths show a repeated use of the site. According to recent results different zones within this part of the site become more and more evident. In the western part we found traces of a dwelling structure - small pits, possibly rests of a construction (Figure 3), corresponding with a sudden decrease of finds outside these traces. Inside the scatter of pits there is a light brown cultural layer with plenty of red ochre, snail-shells collected as adornments and ivory beads. There are only few rather fragmented animal bones. In the eastern part of these structures we found the first hearth which shows four different horizons of firing (Figure 4) – a few centimetres of ashes at the bottom followed by a horizon of charcoal and red horizons. The layers are separated by thin layers of loess. Between this hearth and a second one found in 2001/2002 we stated a high density of stone tools, flakes and bone fragments (app. 1000 pieces/m^2) probably representing a central zone of activities.

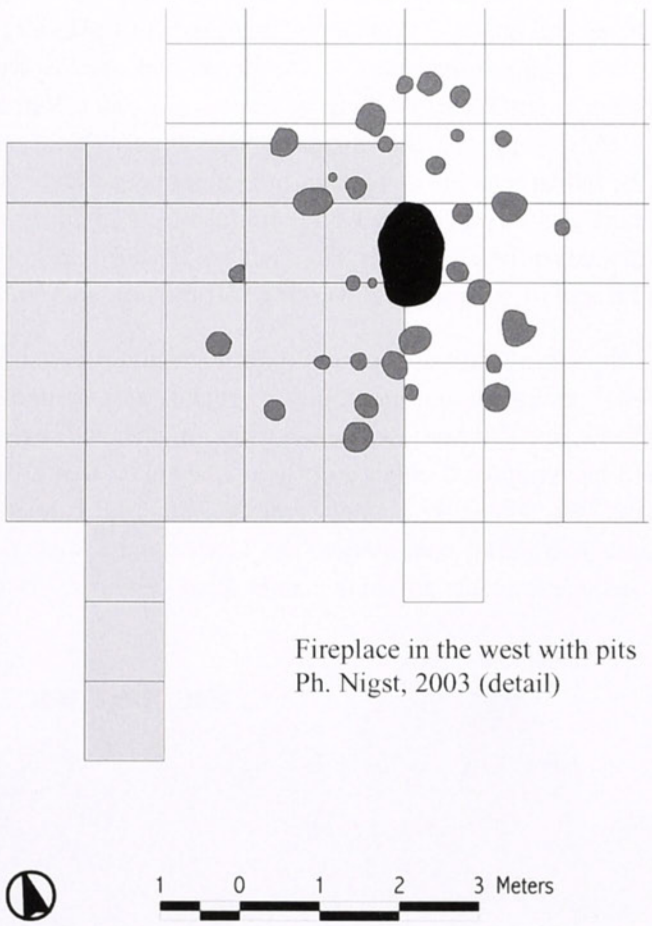


Figure 3. Grub/Kranawetberg, pits around hearth 1.

8 cm above the main layer there is a second living floor (upper layer) which intensifies from southwest to northeast. In its western part finds are only scattered whereas there is a well distinguishable cultural layer in the north-east. It differs clearly from the main layer by the choice of raw material and the ornaments. The differences are mainly visible in the raw material used for stone tools and the type of adornments. Within the upper layers radiolarites and colourful material are predominant. Similar

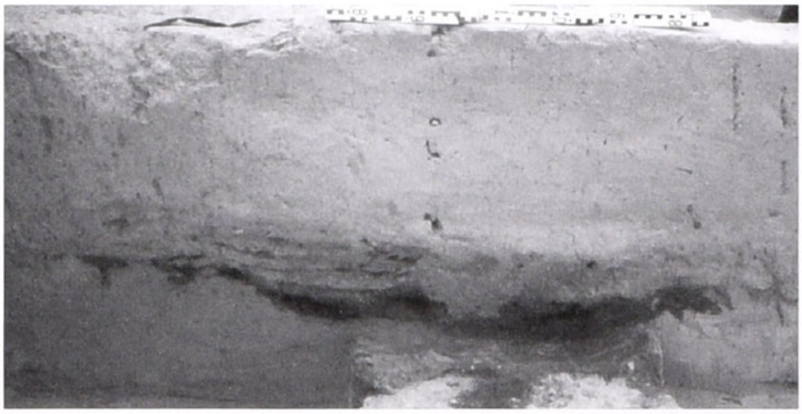


Figure 4. Grub/Kranawetberg, hearth 1.

material can be found in the Carpathian Mountains in the east. Mollusc shells were used as adornments. Microgravettes seem to be less frequent compared to the main layer. Within the main layer most of the artefacts are grey or patinated. Ivory beads and pendants are exclusively from the main layer but there are also perforated mollusc shells. As to the raw material of stone tools a certain quantity – detailed studies are yet to be made – resembles Southern Moravian chert. There are also pieces of probably northern flint but most of the tools and flakes of this layer are patinated. Special materials are a piece of obsidian from Eastern Slovakia and some pieces of crystal rock.

In 2002 we found another horizon with scattered artefacts and animal bones above this second living floor. A few scattered pieces of silex and bone fragments were discovered even 50 cm above the main layer.

For the time being the so-called main layer with the settlement structures is the only layer with radiocarbon data:

Grub/Kranawetberg:	dump zone:	GrA-9062 25,220+/- 250 BP
	Hearth:	GrA-9066 24,830+/-230 BP
	Post hole:	GrA-9065 24,930+/-240 BP
	Main layer:	GrA-9063 24,620+/-230 BP
	Main layer:	VERA 364 25,300+/- 90 BP
Ollersdorf/Haidenberg:		
	Cultural layer:	VERA 366 25,450+/-90 BP

Sedimentological analysis shows that the excavated area has not been affected by solifluidal processes whereas parts of the hill in the north and the south show transported sediments, probably a consequence of agricultural activities. Glacial phenomena detected during excavation are folded parts and gaps within the cultural layer. The main layer as well as the upper layer is affected by these postdepositional processes. From 4 to 5 metres beneath the surface charcoals were found by auger drilling.

As to the climatic conditions and the environment, malacological studies reflect an open land of rather dry loess tundra with some wet or swampy spots. There is a big quantity of molluscs but only a few different species. According to Franz Stadler (Antl-Weiser, Fladerer, Peticzka, Stadler, and Verginis 1997)

Excavation area (Relative location)	Year	Size frequencies (Classes in cm) **Burnt bones** most conspicuous pattern	Cl	Species genus name	MNI (NISP)	Representation Carnivore gnawing	Conspicuous patterns Interpretation
"Dwelling structures with hearths" (In the East)	1995–2002	>30 very few 15-30 few 5-15 many 3-5 abundant <3cm very abundant	L!! R!! A!! C!!	*Mammuthus*	3	Cranial, tusk, molar fragments, few vertebra, frequent rib & cortical limb bone fragments	1) Small fragmented (partly burnt) remnants dominate the bone count
				Rangifer	3	Antler, cranium & mandible fragments, teeth, post cranial fragments, rarely articulated	2) Mammoth cortical and rib fragments with spiral fractures and transverse stepped breaks, and cortical flakes are frequent
				Equus	2	Cranial fragments, teeth, limb bone fragments, limb parts partly articulated	3) Ungulate limb bones with spiral fractures, and articulated bones are evident 4) Few large well preserved objects (head of a wolf, antlers)
				Coelodonta	1	Limb bone (ulna)	5) Hare and ptarmigan carcass quarters
				Canis	2	Cranium and mandible, teeth, post cranial parts, limb bones	6) Bone artefacts: bone point of cortical bone from large/medium sized species and from antler, ribs with multiple cut marks, beads from ivory and ivory points
				Alopex	3	Cranial and post cranial parts	
		Very abundant burnt bones <3cm		*Lepus*	3	Cranial and post cranial parts, partly articulated	**Primary refuse (meal and handicraft debris) dominates & ?casual secondary refuse**
				Lagopus	1	Wing parts partly articulated	***Zone of handcrafting, food preparation, dining, ?conversation s.l., ?resting***

Abbreviations: Cl - further find classes density: L - lithic industries, C - charcoal, R - red ochre, A - adornments s.l. (ivory beads, pierced molluscs), , in () – rare/ low density, !! – Abundant/high density; question marks (?) indicate presumed activities without any taphonomical data. MNI – minimum number of individuals, NISP – number of identifies specimens; © 2003 F. A. Fladerer, Department of Palaeontology, University of Vienna.

Table 2. Animal bones at the 25 ky Grub/Kranawetberg Gravettian camp site near Stillfried an der March.

species preferring dry open land like Puppillidae and Valloniidae as well as species living in dry and slightly wet places like *Succinella oblonga* and *Trichia hispida* are dominating. There occur also species preferring wet areas like *Cochlicopa lubrica, Columella columella,* cf. *Catinella arenaria, Perpolita petronelle, P. hammonis, Euconulus fulvus, E. alderi, Clausilia dubia,* cf. *Neostyriaca corynodes austroloessicua* and *Arianta arbustorum* but they are not very frequent. *Clausilia dubia* is an indicator of at least some bushes and trees. As to the climate species living in cold (*Pupilla muscorum desegyrata, P. loessica, Vallonia tenuilabris*) or preferably cold climate (*Pupilla muscorum, P. sterrii, Succinella oblonga, Trichia hispidaund* cf. *Catinella arenaria*) are predominant. *Perpolita petronella, P. hammonis, Euconulus fulvus, E. alderi, Clausilia dubia, Arianta arbustorum* and *Succinella oblonga* are living in warm as well as in cold climate. At present there is only one species from Grub/Kranawetberg which prefers warmer climate: *Cochlicopa lubrica*.

Especially in the main layer charcoal is very abundant. There exist even pieces up to app. 10 cm. The distribution is not only concentrated in and around the hearths but all over the living floor. At present only few samples of this material have been analysed. We detected Coniferae, presumably pine, and a deciduous tree that is probably birch (M. Kohler Schneider, Botanical Institute, University of Vienna).

First results of palaeontological studies in this area show faunal remains (Table 2) from mammoth, rhino, reindeer, wild horse, arctic fox, arctic hare, wolf and a few remains of bird. Eggshells could also be identified. The bone count is dominated by small fragmented and partly burnt remnants. Very few pieces are bigger than 30 cm. Most fragments are between 3 and 5 cm or smaller. Mammoth specimens are dominating, followed by reindeer and wild horse. The two middle-sized ungulates are represented by cranial fragments, teeth, limb bone fragments, and also some articulated parts (Figure 5). From reindeer, antler and mandible fragments and mandibles are under the more frequent specimens. The most conspicuous finds are mammoth cortical splinters and rib fragments with spiral fractures and transverse stepped breaks (Figure 6). Also cortical flakes are frequent. This may indicate rather manufacturing activities upon this raw material than any food extraction procedure. A limb bone of rhino shows that this animal was at least now and then part of the prey of these hunters. Arctic hare is especially frequent around the second hearth in the northeast. Faunal remains in the area of the dwelling structures are primary waste from meals and handicraft, as well as secondary refuse from advanced butchery phases within a home base area.

Figure 5. Articulated bones of horse.

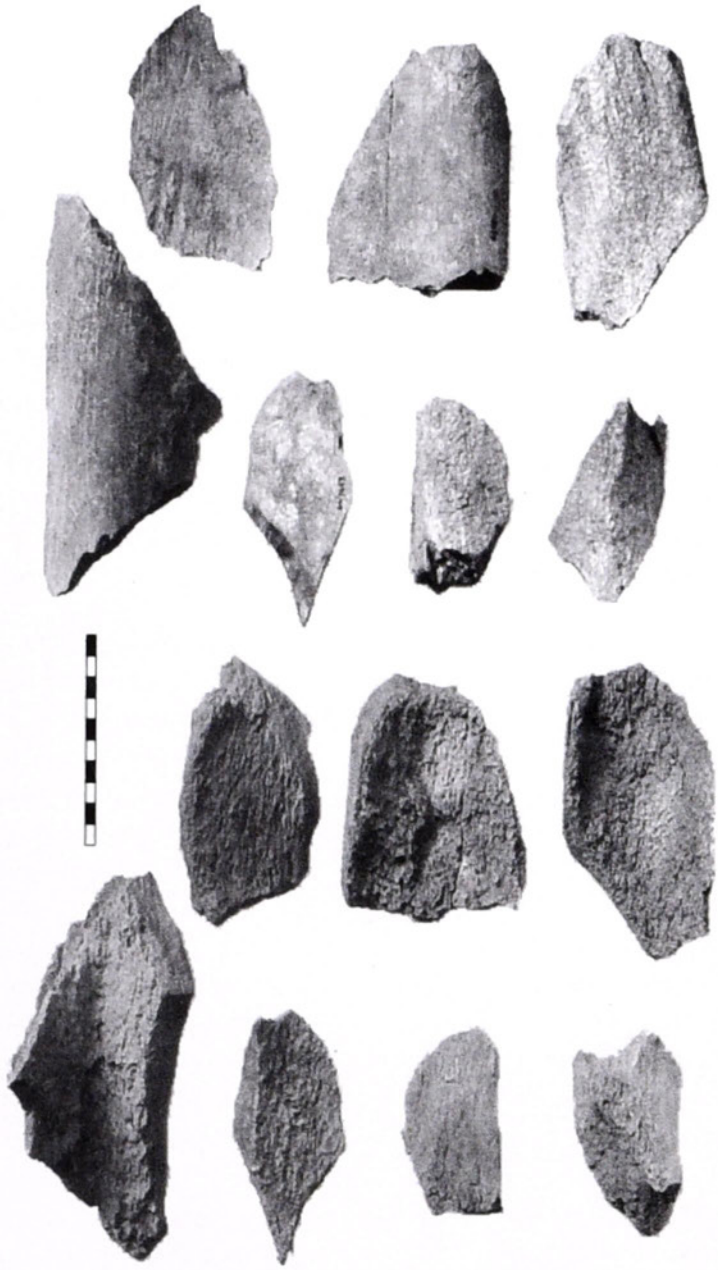


Figure 6. Splinters of mammoth.

Apart from the faunal remains there are thousands of lithic artefacts, more than 90 beads and pendants of ivory and around 50 mollusc shells used as adornment. Among the stone tools microgravettes and microliths are dominant, followed by retouched blades and bladelets. The microgravettes are between 2 and 4.5 cm long (Figure 7). A triangle with a length of about 2 cm long was found near one of the hearths in the main layer. A great percentage of the microgravettes is retouched on the ventral side. Scrapers, burins and borers are distinctively less frequent. A leaf shaped point and a big scraper are special in size and material. An exact list of types is in progress. Apart from the tools there are hundreds of blades and bladelets – most of them fragmented - several thousand flakes, a series of cores, cortical flakes, crested flakes, rejuvenation flakes and countless chips smaller than 1 cm. The distribution of objects west of the first hearth has been studied by Philip Nigst and shows a barrier effect which seems to correspond with the series of pits around the hearth (Nigst 2003). A special density of tools can be observed between the two hearths.

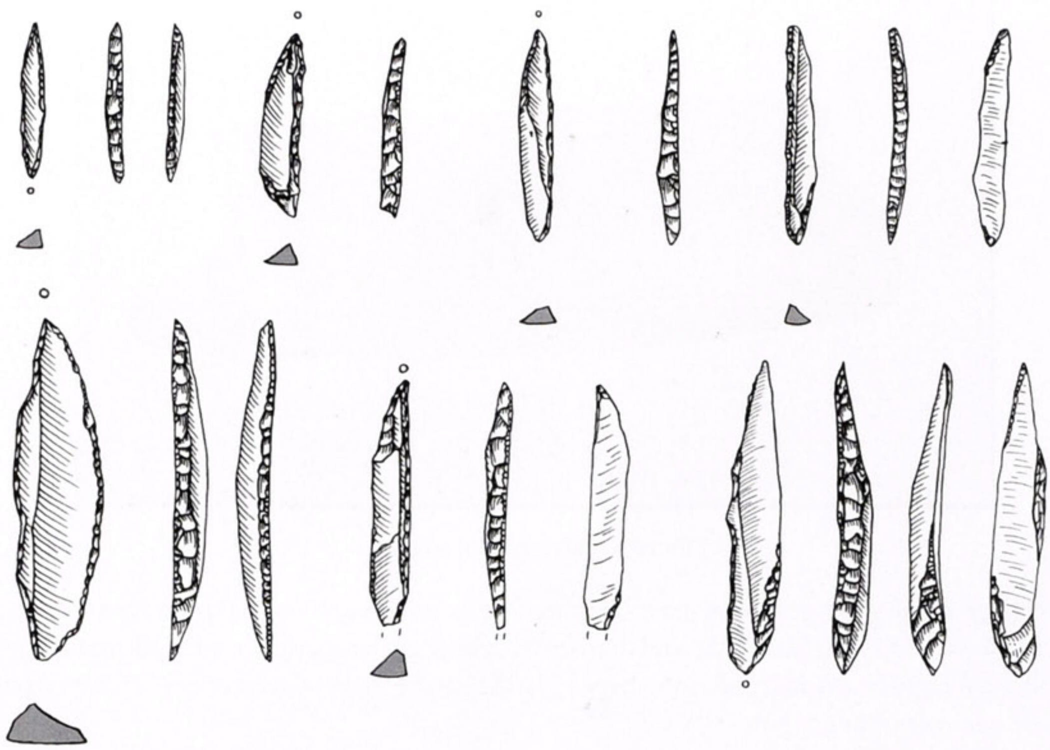


Figure 7. Microgravettes.

Studies concerning raw material still have to be made. Radiolarites mainly from the upper layers could have been brought from the Carpathian Mountains in the East but further studies (concerning thin cuts, analyses and prospection of river gravels etc.) are necessary. In the main layer there are only few radiolarites. There are pieces similar to Moravian chert, possibly flint and chalcedoine among this material which at the moment may be interpreted as closer contacts to the North. The few pieces of crystal rock could have been transported from the western part of Lower Austria. The small flake of obsidian is a variety typical for the sources in Eastern Slovakia and can be regarded as an indicator for long distance contacts to the East as well as the Kostenki Point which is a surface find not far from the excavated area.

Despite of many modified pieces there are only a few bone and ivory tools. The variety is also limited – points, spatulas, awls, fragments of pins and modified antler of reindeer. Modified antler is especially abundant near the second hearth in the northeast. Within the upper layer we found in the same area a haft made of antler and spatula made out of a mammoth rib with clear traces of use. There are also pieces with cut marks suggesting a use as support for cutting (Figure 8). A series of ivory fragments show clear marks of modification. They are very frequent in the area of the second hearth. A fragmented ivory point was found near the first hearth and a 30 cm long point was detected in the northern periphery of the living floor.

Approximately 50 pieces of dentalium and perforated shells of mussels and snails were used as ornaments. More than 90 ivory beads and pendants represent the biggest assemblage of bone adornments of the Austrian Palaeolithic so far. Most of the mollusc shells are dentalium and snail shells. They occur in the upper layer and the main layer and are supposed to have been collected in old marine sediments of the region. As far as the distribution of the adornments is concerned pieces carved from ivory are exclusively found within the main layer. Ivory beads are concentrated there around the hearths as well as between the hearths. They never occur in the periphery of the living floor. According to microscopic studies comparing ivory, antler and bone we found out that all carved implements are made of ivory.

Figure 8. Rib with cut marks.

The assemblage of carved ivory implements (Figure 9) can be divided into different types of beads and pendants (Antl-Weiser 1999) like beads with two heads, cylindrical beads with a notch all around the centre of the bead, perforated beads, and pendants shaped like the canine tooth of deer, or basket shaped pendants and another one resembling a pin.

The cylindrical beads are rather small with a length from 4 to 7.5 mm. The diameter of 2 to 2.5 mm may indicate a certain degree of standardization. A certain number of beads show clear traces of separation possibly from a notched bar. The beads with two heads consist of two spherical or oval joined heads (length from 5 to 8.5 mm). The heads are perfectly rounded without any cuts left. Only one of them is distinctly bigger than all the others with a length of 22 mm. Maybe it was used as a sort of button. As to

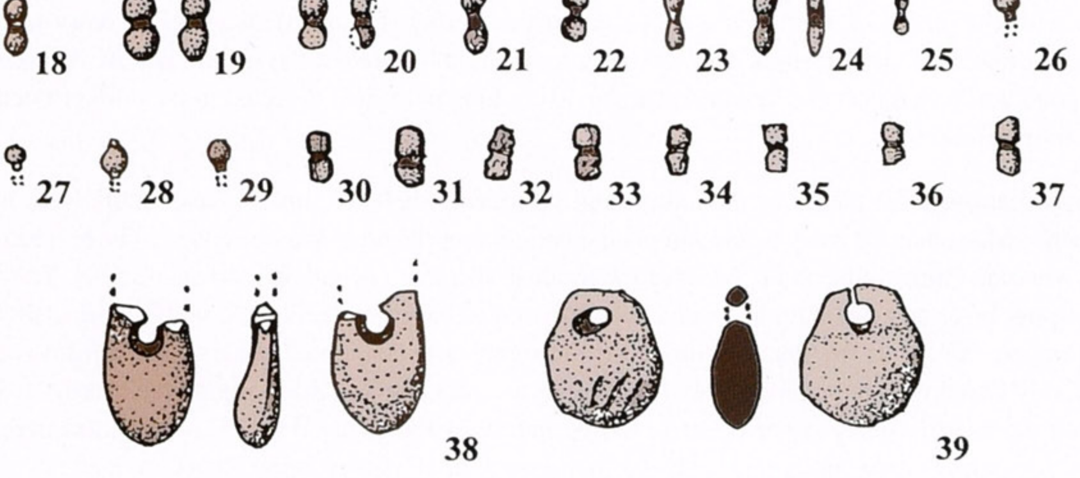


Figure 9. Grub/Kranawetberg, ivory beads and pendants.

Figure 10. Left: canine tooth of a deer from Gudensuhöhle, right: pendant from Grub/Kranawetberg shaped like a canine tooth of a deer.

the fabrication the study is reduced to traces on the object itself. There are no semi products or pieces from another stage of production apart from thin bars which equally may be fragments of pins.

Most of the perforated beads are fragmented. In most cases only the upper part is preserved. Their length varies from 4 to 5 mm. The biconic perforation was carried out from both sides of the piece. There exists only one lower part of a perforated ivory bead. It can be compared to beads from Southern Moravia (Pavlov I - Northwest and Dolní Věstonice, Klíma 1997) and Germany (Mainz-Linsenberg, Geißenklösterle, Hohle Fels, Scheer 1985).

One of the two complete pendants looks similar to the basket shaped beads although there are some differences. The piece from Grub/Kranawetberg (length 16.7 mm, width 15.4 mm and thickness 6 mm) is thinner than the typical basket shaped beads and the transition between corpus and perforated part is not so abrupt. The perforated part is 2.2 mm thick.

The pendant shaped like the canine tooth of a deer is nearly complete. The biconic perforation was carried out from both sides. The front side is bellied whereas the back is rather flat with clear traces of use. In comparison to similar objects from Germany the piece is rather small (length 20 mm). A comparison between a real canine tooth from Gudenushöhle, Lower Austria (Magdalenian) and the pendant of Grub/Kranawetberg indicates that this pendant might be an intentional copy of a canine tooth of a deer (Figure 10).

A perforated pointed pendant (Figure 11) represents another complete piece (length 25.5 mm). Near the perforation this unique flat pendant (thickness 1 mm) is 6mm wide. Traces of use at the back side may be a result of a function rather than being a mere ornament. The size of the piece however limits the range of possible functions. All in all the perforated ornaments show a great variety. Even roots of molars of mammoth have been worked and perforated.

Apart from the fauna and the remains of human activities we found two heavily eroded human tooth fragments. Both fragments were found during wet screening of sediment taken from an area near a hearth and can be clearly classified as tooth fragments of early *Homo sapiens*. One of the fragments is a deciduous left lateral upper incisor and the other a deciduous right first lower molar. Due to the characteristic shape and size, as well as the degree of abrasion, both teeth could have belonged to one single individual, a 5 to 6 year old child. This interpretation is also consistent with their stratigraphical position (Antl-Weiser and Teschler-Nikola 2000-2001).

Figure 11. Pointet pendant.

4. Discussion

The present state of research concerning Grub/Kranawetberg does not allow conclusive remarks about the character of the site but we can already present first results. Chronologically the main layer of the site is situated at the end of the Pavlovian sites in Southern Moravia or between layer 8 and 9 of Willendorf II (Felgenhauer 1956-59). Malacological studies suggest a cold climate and an environment typical of Mammoth Steppe with some bushes and trees (Antl-Weiser, Fladerer, Peticzka, Stadler, Verginis 1997, 4-20).

The geographical position near the river - important for orientation and transport - is typical for base camp of the Early Gravettian (Pavlovian) (Svoboda *et al.* 2000, 211). As far as the main layer is concerned the choice of raw material and to a certain extent the settlement structures indicate relations to the Pavlovian sites in Southern Moravia. Contacts to the east become also evident through the piece of obsidian and the point of Kostenki type from the surface.

First results of paleontological studies, the settlement structures and the intensity of finds of the cultural layer let us suppose that Grub/Kranawetberg was a base camp. The frequency of arctic hare, the tusk of a neonate of mammoth, the eggshells and parts of bird could serve as an argument for an occupation of the site probably from winter to early summer. In contrast to the big body parts of the dump zone faunal remains in the area of the dwelling structures are primary waste from meals and handicraft, as well as secondary refuse within a home base area. At present palaeontological and spatial analysis as well as studies of the châine operatoire in this place are in its beginnings and all results are preliminary impressions.

The pendants and beads from Grub/Kranawetberg represent the biggest assemblage of carved ivory ornaments in the Austrian Palaeolithic. First comparisons have shown that most of the types are spread all over Europe during the whole Palaeolithic period. When we try to find similarities to the adornments of Grub/Kranawetberg, the closest parallels to the double headed beads are among the material of the Pavlovian sites of Southern Moravia, which let us suppose contacts between these two regions as far as the occupation of the main layer is concerned. Double headed beads are also known from Kostenki

IV (Abramova 1995) which leads us more to the east. In Austria itself there exist practically no analogies. Even the few pieces of the Willendorf II sequence cannot be compared to this material.

Regarding the repeated use of the site it is highly probable that each layer consists of overlapping occupations which cannot be separated at first sight. As to the upper layer we only have a vague impression because it is almost certain that we have not yet reached the central parts of this occupation. Up to now we don't have evidence of closer relations to the North in this layer. The nearly exclusive use of radiolarites resembling material of the Carpathian Mountains may indicate increased relations to the East. But at the moment our information is too fragmentary to see whether this may correspond to the hypotheses of M. Otte or J. K. Kozłowski who sees a tendency to the East versus the end of the Pavlovian sites in Southern Moravia (Otte 1993, 56-64, Escutenaire, Kozlowski, Sitlivy, Sobczyk 1999, 14ff.). First of all we would need radiocarbon data of the upper layer in order to see if there is a relevant time span between these occupations.

It is even more difficult to determine the role of the site on a regional scale. The other sites in the area of Stillfried all have an excellent view to the plain in the South and the North-East. At the present state of analyses we can't say much about their relation to Grub Kranawetberg or their contemporaneousness. During salvage excavations at Ollersdorf/Heidenberg a series of hearths and a big quantity of well preserved faunal remains have been detected. The raw material of stone tools resembles the main layer of Grub/Kranawetberg whereas the stone industry is dominated by unretouched blades and bladelets, burins and borers. The site beneath the Bronze Age rampart didn't show any settlement structures within the excavated part. The site is characterised by a big quantity of microgravettes and an only small series of other tools. The choice of raw materials is dominated by radiolarites. Two pieces of antler from reindeer are the only faunal remains (Felgenhauer 1980). The other sites in the area are only surface collections.

5. Conclusion

Summarizing the aspects mentioned in this context we situate the site Grub/Kranawetberg towards the end of the Pavlovian sites in southern Moravia with clear similarities of the occupation of the main layer to the north and some to the east. Layer 9 from Willendorf II and parts of the Aggsbach context are slightly younger than the main layer of Grub/Kranawetberg. Preliminary palaeontological studies support the hypothesis of a home base at Grub/Kranawetberg. The beads with two adjoining heads resemble pieces found in Southern Moravian sites. The majority of the beads and pendants, in particular the beads with two adjoining heads, light up the relations to Southern Moravia and Eastern Europe. In Austria itself there exist practically no analogies.

The upper layer from Grub/Kranawetberg might show more tendencies to the east as far as raw material procurement is concerned. There are many differences between the main layer and the upper layer which makes us believe that the upper layers belong to a different period of occupation.

6. Acknowledgments

Excavations at Grub/Kranawetberg have been financed by the Federal Ministry of Science and Education, the association of "Friends of the Natural History Museum, Vienna" and private donations. The community of Angern supported the work with practical aid concerning earthworks etc. and organisational aid. Part of the excavation and most of the scientific analyses carried out so far have been subsidised by a grant of the Austrian Fund of Scientific Research (FWF P 11.940 GEO).

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SOME PRELIMINARY OBSERVATIONS ON INTRASITE SPATIAL PATTERNING OF GRUB/KRANAWETBERG (1995 AND 1996 AREA)

P. R. Nigst

Abstract

This paper is a preliminary report on intrasite spatial analysis of a part of the Gravettian site of Grub/Kranawetberg in Lower Austria. The area to the west of the hearth I was selected for analysis. In this paper, only the first step of intrasite spatial analysis is presented: the mapping of find quantities and visual inspection of the produced distribution maps of finds per 50 x 50 cm grid cells. The analysis shows two different zones. Zone I is characterised by only a few artefacts and is therefore interpreted as a periphery area of the settlement. On the contrary, Zone II contains numerous finds but their distribution is not homogenous. Besides the finds, there are evident structures (pits and part of hearth I) present in Zone II, which is interpreted as a part of a dwelling. Especially the distribution of lithic artefacts, pieces of ochre, red ochre and limonite give a hint of the existence of a dwelling.

KEYWORDS: intrasite spatial analysis, mapping find quantities, dwelling structures, hearth, Gravettian, Lower Austria.

1. Introduction

The basic idea behind intrasite spatial analysis is that distributions of finds in archaeological sites somehow reflect past human behaviour and ideas. Spatial patterns of finds as archaeological evidence are a result of a number of complex processes. Trying to identify these processes and describing the genesis of a site is one of the basic struggles in intrasite analysis. The goal is to identify - beside various natural processes - past human behaviour and ideas that shaped our record.

Mapping lithic artefacts, whether this means piece plotting or mapping find quantities, is one of the basic methods used in the exploration of spatial patterns at Palaeolithic and Mesolithic sites. An application of mapping find quantities is given below by presenting the first results of an intrasite spatial analysis of the Gravettian site of Grub/Kranawetberg.

2. The site

At Grub/Kranawetberg, near the Valley of March River (about 40 km to the northeast of Vienna, Austria, near the Slovakian-Austrian border; see Figure 1), it was possible to investigate a Gravettian site (see Antl-Weiser and Fladerer, this volume). The site has been known since the 1970s from surface finds, and was excavated by W. Antl-Weiser (Naturhistorisches Museum, Prähistorische Abteilung, Vienna) between 1993 and 2002. Some preliminary reports (Antl 1997, 1998, 1999, Antl-Weiser 1994, 1995, 1996a, 1996b, Antl-Weiser *et al.* 1997) and special research papers (Antl and Verginis 1998, Antl-Weiser 1999, Antl-Weiser and Teschler-Nicola 2000-2001) have been published.

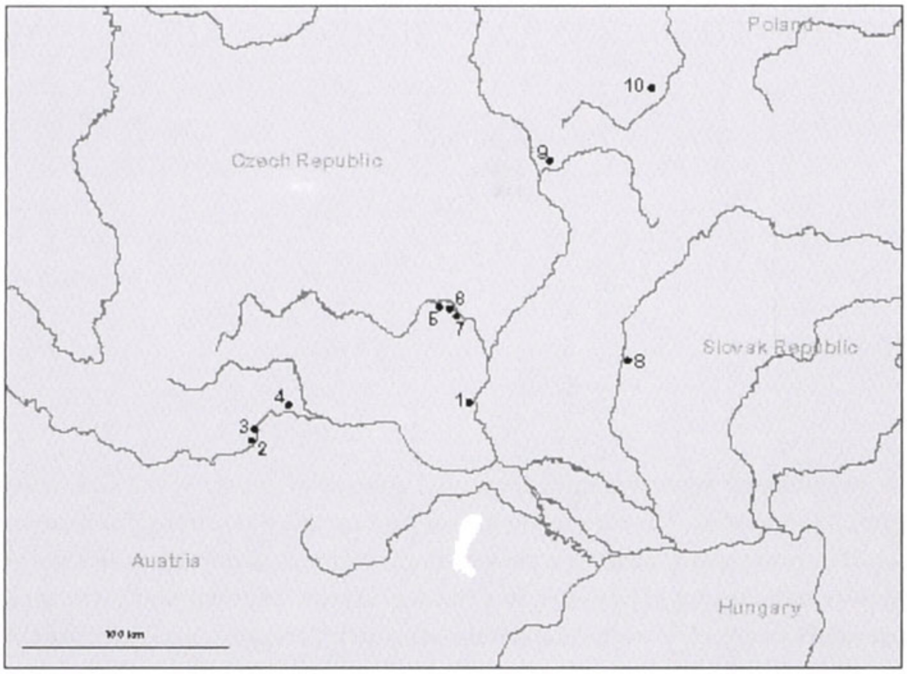

Figure 1. Map of the Middle Danube area showing the location of Grub/ Kranawetberg (1) and a selection of other Gravettian sites: 2 Aggsbach, 3 Willendorf II, 4 Krems-Wachtberg, 5 Dolní Věstonice sites, 6 Pavlov sites, 7 Milovice, 8 Moravany sites, 9 Předmostí, 10 Petřkovice (Graphic: P. Nigst).

The largest excavated area, Section 3/C with an excavated surface of about 120 m^2, contained two archaeological horizons, the *Hauptkulturschicht* (main cultural layer) and the *Obere Kulturschicht* (upper cultural layer). In the last few years of excavation, some archaeological horizons above the *Obere Kulturschicht* were recognized. The *Hauptkulturschicht*, which is of interest for this study, yielded most of the finds (lithic artefacts, bones, non-siliceous stones, pieces of ochre, red ochre and limonite, charcoal etc.). Radiocarbon dating places the *Hauptkulturschicht* around 25 ky BP (VERA-364: 25,300 ± 90 BP, GrA-9063: 24,620 ± 230 BP, GrA-9065: 24,930 ± 240 BP, GrA-9066: 24,830 ± 230 BP, all dates are from charcoal).

While it was impossible to uncover evident structures in the *Obere Kulturschicht*, the *Hauptkulturschicht* contained several of them: two hearths and a number of small pits. Some of the pits are deep, some shallow. All pits are grouped around the two hearths. For an example, among the pits concentrated in the vicinity of hearth I (quadrants E/F 9/10; excavated 1996 and 1997) not one is located more than 2.5 metres away from the hearth.

The measured finds of the *Hauptkulturschicht* consist of thousands of lithic artefacts, many of them fragmented or tiny chips; further fragments of bones and antler, pieces of ochre, red ochre, limonite, non-siliceous stones and charcoal are also present, as well as fragments of tools made of bone/antler such as like needles. Many microgravettes characterize the lithic inventory. Scrapers, burins, burin spalls, microliths and edge retouched pieces are also present. Among the finds recovered through wet sieving are - besides thousands of chips, bone fragments and the like - about 90 ivory beads and two fragmented deciduous teeth of *Homo sapiens*. Faunal remains are highly fragmented and some of them show cut marks. Among the identified species are *Mammuthus primigenius*, *Coelodonta antiquitatis*, *Rangifer tarandus*, *Equus* sp., *Canis lupus*, *Alopex lagopus* and *Lepus timidus* (Antl-Weiser 1999, Antl-Weiser and Teschler-Nicola 2000-2001, Fladerer 1997).

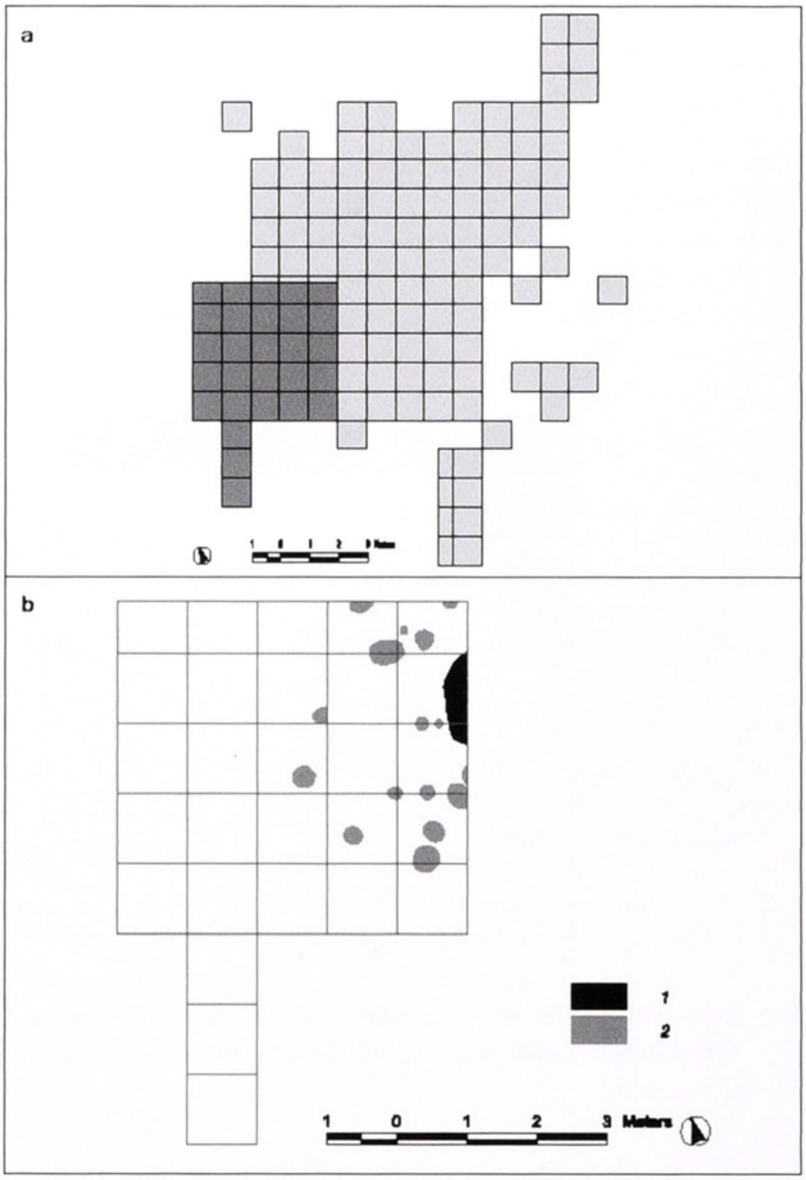

Figure 2: a) Grub/Kranawetberg, trench 3/C: excavations 1995 to 2002 (dark grey: analysed area), b) Features in 1995 and 1996 area (1. hearth; 2. pit) (Graphic: P. Nigst).

3. Analysed area and material

The studies presented here are restricted to the *Hauptkulturschicht* (main cultural layer) in the south-western corner of Section 3/C (see Figure 2a). The author conducted M.A. thesis research on intrasite spatial patterning of this area (Nigst 2003).

The quadrants selected for analysis were excavated in 1995 and 1996 and cover an area of 26.75 m^2 to the west of hearth I. Hearth I (its western part was excavated in 1996, the eastern part in 1997) was constructed by digging out a shallow pit approximately 10 cm deep and 90 cm in diameter (in the later burning phases the hearth grows a little bit in diameter). The hearth seems to have been used several times; at least 4 phases are clearly separated by sterile, approx. 2 to 3 cm thick loess layers. Sediment below the first burning phase of the hearth and between the phases shows effects of a burning fire such as the reddish coloration. Beneath the loess layer separating phases I and II, there was a well preserved ash layer.

Besides the hearth there are 16 pits present. All pits are grouped around the hearth as shown in Figure 2b. As mentioned above, none of the hearth-to-pit distances exceeds 2.5 m. Some of the pits could be related to the construction elements of a dwelling, as suggested by W. Antl-Weiser (Antl-Weiser 1999, 24; Antl-Weiser and Teschler-Nicola 2000-2001, 202).

Thousands of finds have been excavated in the area selected for analysis. About 2,300 of them were recorded by individual coordinates; the others (< 5 mm) were recorded by Quadrant (1 x 1 m) through wet sieving of the sediment. In this part of analysis only single measured finds are used. The author's database includes 1,592 lithic artefacts, 271 bones or bone fragments, 194 non-siliceous stones, 216 tiny pieces of ochre, red ochre and limonite and 79 more finds consisting of pieces of charcoal, molluscs and pieces of burnt clay, making a total of 2,352 finds (see Figure 3).

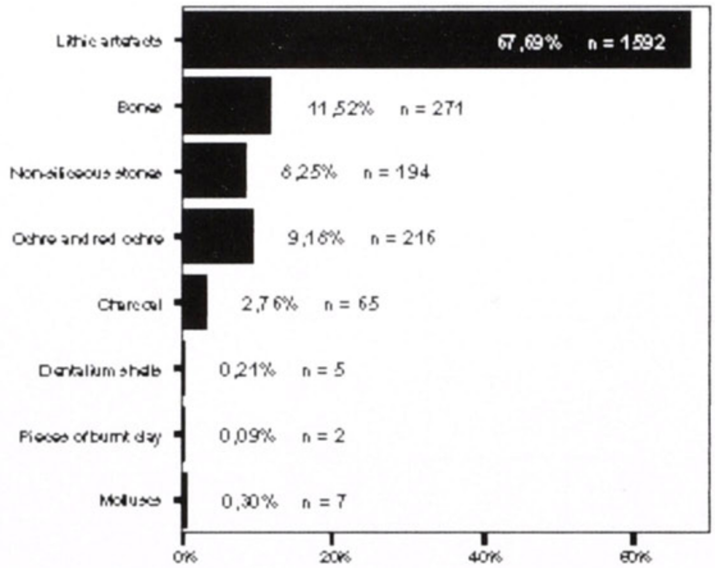

Figure 3. Grub/Kranawetberg, trench 3/C, 1995 and 1996 area: Find categories of all finds recorded by individual coordinates (n = 2,352).

The database is formed by the excavation documentation (field drawings and find protocol) and further data of the lithic artefacts recorded by the author (raw material, patina, cortex, size and weight, fragmentation, type of blank, type of modification).

4. Methods

There are many different approaches to intrasite spatial analysis. The author employs a type of site structural approach. The site structuring is described by analysing the association between *structures évidentes* and *structures latentes* sensu Leroi-Gourhan (1972, 325), the relation between habitation features (the evident structures; e.g. hearth, pits) and patterning in the distribution of material culture remains (latent structures). In a way, this approach is also feature oriented.

Intrasite spatial analysis presented here is the first step in the author's approach (see Nigst 2003, 33) and consists of mapping find quantities per grid cell and comparing the distribution maps of different find categories. This analysis' goal is to acquire an idea of the general spatial patterns and the human behaviour that shaped them.

The method used in this paper consists of mapping find quantities by using equidistant group intervals (for discussion see Cziesla 1990). This is done by calculating the number of finds per grid cell; in the current analysis 50 x 50 cm grid cells and 5 or 6 groups are used. The equidistance ***d*** is determined by dividing the number of finds in the grid cell with the maximum of finds ***n*** by the number of groups ***g***:

$$\mathbf{d = n / g}$$

The groups are calculated as follows: group 1 = {1 to d}, group 2 = {(d+1) to 2d} and so on (see Table 1 for an example with six groups). Circles with linear increasing diameters are used as cartographic symbols.

group 1	1 to d
group 2	(d + 1) to 2d
group 3	(2d + 1) to 3d
group 4	(3d + 1) to 4d
group 5	(4d + 1) to 5d
group 6	> 5d

Table 1. Example with six groups: Group calculation for mapping find quantities by using equidistant group intervals.

All analysis is done within a Geographic Information System (GIS), which is used as an analytical tool (Burrough and McDonnell 1998, Gaffney and Stancic 1991, Wheatley and Gillings 2002): A GIS meets all requirements for recording, storage, transformation and analysis of georeferenced data. Spatial data analysis as well as interpretation and visual presentation of analysis results are done within a GIS.

The GIS-software ArcView GIS 3.2a with SpatialAnalyst and 3DAnalyst is used, extended by scripts or extensions written by the author or third-party-solutions available over the World Wide Web.

5. Some spatial patterns

A map of the distribution of the entire find assemblage displays a dense concentration of finds in the eastern part of the analysed area around the hearth (see Figure 4a). In this dense concentration the number of finds per grid cell reaches 92. The distribution seems to radiate from the hearth. At a distance of 2.5 to 3.0 meters from the hearth, the find density drops to a very low value. In this western part none of the grid cells contains more than 15 objects.

In order to explore this pattern in detail, the distribution of different find categories (lithic artefacts, bones, non-siliceous stones and pieces of ochre, red ochre and limonite) will be examined.

About 68% of the single measured finds are lithic artefacts consisting of all categories of debitage, many of the pieces are tiny chips. The distribution of the lithics (see Figure 4b) more or less mirrors the distribution of the entire assemblage. There seems to emerge a certain pattern in the distribution: in close vicinity to the hearth the distribution shows a dense concentration of lithic artefacts. There are some grid cells with about 60 lithic artefacts. Beyond this concentration artefact density seems to drop a little bit, while at a distance of 2 to 3 m from the hearth there are again areas of lithic concentrations

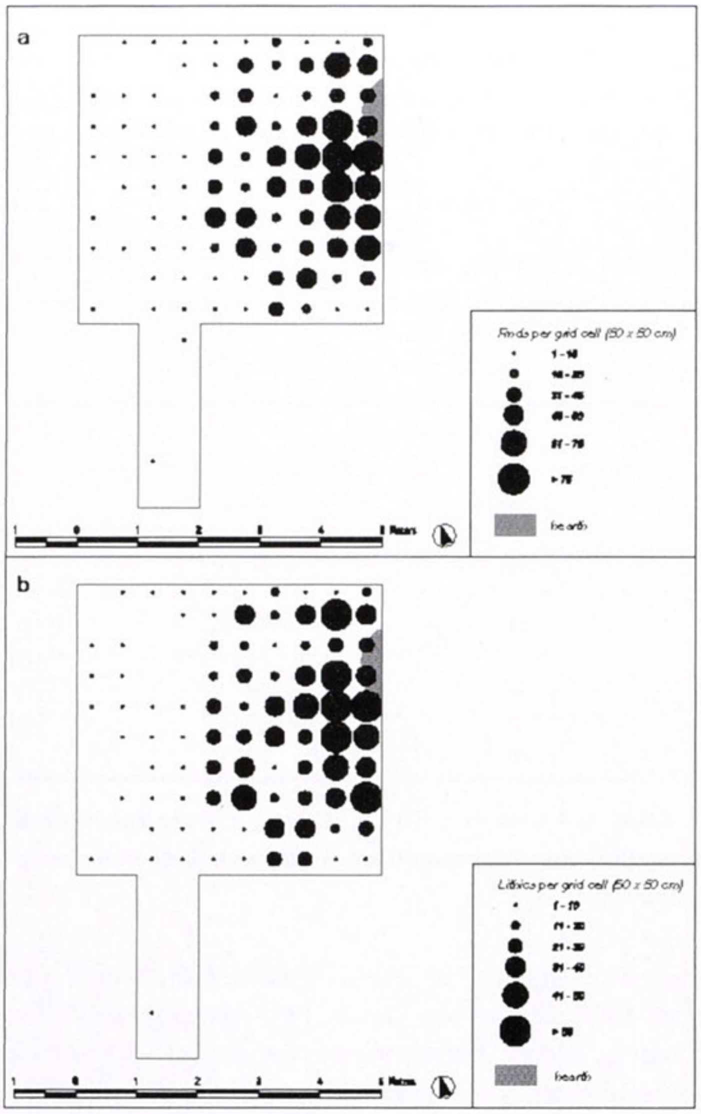

Figure 4. Grub/Kranawetberg, trench 3/C, 1995 and 1996 area: Distribution of (a) finds per grid cell (50 x 50 cm) and (b) lithic artefacts per grid cell (50 x 50 cm) (Graphic: P. Nigst).

(up to 41 lithic artefacts per grid cell). In the western part of the analysed area (= beyond the distance of 3 m from the hearth) the density drops to no more than 10 lithic artefacts per grid cell. This pattern could be the result of dumps at a distance of 2 to 3 m from the hearth, post-depositional processes or an accumulation of lithic artefacts against some kind of wall belonging to a dwelling.

Bones and bone fragments show a different distribution compared to lithic artefacts (see Figure 5a). The only common pattern is that the distribution of bones radiates out from the hearth; here this pattern is even more evident than among the lithic artefacts. The plot displays a dense concentration of bones around the hearth with up to 55 bones/bone fragments per grid cell. This corresponds well to a *drop zone* sensu Binford (1978). Many bones are highly fragmented into small pieces and can be interpreted as refuse from food preparation and consumption and/or crafts activities in close vicinity to the hearth (Fladerer 1997).

Ochre, red ochre and limonite are limited in their distribution to the eastern half of the analysed area (see Figure 5b). In the western part there is not one single measured piece of ochre, red ochre or limonite present. The distribution in the eastern part is very inhomogeneous: In some grid cells we can count 9 or

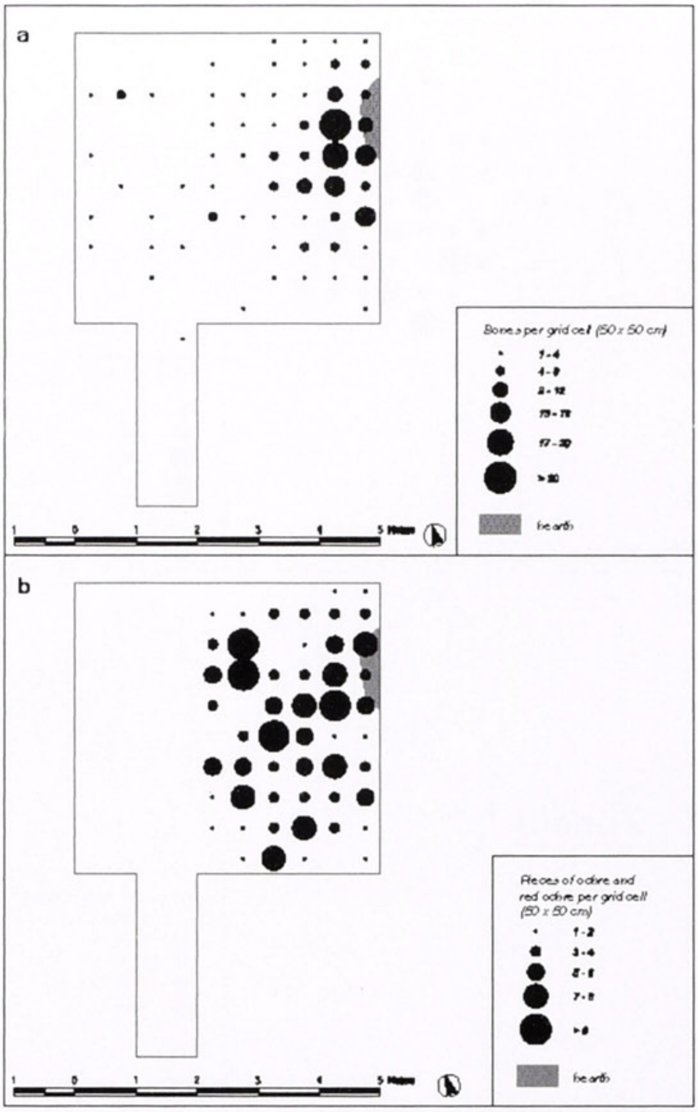

Figure 5. Grub/Kranawetberg, trench 3/C, 1995 and 1996 area: Distribution of (a) bones per grid cell (50 x 50 cm) and (b) ochre, red ochre and limonite per grid cell (50 x 50 cm) (Graphic: P. Nigst).

10 pieces. In contrast to the patterning among the lithics and bones, there seems to be no clear association between the hearth and the distribution of ochre, red ochre and limonite.

The distribution of the non-siliceous stones is displayed in figure 6a: The "richest" grid cell contained 10 non-siliceous stones. The majority of the non-siliceous stones were recovered in the eastern part of the analysed area, with an inhomogeneous concentration in the southern part. A concentration around the hearth is not as evident as among the lithic artefacts or bones.

6. First preliminary interpretation

From the patterns described above, two zones emerge: Zone I and Zone II (see Figure 6b). The area covered by each zone is nearly the same, but the number of single measured finds in each zone is quite different: The average number of finds per sq. m. in Zone I is more than 13 times that of Zone II (see Table 2). Zone I is characterized by a dense concentration of lithic artefacts, with more than 90% of all lithics located within this zone. Internal distribution of lithic artefacts in this zone was described

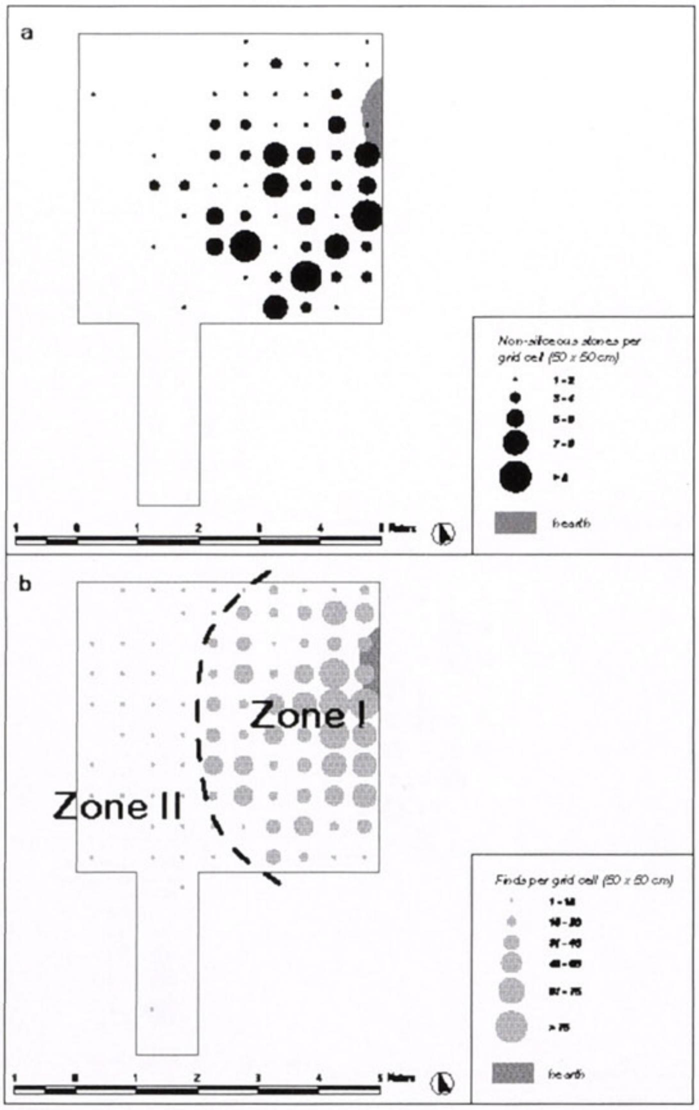

Figure 6. Grub/Kranawetberg, trench 3/C, 1995 and 1996 area: (a) distribution of non-siliceous stones per grid cell (50 x 50 cm), (b) location of Zone I and Zone II (Graphic: P. Nigst).

above. Further, most (again more than 90%) pieces of bone and nearly all pieces of ochre, red ochre and limonite can be found in Zone I. On the contrary, within Zone II only 6 (or 2.8%) out of 216 pieces of ochre, red ochre and limonite, and only a few bones (about 9.1%), non-siliceous stones (about 7,7%) and lithic artefacts (about 6,8%) have been recovered (see Table 3).

As a first preliminary interpretation, we can assume that Zone II is a periphery area of a settlement, with only a few remains. Zone I could represent a part of some kind of dwelling structure. As mentioned above, distribution of the lithic artefacts could give a hint to this interpretation, but other explanations of the lithic distribution pattern are possible and have to be tested (see Nigst 2003). Furthermore, the limited spread of pieces of ochre, red ochre and limonite could help to locate a possible dwelling: concentrations of ochre/red ochre in dwelling structures is a known pattern from other Upper Palaeolithic sites ((e.g. Gönnersdorf, Konzentration I (Bosinski 1979) and Pincevent, habitation 1 (Leroi-Gourhan and Brézillon 1966)). Finally, the distribution of the pits seems to support this "dwelling hypothesis."

	Area in m^2	Number of finds	Finds per m^2
Zone I	13,17	2194	166,59
Zone II	13,58	158	11,64
total	26,75	2352	87,93

Table 2. Zone I and Zone II: area in sq. m., number of finds and average number of finds per sq. m.

The author wishes to stress the preliminary character of this interpretation. More detailed analyses, especially piece plotting, spatial plotting of different raw material clusters to get an idea of the settlement history and site formation, application of *Ring and Sector method*, refitting analysis of lithics and other find categories have to be conducted on the spatial patterning of Grub/Kranawetberg in order to verify or disprove this interpretation. Some of these analysis methods are currently carried out as part of the author's M.A. thesis research (Nigst 2003).

	Zone I			Zone II			total
	Number	% find category	% Zone I	Number	% find category	% Zone II	
Lithic artefacts	1484	93,22	67,64	108	6,78	68,36	1592
Bones	249	91,88	11,35	22	8,12	13,92	271
Non-siliceous stones	179	92,27	8,16	15	7,73	9,49	194
Ochre, red ochre and limonite	210	97,22	9,57	6	2,78	3,80	216
Charcoal	59	90,77	2,69	6	9,23	3,80	65
Dentalia	4	80,00	0,18	1	20,00	0,63	5
Molluscs	7	100	0,32	0	0	0	7
Burnt clay	2	100	0,09	0	0	0	2
total	2194	93,28	100	158	6,72	100	2352

Table 3. Representation of the find categories in Zone I and Zone II.

7. Acknowledgements

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The author thanks Prof. Dr. Gerhard Trnka for discussions. The critical remarks of Dr. Walpurga Antl-Weiser, Mag. Iris Ott and Dr. Monika Derndarsky improved my work a lot. I have benefited from extended, not always archaeological conversations with a number of people, notably Mag. Bence Viola, Dieta Svoboda, Herbert Böhm and Lorenz Nigst. Further many thanks to my parents, Monika and Dr. Peter Nigst, for emotional and financial support. Finally many thanks to Ernest Jilg, who corrected my English.

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MICROWEAR ANALYSIS AND CURATED TOOLS: GRUBGRABEN AL I, A CASE STUDY

M. Derndarsky

Abstract

The results of micro-wear analysis of lithic artefacts from a site are often transformed into "work at this site" and "activity areas". In this study, the use-wear traces from selected tools from the Epigravettian site of Grubgraben, Lower Austria, demonstrate a more complex human behaviour. The wear features indicate that the retouched tools were resharpened after their last use, which favours the theory that they were not discarded on the activity areas themselves. Overlying burin facets point to an intensive use of the examined tools and to a curated technology.

KEYWORDS: lithic use-wear, Grubgraben, Epigravettian, curation

1. Introduction

Archaeology's ultimate goal is to describe and explain past human behaviour. Micro-wear analysis of lithic artefacts is a useful method to help in this reconstruction. Often, this type of analysis results in tables stating how many artefacts of a site were used for a certain task such as scraping hide or whittling wood to demonstrate past behaviour on the site. A more complex behaviour will be shown by the results of the use-wear analysis of selected tools of Grubgraben, AL I.

In lithic technology, lithic artefacts are no longer seen as static implements just typical for a "culture" but as the products of production and selection of blanks, their modification, use, resharpening and transformation, re-use, possibly the transportation to another site and finally their discard, which might have occurred somewhere in this cycle (chaîne opératoire; cf. Figure 1). Thus, it has to be taken into account that the use-wear on the tools of one site might not reflect all the activities conducted there or display working processes, which had taken place elsewhere.

2. The terminus "Curation"

L.R. Binford (1973: 242f.) defined a curated technology as a technology "*in which a tool once produced is carefully curated and transported*". He assumed that more care would be taken when producing tools to be used for a long time, and that tools would be discarded in terms of their estimated utility for future use. However, the production of most lithic artefacts - including the tools discussed here - can neither be regarded as very time-consuming nor as overly difficult. An explanation for curation of such tools could be scarcity of high quality raw material or personal preferences of the tools users. During the nineties different aspects of this term have been applied (Odell 2001) and thus the use of the term "curation" has been criticised for the lack of standardised use (Nash 1996). Here, the term "curated" is applied to individual tools (as in Shott 1996), which do show clear traces of resharpening and thus of curation.

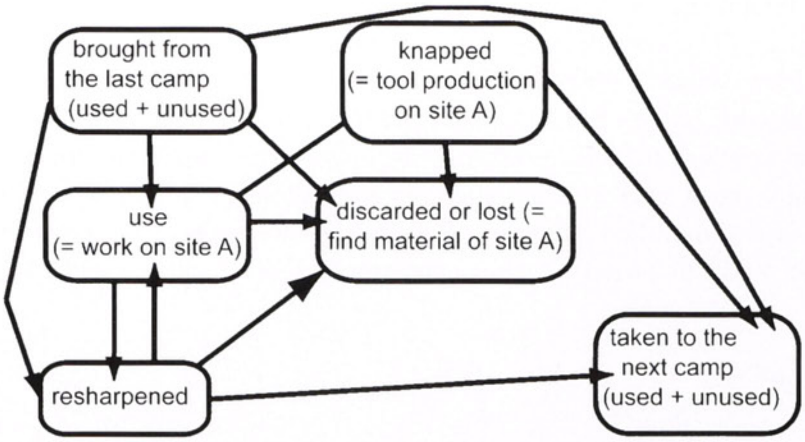

Figure 1. Relations between tool production, tool use and the lithic find material on a site.

3. Grubgraben AL I

3.1. The site

The Epigravettian site of Grubgraben, VB Krems, Lower Austria, is located 15 km to the north of the Danube, east of a NE-SW running "Hohlweg" (sunken road). The site is known since the end of the 19th century and due to exposed profiles the existence of several archaeological layers was known. In 1981 A. Montet-White, University of Kansas, started a project to examine the late Gravettian settlement of the area and started excavations in Grubgraben in 1986-87 (Montet-White 1990a). The excavations were continued in 1989/90 by A. Montet-White and F. Brandtner (Brandtner 1990), then in 1993/94 by F. Brandtner. The description of the site and the find material is limited to the earlier excavations, since detailed information about the later investigations has not been published yet.

Five archaeological layers were detected, dating to the Epigravettian. This study deals only with finds from the uppermost archaeological layer (AL I). This layer (AL 1) was apparently limited to the surroundings of the excavation, where a concentration of sandstone and gneiss as well as a small number of artefacts and bone fragments could be found. Approximately 92 m² were excavated until 1990. This layer seemed to represent two settlement periods, separated by a thin loess layer (Haesearts 1990, 20-27; Montet White 1990b, 47-60; Montet-White and Williams 1994; Williams 1998, 9f.). A radiocarbon date, derived from bones, dates AL 1 to 16.800 +/- 280 (Lv-1825; Gilot 1997, 91).

3.2. The lithic find material

On the site, artefacts made of different raw materials were found. Fine-grained flints resembled in their mineralogical composition the raw material of Maków and Stránská skála. The radiolarites had in part parallels with those from the Váh basin (Pawlikowski 1990, 103). 3% of the artefacts in AL 1 were made of quartz (Montet-White 1990c). In AL 1, burins were the most frequent tool type, followed by endscrapers, backed bladelets and marginally retouched tools (Williams 1998, 46). Only a few selected tools were provided for this analysis by the late excavator F. Brandtner, information about the site and the find material was not made available.

4. Methods

For the use-wear analysis, both high power analysis and low power analysis were used (cf. e.g. Keeley 1980, Kamminga 1982, Anderson *et al.* 1993, Juel Jensen 1994) and the features detected were compared to experimentally used artefacts made of similar raw materials (cf. e.g. Derndarsky 1997, 2001; n.d.). The archaeological artefacts were cleaned with mild detergent and distilled water in the ultrasonic tank. They might have been cleaned with hydrochloric acid by the excavators earlier. The microscopes used were a stereomacroscope (Nikon SMZ-U, magnification: 7.5-75X) and a metallurgical incident light microscope (Nikon Epiphot, 10X, 20X and 40X objectives used). The colour photos taken under low magnification were scanned and thereafter processed with Adobe Photoshop 5.0, i.e. I substituted black for the background and modified brightness and contrast to improve the visibility of the features in the images. Afterwards the pictures were converted to grayscale and a scalebar added.

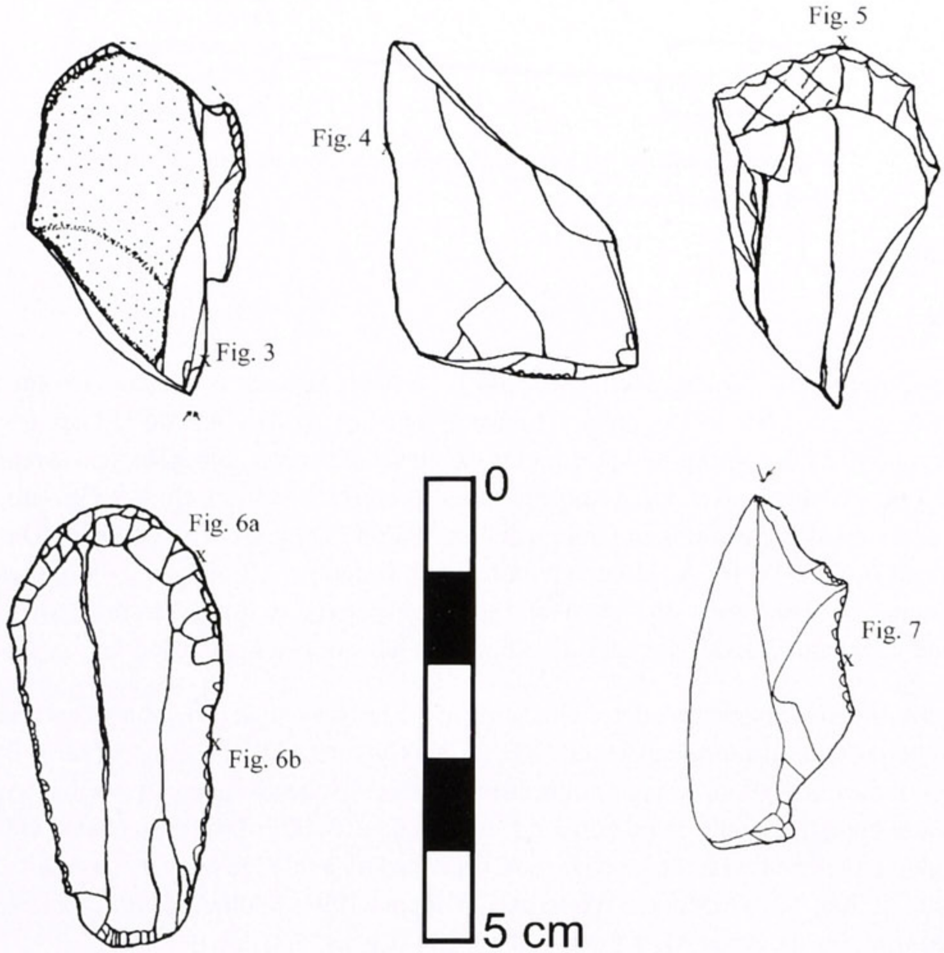

Figure 2. Lithic artefacts from Grubgraben, AL I.

The preservation of lithic artefacts corresponds to the other Palaeolithic loess sites in this area: The majority of the fine-grained flints of Grubgraben displayed white patina. This frequent occurrence of patina indicates that it has to be assumed that most use-wear polishes have weathered away or changed their original appearance (for post-depositional alterations of polishes see Plisson and Mauger 1988; Levi Sala 1996), even on the radiolarites, which are not or only lightly patinated. Apart from some pieces showing the traces of a strong impact, clear scarring and/or rounding can be found on many dorsal ridges, suggesting that such damage at the edges cannot be attributed automatically to use. Due to this post-depositional surface and edge modifications the exact use of individual artefacts cannot be reconstructed but only reoccurring traces (Yamada 2000; 39f.).

5. Results of the analysis of the selected tools of AL 1 (Figure 2)

5.1. Burins

Sides of burin facets were generally often used for smoothing a rather hard material (Juel Jensen 1988, 72; cf. e.g. the microwear traces of Temnata Cave, see below). This kind of use results in scarring of the rather steep edge, but does often not produçe use-wear polishes on radiolarites, which would be recognisable on archaeological artefacts. Thus, results could in this case only be achieved with low power analysis.

Eight artefacts with one or more burin facets were examined. Resharpening, which could be seen by burin facets overlying older ones, was detected frequently. Edge scarring was found only on the "older" burin facets and stopped, where they were overlaid by a "younger" facet (Figures 3-4). A burin displayed some rounding on the retouched longitudinal edge and scarring on the older burin facet, while the recent burin facet was fresh. Thus, the tools seem to have been used several times, and before the creation of the first burin facet a retouched edge could have served the same purpose. On long burin facets, where no resharpening could be recognised, no edge-scarring could be seen. These intact youngest facets also confirm the interpretation of the scarring as use-induced - or at least as older than the resharpening of the tools.

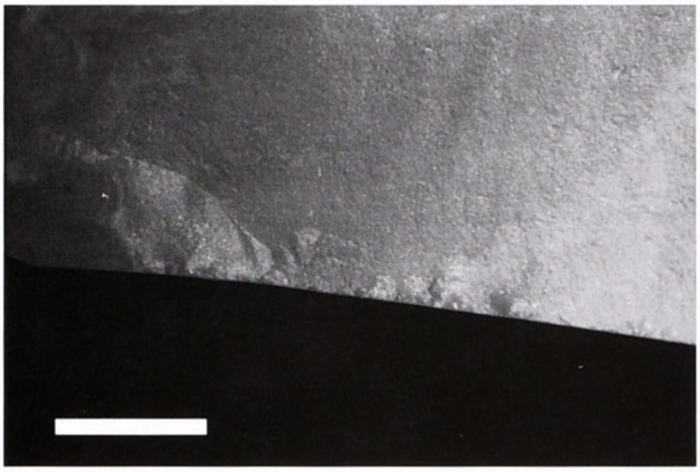

Figure 3. Edge scarring up to the youngest burin facet (Magnification: 15X, scale bar: 2 mm).

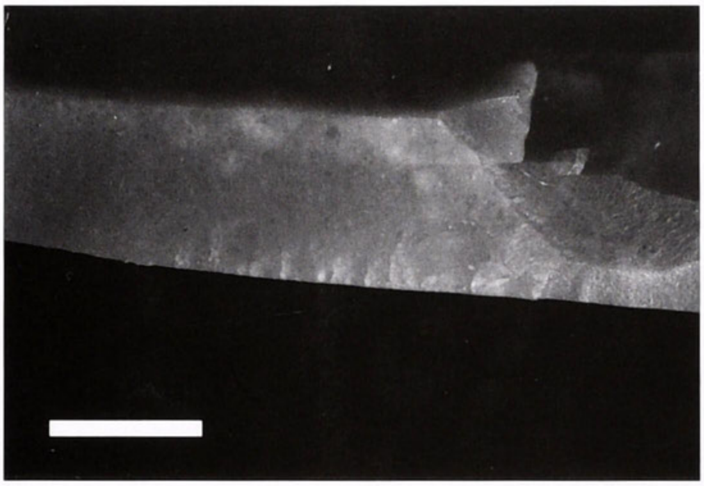

Figure 4. Flat regular scars along the edge, interrupted by the youngest burin facet (Magnification: 15X, scale bar: 2 mm).

5.2. Scrapers

On all of the three examined "short scrapers" a clear rounding of the scraping edge was visible under low magnification and striations could be noted when the tools were examined under high magnification (Figure 5), while the endscrapers on longer blades displayed no rounding. With exception of rounding, often interpreted as an indication of the treatment of hide, processing harder materials results in edge scarring. Such scarring can hardly be discovered on the retouched edges. However, on the examined long scrapers the edges seem to be sharp. Thus, the interpretation could thus be that:

- the longer scrapers were used for a material that does not leave any clear macroscopic traces on retouched edges like fresh skin or wood. The use of shorter artefacts for scraping hide could be compared with the choice of tool use at the Late Palaeolithic site of Abri Pont d'Ambon where the hide scrapers were on average shorter than the wood and bone scrapers. Even the wood and bone scrapers there seemed to be resharpened, compared with the length of the used unmodified blanks (Célérier and Moss 1983).

- they were not used

- they were resharpened.

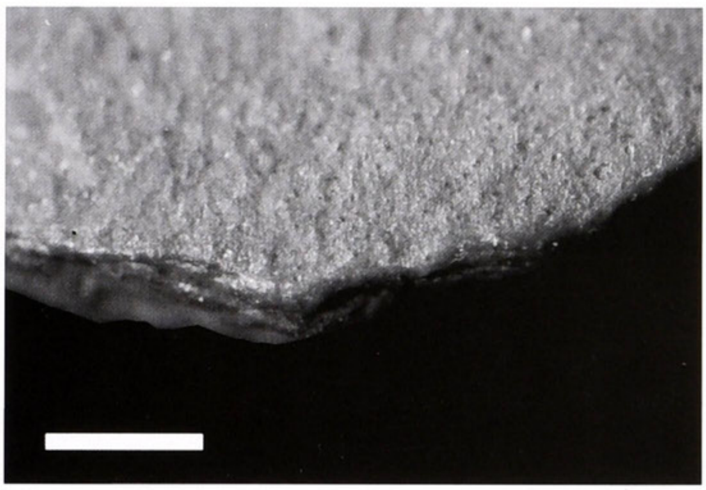

Figure 5a. Clear edge rounding under low magnification (Magnification: 30X, scale bar: 1 mm).

Figure 5b. Same area, rough polish and striations (Magnification: 200X).

On two long scrapers a small area with polish and striations could be found (Figure 6a), where less retouches were noticed. These could be the remains of use-wear traces produced before the resharpening. The difference in the wear traces on the longer and shorter scrapers could indicate that the longer scrapers were resharpened because they were still regarded as useful tools, i.e. they were curated, or because a sharper edge was necessary for the use of these tools.

5.3. Others

On a zinken parts of the concave retouched edge were rounded, i.e. it seems to have been used rather for smoothing than for drilling'. Since the centre section of the retouched edge did not display any wear traces, also this piece seems to have been resharpened. On most of the examined artefacts more than one edge seems to have been used. Retouched edges on the burins displayed use-wear and longitudinal edges on tools made of blades exhibited very continuous scarring and striations along the edges (Figure 6b). Even very short edges were used for cutting (Figure 7).

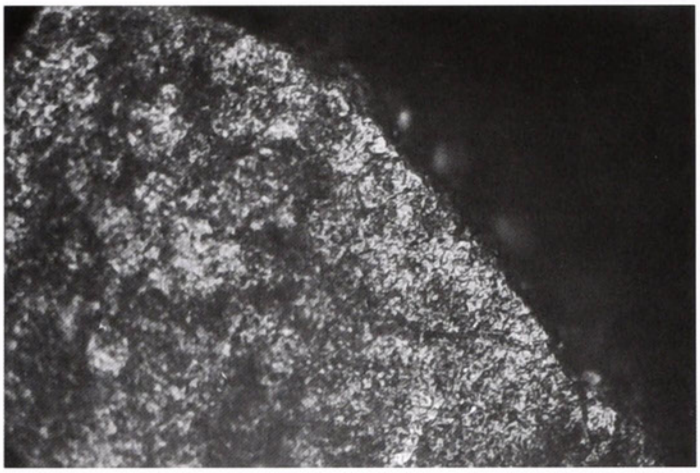

Figure 6a. Small polished area with striations on long scraper (Magnification: 200X).

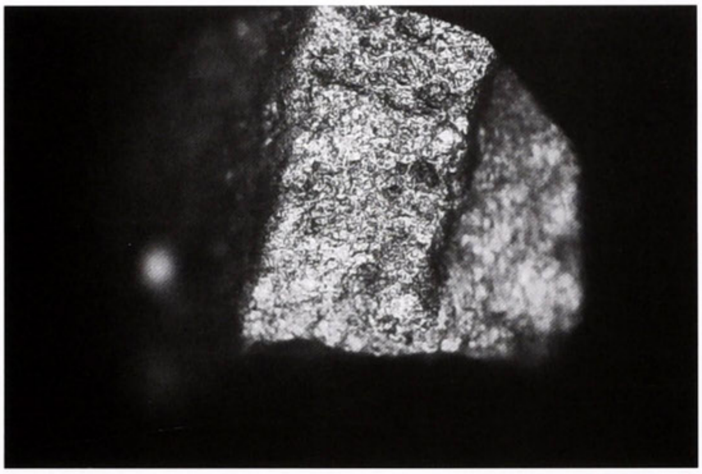

Figure 6b. Polish and fine striations parallel to the edge (Magnification 200X).

6. Comparisons (Figure 8)

6.1. Results of the microwear analysis of other Epigravettian Sites

The Epigravettian site Rosenburg, Lower Austria, which was dated by a radiocarbon date to 20.120 +/- 480 (Lv-1756; Gilot 1997, 91), yielded mostly small and unretouched artefacts. The tool types consisted mainly of backed bladelets and backed points (Ott 1996). Thus, the edges of most tools could have been used only until they became blunt. Use-wear traces can be found on the raw material types which seemed to have been knapped at the site, as well as on those which might have been transported to the site as blanks (Derndarsky 1997). The technological analysis as well as the use-wear analysis indicated that this site was a shortly visited camp where few activities took place - if the majority of the curated tools was not carried away.

Figure 7. Polish and striations parallel to the short working edge (Magnification: 200X).

Also, on the site Saint-Antoine à Vitrolles, locus 2 (Hautes-Alpes, France), which is dated to the evolved Epigravettian on basis of the lithic artefacts, the backed bladelets - here the microgravette points - were the most frequent tool type. The number of artefacts amounted to more than 70.000. This site seems to have been visited several times. Micro-wear analysis indicated activities connected to hunting and hide processing (Gagnepain *et al.* 1999).

Micro-wear analysis of "pointes à cran" from the Early Epigravettian sites, Grotta di Paina and Grotta Paglicci, Italy, displayed edge scarring on these pieces, which are characteristic for use as projectiles (Broglio *et al.* 1993).

Most of the archaeological layers of Temnata cave, Bulgaria, were regarded as a base camp. The scrapers of the Gravettian and Epigravettian layers were used mainly for working hide but to a minor extent also for working wood and bone. The burins, however, were nearly exclusively used for wood and bone working (Giourova and Schtchelinski 1994, 164).

Orfej I, Eueura (Rhodope mountains, Bulgaria) is also dated on the basis of lithic artefacts to the "Tardigravettian" (19.000-15.000 BC) and interpreted as a seasonal base camp. Among 298.986 artefacts, 297 "tools" were found, microgravette points and small backed tools being the most frequent. According to the microwear analysis conducted by M. Gurova, most of the tools were used, about a fourth of them polyfunctionally. Few of the sample of unretouched artefacts, however, displayed traces of use, still ca. one sixth of these polyfunctional traces (Gyourova 1998b). The frequent use of modified tools resembles the situation in Grubgraben AL I.

6.2. Other analyses

P. Vaughan (1985) detected that many of the used parts on burins from the Magdalenian sites of Andernach 2 and Zigeunerfels in Germany and Cassegros, France, were not the sides of burin facets or the burin tips themselves. The burin impact interrupted the use-wear traces at the edge in Andernach more frequently than use-wear traces occurred in connection with the burin facet (51 resp. 6+15 used zones) - or use-wear traces could be found on another edge of the tool. Also at Cassegros, the use-wear traces were interrupted by burin blows but the burin tips or burin facets were used more frequently (3: 1+6). Thus, it could be argued that the burins in South Germany and Austria were re-used more intensively than in France, which might be due to the availability of high quality raw material.

On the Epigravettian site Piekary IIa, Kraków area, the frequency of modified tools was unusually high (9.3-12 % of ca. 1600 artefacts). On the basis of refitting it was assumed that the tools were produced and resharpened on the site (Morawski 1981, 68). The most frequent tool type were burins, also burin spalls occurred in high numbers (up to 21%). That gave rise to the question whether the burin spalls really were the result of resharpening or whether they replaced bladelets (Kozlowski 1998, 799). According to W. Morawski (1981, 70) the analysis of the burins and burin spalls showed "*that both classes correspond to each other in all respects. The spalls found here originate from the production and conversion of burins left behind by previous users. On the other hand, burins were generally not removed from the workshops, at least not in large numbers.*"

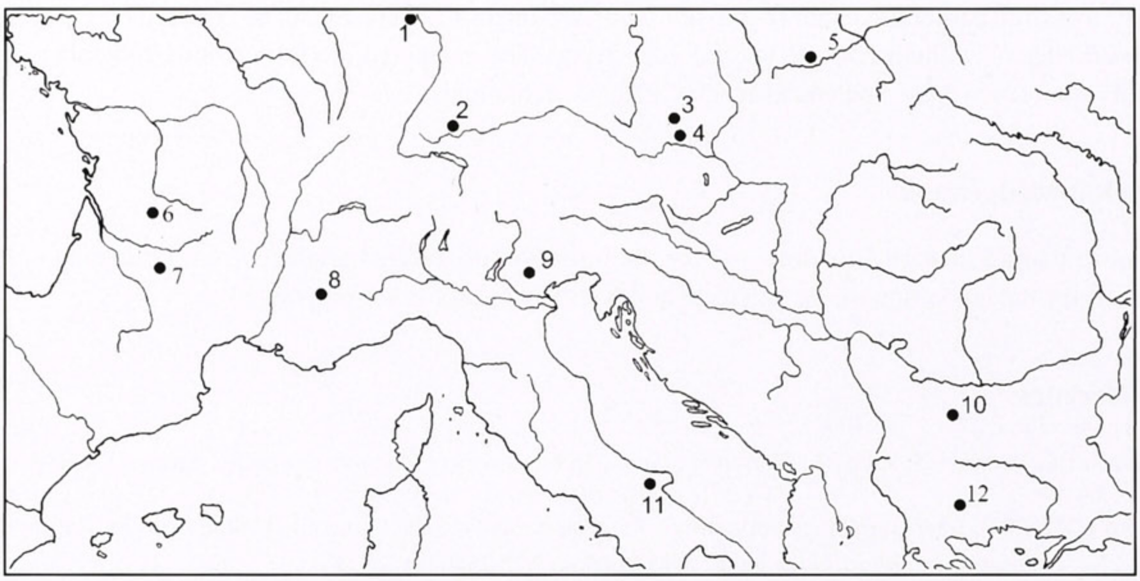

Figure 8. Late Upper Palaeolithic sites mentioned in the text (1:Andernach; 2: Zigeunerfels; 3: Rosenburg; 4: Grubgraben; 5: Piekary; 6: Pont d'Ambon; 7: Cassegros; 8: Saint-Antoine à Vitrolles; 9: Grotta di Paina; 10: Temnata; 11: Grotta Paglicci; 12: Orfej).

7. Discussion and conclusions: Behaviour patterns in Grubgraben

The repeated occurrence of edge scarring up to the youngest burin facets and the lack of edge scarring on them indicates clearly a certain pattern of use, i.e. repeated use and resharpening after the last use. Even though scrapers could have been used without the occurrence of use-wear traces, the presence of rounding *and* polishes on the short scrapers and their absence on the longer scrapers point to the same behaviour pattern, namely resharpening of those tools which still seemed suited for further use.

Thus, the example of the artefacts from Grubgraben can demonstrate that use-wear traces cannot be converted to "work on the site" without further discussion. Since many of the artefacts in Grubgraben seem to have been resharpened after the last use instead of being thrown away directly, which means that they were curated for future use, it seems unlikely that they were discarded on the activity area itself but it is more likely that the tools were left only when the site was abandoned, or that the tools might have been lost somewhere during the ongoing settlement period. Therefore, it cannot be argued that the distribution of the artefacts here corresponds to the original activity areas. From ethnographic parallels it is well-known that tools were often repaired or used for other purposes wherever possible, instead of being left on the original place of use (Binford 1978, 334-351).

The results of the spatial analysis of AL 1 accord with those of the micro-wear analysis: According to A. Montet-White and J. T. Williams (1994, 133f.) the ratio of burin spalls to burins amounts from 3: 1 to 4: 1 in some areas, which is a further indication for the repeated use of the tools. The burins were concentrated west and northwest of the burin spalls. Since the burins could not be refitted with the burin spalls, it was assumed that "*individual burins were not discarded in the area where they were made or sharpened*" (Montet White and Williams 1994, 134).

The intact appearance of burin facets and scraping edges could lead easily to the assumption that these tools were not used and that they therefore were of less importance for the working processes than simple flakes with clearly blunted edges. While unretouched edges can have been used only once, until they had become too blunt, modified edges can have been used repeatedly, without recognisable use-wear traces from earlier use phases being left. Thus, the intensity of use cannot be deduced by the number of "used edges", without considering the edge types. The examined artefacts from Grubgraben AL I point to an intensive use and an extremely "curated technology".

8. Acknowledgements

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THE GRAVETTIAN OCCUPATION OF THE UHERSKÉ HRADIŠTĚ AREA

P. Škrdla

Abstract

The aim of this paper is to present one of the important and hitherto little known Gravettian microregions. In addition, this paper provides preliminary information about an ongoing project of the Grant Agency of the AS CR, focusing on the Paleolithic occupation of the Uherské Hradiště area.

KEYWORDS: settlement pattern, Gravettian, Uherské Hradiště area

1. Geography

The Uherské Hradiště area lies halfway between the Dolní Věstonice-Pavlov microregion (approximately 65 km to the southwest) and the Předmostí microregion (approximately 40 km to the north). In fact, the Uherské Hradiště area connects these two settlement microregions.

Using geographic coordinates, the region of interest is located as follows: latitude between 48°50' and 49°11' north, longitude between 17°15' and 17°35'east. In a current map, the region is bordered by the town of Napajedla to the north and Veselí nad Moravou to the south. Geographically, the Uherské Hradiště microregion represents the northern termination of the Vienna Basin (Carpathian intramontaneous Neogene Basin) known as the Lower Morava Valley. The Lower Morava Valley is flanked by the Chřiby Highland to the west and Vizovice Highland to the east. The highlands come closest to each other around Napajedla, where they form one of the most important passages in Moravia – the Napajedla Gate. The whole region is drained by the Morava River and its smaller tributaries. The Gravettian sites are located on the margins of the highlands within sight of the Morava River.

2. History of research

The history of Paleolithic research in this region may be divided into three main stages. The first stage, starts at the beginning of the twentieth century, is connected with the *"Starý Velehrad"* association. The association members and other interested individuals iniciated an intensive field survey of the region, and during World War II they reported several Paleolithic sites in their journal *"Sborník velehradský"*. Paleolithic finds from Velehrad (Zelnitius 1938, 16), Ostrožská Nová Ves (Hrubý 1940, 27; Horsák 1940, 93; Horsák 1941, 90, 92), Boršice u Buchlovic (Hrubý 1940), Mařatice (Skutil 1940, 59), Kunovice (Horsák 1941, 89), Derfle (yet Sady, Horsák 1942, 71), and Tučapy (Horsák 1942, 75) were published here. According to a recent critical analysis, only the finds from Ostrožská Nová Ves and Boršice may be dated to the Gravettian period. An isolated and sporadic salvage excavation was carried out in 1938 by Vilém Hrubý in Spytihněv. He excavated two concentrations of Paleolithic artifacts that were associated with bones and charcoal, and one osteological deposit. However, his stratigraphic observations are unclear, due to his lack of experience in Pleistocene geology and the circumstances of the rescue excavation on a new road construction. During World War II and later, Hrubý continued an intensive survey of the region, and published all recorded Paleolithic artifacts and Pleistocene faunal remains from the region (Hrubý 1951). In his article *"The Paleolithic Finds from the Uherské Hradiště Area"* (Hrubý 1951), he reported Paleolithic finds from more than 50 locations on the cadastral territories of 25 villages. The publication of this paper brings to a close the first stage of Paleolithic research - a period dominated by enthusiastic amateur archaeologists interested in prehistoric research in their region.

The second stage of Paleolithic research saw two salvage excavations and intensive surface surveys, carried out by a new generation of amateur archaeologists. The first salvage excavation was undertaken by Bohuslav Klíma in Boršice – "Chrástka". This site had been known since the beginning of the twentieth century and had been surveyed by several amateur archaeologists (Hrubý 1940, 1951). At the beginning of World War II, in 1939, Hrubý opened a small trench and uncovered isolated bones and artifacts (Hrubý 1951, 71). After World War II, František Kalousek chose this site for a systematic excavation. The results of this excavation were, however, negative. In the early sixties, a former employee of Institute of Archaeology, Bedřich Vyskočil discussed with Klíma concerning Paleolithic cultural layers disturbed by deep ploughing for a new vineyard. Klíma carried out a small-scale rescue excavation and one of his trenches (trench A) documented a cultural layer in situ. The trench A yielded a series of 258 artifacts in association with a small mammoth bone deposit and charcoal (Klíma 1964). Based on stratigraphy and artifact morphology, Klíma attributed the site to the Pavlovian, a classification that was confirmed 35 years later by ^{14}C dating (Svoboda 1999, 147). The second salvage excavation was carried out in Jarošov (which is today incorporated within Uherské Hradiště). During the construction of a new sporting area with an artificial skiing slope and tennis court, Rudolf Procházka and later Karel Valoch together with Luděk Seitl excavated two, probably separate concentrations of faunal remains (mainly mammoth) with isolated stone artifacts (Procházka 1983, Seitl and Valoch 1998). At the same time, surface surveys carried out by amateur and professional archaeologists continued. However, only finds collected by Vyskočil were systematically examined by Klíma, who deposited this collection at the Institute of Archaeology in Brno (the Gravettian site of Boršice – "Chrástka" and the Aurignacian site of Boršice – "code 331") and published a smaller collection from the site of Stříbrnice (Klíma 1972); the activities and collections of other individuals were not documented. Another surface collection was collected and published by Valoch from the site of Hostějov (yet on the boundary between the cadastral territories of the villages Osvětimany and Žeravice; Valoch 1985). Klíma (1952) and later Martin Oliva (1998) surveyed the region of the Napajedla Gate and reported a series of sites on the cadastral territory of the town of Napajedla (M. Oliva 1998, he mentions amateur archaeologists such as A. Koutný, M. Šnajdr, and dr. Králík). Generally, the second period of Paleolithic research is characterized by continuing surface surveys associated with two rescue excavations carried out by professional archaeologists.

The third stage of Paleolithic research begins in the early 1990, and it is connected with two projects. The first project was carried out by researchers of the Institute of Archaeology, AS CR, under direction of Jiří Svoboda (Svoboda *et. al.* 1995, 1999, 2000). As a part of this project, material from the eponymous site of the Pavlovian – Pavlov I – was published (Svoboda ed. 1994, 1997), a series of Gravettian sites was re-excavated, and collections from several other sites were reexamined. During the field surveys, the site of Jarošov II (Institute of Archaeology site - IA) was discovered, and because the stratified cultural layer had been disturbed by agricultural activities, the site was subjected to salvage excavation between 1996-2000 (Škrdla 1999b, 2001; Škrdla and Kruml 2000; Škrdla and Musil 1999; Škrdla and Lukáš 2000). Almost 20,000 stone artifacts, faunal remains, pieces of red ochre, and baked clay lumps were recorded. A final study and evaluation of these materials are in progress. Simultaneously, we checked all the known museum collections containing materials from this region (the Institute of Archaeology, AS CR, at Brno, the Slovácké museum at Uherské Hradiště, the museum in Zlín, the Moravian Museum in Brno) and initiated an intensive field survey of the region, with the aim of verifying and relocating previously identified sites and to locate new ones. The region under study was digitalized and a 3-D map was constructed. All currently published sites were identified in the field and located using in absolute

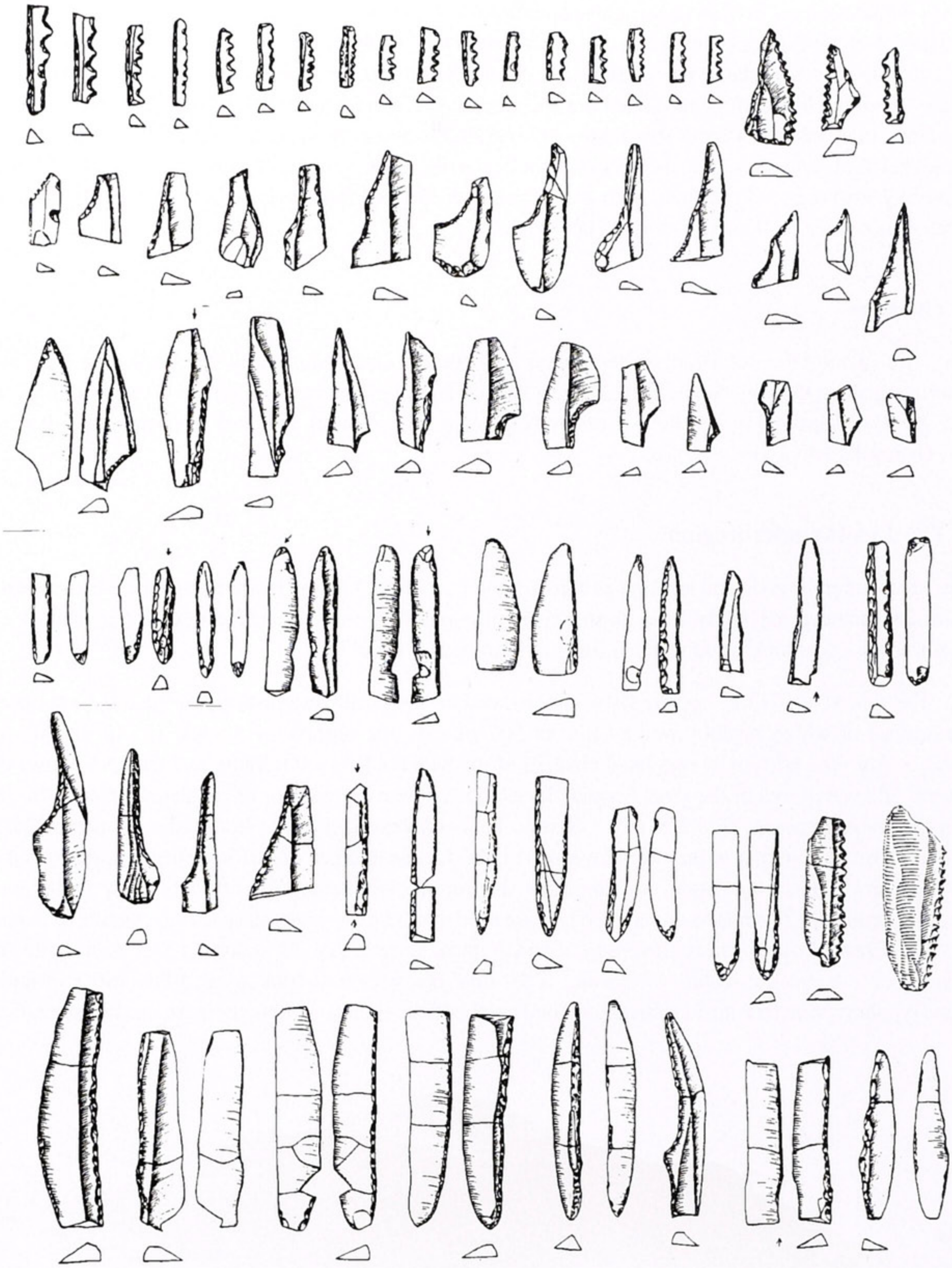

Figure 1. Jarošov II – IA site. Selected artifacts.

coordinates (using GPS). A minimum of 15 new sites were recorded, but only two small sites evidently belong to the Gravettian (Kněžpole – "Hrádek" and Spytihněv – "Duchonce"), the rest representing sites of the Morava-type Aurignacian and non-diagnostic collections. The project is in progress and will be completed in 2005 by a final monograph including materials from the site of Jarošov II accompanied by a catalogue of the related Paleolithic sites. A parallel project was carried out in the 1990´s by Oliva of the Moravian Museum, who carried out surface surveys in the area of Napajedla Gate and published the Gravettian materials from this region (Oliva 1998), however, with limited critical reanalysis of the earlier finds and sites, and, as a result, with is a series of inaccuracies. With the exception of Bořek Žižlavský who reported two sites from the cadastral territory of Buchlovice (Žižlavský 1999), no other amateur activities are known from this last stage.

3. The sites

The sites of the Uherské Hradiště settlement area form a chain, starting at the Napajedla Gate and continuing along the both banks of the Morava River. The settlement may be divided in two microregions (the Jarošov microregion and the Spytihněv-Napajedla microregion), and two isolated sites – Boršice and Ostrožská Nová Ves.

4. The Jarošov microregion

The sites within the cadastral territory of Jarošov and its vicinity form a cluster around the site of Jarošov II, which includes site IA and two faunal concentrations with isolated artifacts nearby, a smaller site of Kněžpole – "Hrádek", and isolated finds at Mařatice – "Kolébky".

The richest site is the Jarošov II-IA site, located on the northwestern slope of the hill Černá hora, the summit of which reaches an elevation of 302 m. asl. The altitude of the site is 245 m. asl., the distance from the artificially regulated channel of the Morava River is 0.5 km, and the spot allows the control of a wider area of the river basin as far as the southern entrance of the Napajedla Gate. The site was excavated between 1996-2000 by P. Škrdla. This excavation yielded a stratified collection of 2,020 artifacts over 1.5 cm in size that were inventoried in 3-D, and another 17,361 screened artifacts (smaller than 1.5 cm). The surface collection from this site consists of another 740 artifacts. Only preliminary data concerning the raw materials and typology are available. The raw material spectrum consists of mainly Krakow-Czestochowa Jurrasic flint (typical and atypical varieties, ca 80%), erratic flint, radiolarite and other silices. A specific feature of this site is the total dominance of backed microliths (90% of tools) in the typology, which is outside the range found in other Gravettian assemblages (perhaps this is the result

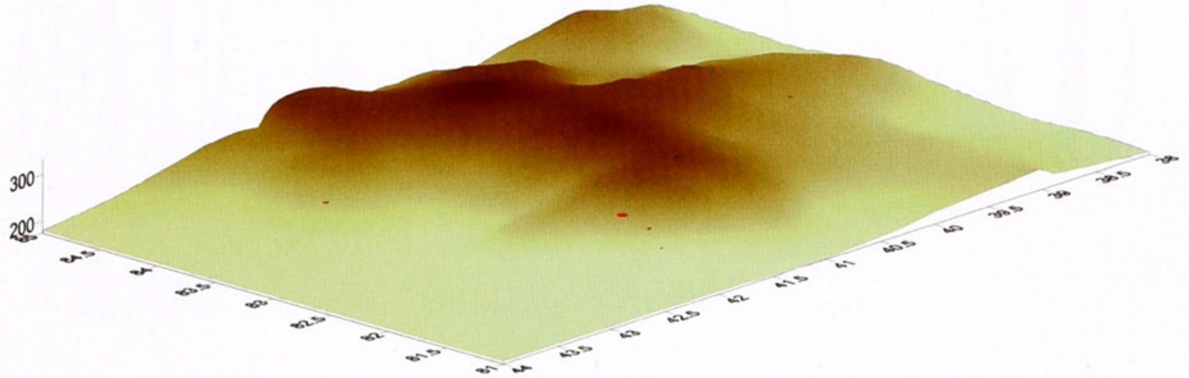

Figure 2. The location of sites in the Jarošov microregion. Scale in km.

of intensive wet screening). The analysis of faunal remains carried out by R. Musil is in progress. The remains are distributed over an area ca. 50 m in diameter and the site may be classified as a medium-sized locality.

Some 200 m to the south and ca. 20 m downslope from the IA site, two concentrations of faunal remains (mainly mammoth) were excavated (the distance between the two is 20 m), with isolated stone artifacts (Procházka 1983, Seitl and Valoch 1998). From these contexts, Procházka only found 4 artifacts and Valoch a further 8. However, neither the relationship between these two concentrations, nor their relationship to the IA site are clear. There are two possible hypotheses concerning the relation between the main site and the faunal remains. The first hypothesis predicts contemporaneity (as in Dolní Věstonice I and II or Předmostí) and the second one different age for the individual parts of the site. As a result, these two concentrations may either be described as specialized activity areas or areas of episodic settlement. Unfortunately, no datable samples from either Valoch's or Procházka's excavation are available, and the possibility of re-opening their excavations is limited because these areas were probably completely excavated. Recently, A. Verpoorte (personal communication 2003) dated a mammoth humerus fragment from Valoch's excavation. It provided a date about 2,000-3,000 years younger in comparison with the series of dates from the IA site (Table 1). However, the bone was stored without conservation for 20 years in a museum depository, and may be contamined. Therefore, in the summer of 2003, a small trench was carried out near the Procházka's earlier excavation in order to recover some new datable material.

The small surface site of Kněžpole – "Hrádek" is located on the north-facing crest of the slope of Rovnina Hill, the summit of which reaches an elevation of 336 m. asl.; the distance from the artificially regulated channel of Morava River is 1.5 km. This site yielded a collection of 28 artifacts made mostly of erratic flint (19 pieces), and radiolarite (7 pieces), one piece of porcelanite and one piece of silicificated sandstone with glauconite. The artifacts were sporadically distributed over an area 50 m in diameter, and the site may be classified as small-sized.

Three isolated artifacts were collected at Mařatice – "Kolébky", on the edge of a blind valley on the southern slope of Rovnina Hill. The altitude is 250 m. asl.; the distance from the artificially regulated channel of the Morava River is 3 km. The artifacts were sporadically distributed over an area with a diameter of 50 m and the site may be classified as an occasionally visited one.

5. The Spytihněv-Napajedla microregion

Within the cadastral territory of Spytihněv and Napajedla there are ca. 10 sites located on the eastern slopes, for 5 km bordering the right bank of the Morava River inside the Napajedla Gate. In the following paragraphs, the sites are described from south to north.

In 1938, Hrubý carried out a salvage excavation at a new road construction site in Spytihněv. He documented three findspots at the foot of a hill, the summit of which reaches an elevation of ca. 300 m. asl. The altitude of these findspots lied in about 188 m. asl.; the distance from artificially regulated channel of the Morava River is 100 m, and their locations allow the control of the southern entrance of the Napajedla Gate. Two findspots, with stone artifacts and faunal remains, were located in the "Němeča" field and the third, with only faunal remains, in the "Podvinohradí" field. The collection from Němeča is stored in the Museum of Moravian Slovakia in Uherské Hradiště and consists of 29 artifacts; however, the question of its homogeneity is open, because several probably post-Paleolithic artifacts were included in it. The raw material is erratic flint, in five cases Krakow-Czestochowa Jurrassic flint, one case is radiolarite and another is a local raw material. However, the Krakow-Czestochowa Jurrassic flint and the radiolarite (Széntgál type from Hungary) represent post-Paleolithic rather than Gravettian artifacts. Typologically, the collection looks like a selection of nice artifacts (mainly long blades) and tools. The typological spectrum consists of three endscrapers, two double endscrapers, one multiple burin and two combinations endscraper/burins. The artifacts were excavated from a low elevation not typical for the Gravettian, and several interpretations of the site function are likely: a short-time site, a hunting or butchering place, or a downslope redeposition. At the moment I prefer the last possibility because of the lack of a loess cover above the findspots, and the new discovery of a smaller site in the "Duchonce" field, in the above area where the loess cover starts at the altitude of 250 m. asl. - as is characteristic for the Gravettian. Because of the still unresolved questions about the site function and its geological context, we plan a limited trenching for the summer of 2004.

The site of Spytihněv - "Duchonce" is located directly above Hrubý's findspot with a concentration of faunal remains in the "Podvinohradí" field. The altitude of this site is 250 m. asl.; it lays about 60 m above the site of "Podvinohradí". The site was discovered in the spring of 2003 and surface surveys since that time have yielded a collection of 11 stone artifacts and isolated bone fragments. The stratigraphic position of the finds was verified by a small excavation in 2003. This limited excavation (it covered an area of only 18 m^2) yielded a series of ca. 400 artifacts (including microchips), in association with the series of bones (mainly mammoth) and charcoal in situ in a preserved loess deposit (thickness up to 25 cm) lying directly below the plough zone. The artifacts are produced mainly on erratic flint, with only several pieces of radiolarite present. In contrast with Jarošov II, no microliths were found even though all sediments were sieved. This site may be classified as a small one. The central part of the site is characterized by a concentration of microchips and has the shape of an irregular circle with a diameter of 3 m. The bigger bones were located on the margins of this concentration and reflect the so-called "centrifugal effect" (cf. Svoboda *et al.* 1993). No traces of a hearth were documented. Based on the number of artifacts, the site dimensions, and refittings, the site may represent a "single event". Further excavation of this site is being prepared.

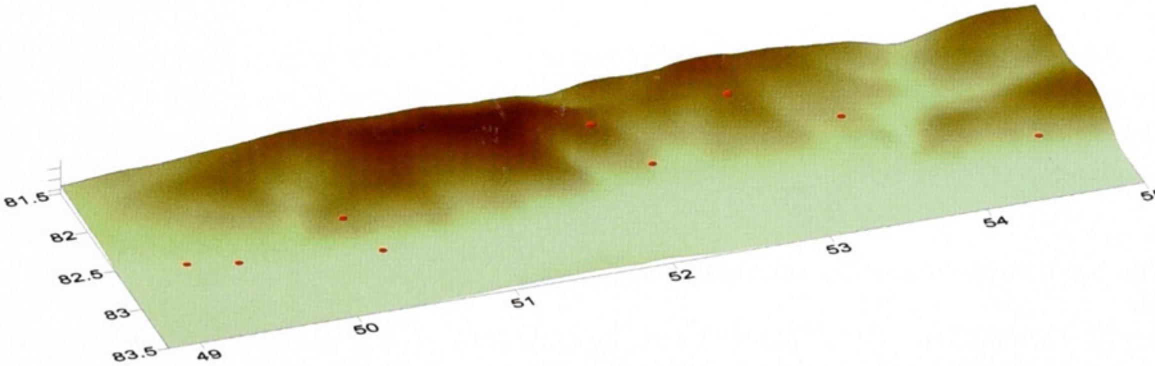

Figure 3. The location of a sites in the Spytihněv-Napajedla microregion. Scale in km.

The site of Napajedla II is located on a northeast-oriented crest on the slope of Maková Hill, whose summit reaches an elevation of 338 m. asl. The altitude of the site is 290 m. asl.; the distance from the artificially regulated channel of the Morava River is 1 km, and the location allows a control of the Napajedla Gate. The material of this site is stored in the Moravian Museum and it has been described by Oliva (1998). According to this author, the collection of artifacts numbers about 1,000 items, mostly made of erratic flint (occasionally Troubky-Zdislavice chert and rock crystal). The typological spectrum consists of burins, one endscraper, and a series of about 20 microlithic artifacts (mostly backed microblades, an occasionally microgravette, and other two microlithic points), and varia. The artifacts were distributed over an area of about 50 m in diameter, and the site may be classified as a medium-sized one.

The site of Napajedla III – "Brickyard" lies lower on the same slope, at an altitude of about 210-220 m. asl. It yielded only a small collection of ca. 25 finds, including several burins and a backed microsaw (Oliva 1998). The artifacts are made mostly of erratic flint (80%) and radiolarite (20%). The site may have been connected with Napajedla II.

One kilometer to the north of Napajedla II site lies another important site, Napajedla I – "Šardica", the richest one within the Spytihněv-Napajedla microregion (ca. 2,000 collected artifacts). The site is located on an eastern-oriented crest on the slope of a hill, the summit of which reaches an elevation of 364 m. asl. The altitude of the site is between 270-295 m. asl.; the distance from the artificially regulated channel of the Morava River is 1.5 km, and the location allows a control of the Napajedla Gate. Basing on the spatial distribution of artifacts, the site may include several units, partly overlying each other; therefore new surveys were carried out in three sectors (Oliva 1998). M. Oliva (1998) described the material stored in the Moravian Museum, Brno and the Museum of Zlín. The raw material spectrum consists of erratic flint (66%) and radiolarite (25%), supplemented by local raw materials. The radiolarite dominates in the lower part of the site. The typological spectrum is composed of burins (53%), endscrapers, often laterally retouched (11%), microlithic artifacts (backed microblades – 2.6%, geometric microliths are missing), combined artifacts (10%, repeatedly a burin with endscraper or another tool) and multiple tools (11%), rarely borers, truncated pieces and Kostenki-type knives, points, sidescrapers, notched and denticulated tools, splinters, etc. (for more details see Oliva 1998). Based on the presence of specific wedge-shaped cores for microblades (see Oliva 1998, figs. 2:5-6), the presence of Troubky-Zdislavice chert, and an altitude ranging up to 290 m. asl., i.e. features more typical for the local Morava River-type Aurignacian, a possible mixture with the Aurignacian cannot be excluded. The artifacts were distributed over an area with diameter of ca. 250 m, and the site may be classified as medium-sized one.

In addition, Oliva (1998) mentions further small sites with non-diagnostic artifacts within the same area: Napajedla V, VI, VIII.

6. The site of Boršice – "Chrástka"

This site is located on the right bank of the Morava River, on the northeastern slope of a hill, the summit of which reaches an elevation of 340 m. asl. The altitude of the site is 264 m. asl.; the distance from the artificially regulated channel of the Morava River is 3.6 km, and the location allows control of a wide area of the river basin. The artifacts were collected over an area of about 100 m in diameter. There are three main collections: Klíma's stratified assemblage (258 artifacts), Vyskočil's surface collection

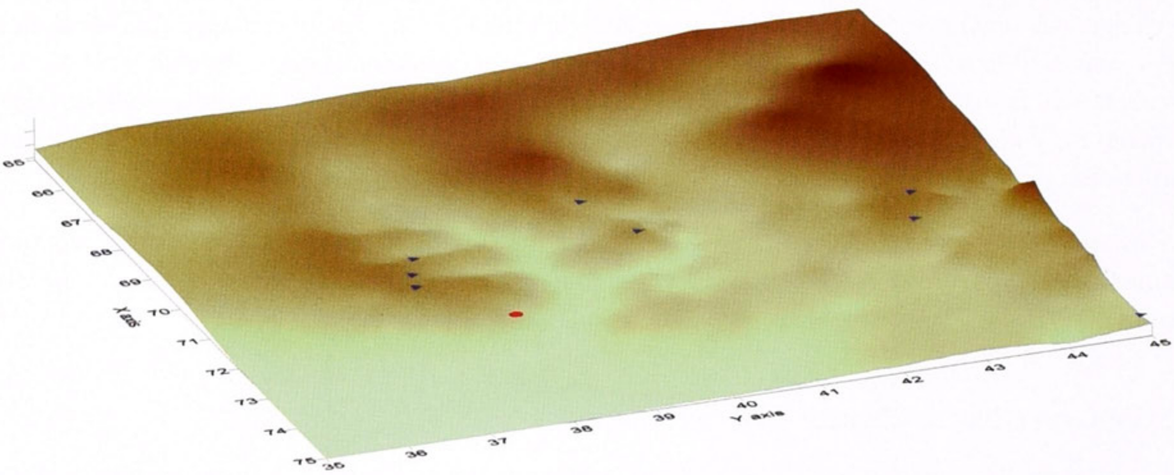

Figure 4. The location of the Boršice – "Chrástka" (ring) site in comparison to other Aurignacian sites (triangles). Scale in km.

(576 artifacts) and a collection stored in the Museum of Moravian Slovakia in Uherské Hradiště (in particular, Suchánek's and Hrubý's collections, ca. 1500 artifacts). The raw material spectrum of the Klíma collection is characterized by the total dominance of erratic flint, supplemented by occasional pieces of radiolarite (2), Krakow-Czestochowa Jurrasic flint (3), and 15 others (mainly fired artifacts). The typological spectrum of this collection is composed of one partially backed microblade, three burins (two on broken blades, one atypical transverse burin on lateral retouche), one artifact ranging morphologically between an endscraper and a truncated blade, two points and one double point, two combined tools (multiple burin and combination burin/notch), a retouched blade, a splinter and a chissel. This collection is supplemented by surface finds of Vyskočil, who collected more microliths (five backed microblades, a pointed backed microblade, a denticulated backed microblade, and a microgravette), and a series of burins (15 simples and 5 multiples). The endsrapers were not documented in either collection. The site may be classified as a medium-sized locality. The collection in the Museum of Moravian Slovakia has been analyzed by Oliva (1998).

7. The site of Ostrožská Nová Ves – "Padělky"

The site is located on the left bank of the Morava River, on a slight elevation close to the foot of the western slope of a hill, the summit of which reaches an elevation of 250 m. asl. The altitude of the site is 190 m. asl.; the distance from the present controlled course of the Morava River is 3.2 km, and the location allows a control of a wide portion of the river basin. A small surface collection of artifacts (ca. 100 pieces) was collected predominantly by František Botek and it is actually separated in two museum collections (the Moravian Museum in Brno and the Museum of Moravian Slovakia in Uherské Hradiště). The site is not stratified and the finds were collected over an area of about 100 m in diameter, free of loess. The artifacts are mostly made of erratic flint, occasionally of radiolarite, and Krakow-Czestochowa Jurrasic flint. The typological spectrum consists of two microliths (backed microblades), six endscrapers (one of them steeply retouched), three burins (two dihedral, one made on point), two splinters, and a raclette. From the technological point of view, the artifact dimensions are smaller compared to the other Gravettian sites in the region. The site may be classified as a small-sized one.

8. Dating

Only two sites, Jarošov II and Boršice, provided ^{14}C dates. The remaining sites were not dated either because of missing datable samples from previous excavations, or because of a lack of organic material in the case of the surface sites. According to the ^{14}C dating, the Gravettian occupations of the Jarošov II-IA site and Boršice – "Chrástka" are associated with the Evolved Pavlovian stage (cf. Svoboda ed. 1994, van der Plicht 1997). There is a problem with possible contamination in the date from Valoch's excavation of faunal remains at the Jarošov II - faunal deposit. Another question is the slight difference between the dates from the Groningen and Vienna laboratories: the Vienna results seem to be slightly earlier than those from Groningen.

During 2003, more datable samples were obtained from the sites of Jarošov II - Procházka's excavation (bones), and Spytihněv – "Duchonce" (charcoal and bones), while the test pits at the sites Kněžpole - "Hrádek" and Spytihněv – "Němeča" did not provide samples.

9. The Gravettian settlement strategy

As a first step, we digitized the areas of interest and created 3-D maps using the Surfer (from Golden Software) program. We chose to use the 1:25,000 scale maps of "General Staff" of the Czechoslovak Army from the middle of twentieth century, using S-42 Map datum (Czechoslovakia), which are digitized

No.	sample name	location	value			
GrA-11454	Boršice 1964	trench A	25 040	±	300	BP
GrA-9604	Jarošov II-1	S18, S19, S32, S33	25 780	±	$^{250}/_{240}$	BP
GrA-9613	Jarošov II-2	S18	25 110	±	$^{240}/_{230}$	BP
GrA-15137	Jarošov II-3	S126d	26 220	±	$^{390}/_{360}$	BP
GrA-17191	Jarošov II-4	S137a, S137c	26 340	±	180	BP
GrA-17087	Jarošov II-5	S151c, S151d	26 950	±	200	BP
VERA-757	Jarošov II-01	S47c	27 200	±	200	BP
VERA-758	Jarošov II-02	S59b	26 900	±	200	BP
VERA-759	Jarošov II-03	S74b, S75a	27 200	±	200	BP
GrA-20495	Jarošov, excavation 1980 (K. Valoch)	bone accumulation	23 120	±	200	BP

Table 1. Radiocarbon datings overview.

in a grid of 250 m. Using these coordinates, we identified the location of the sites. During the field data recording we used a GPS personal navigator (eTrex from Garmin).

In a preliminary studies of settlement geography (Škrdla and Svoboda 1998, Škrdla and Lukáš 2000), we specified eight characteristics of the Pavlovian settlement strategy:

1. a location along an important river

2. a location on expressive features in the landscape

3. a strategic position which allows:

a) control of the river valley in general

b) control of the "gates" within the valleys

c) control of the confluence of important rivers

4. predominantly northern orientation of the locality

5. located on the slope of a hill (usually with a peak reaching an altitude of more than 300 m. asl.)

6. altitudes of the sites range between 200-290 m. asl.

7. relative altitudes range between 10-100 m above the present river level

8. small streams and springs are located in the vicinity

The preliminary analysis demonstrates a strong association of these features with Gravettian/ Pavlovian localities. On the basis of these results, we argue in favour of a high degree of standardization in the Pavlovian settlement strategy. In addition, we argue that the Gravettian/Pavlovian settlement strategy differs significantly from the Aurignacian strategy, which is characterized by sites at higher altitudes (about 300 m. asl.), on the top of elevations, in locations more distant from the river and placed more deeply inside the highlands.

The differences in settlement strategy of the various Paleolithic cultures are statistically tested in order to create a characteristic vector describing the particular settlement strategies. The results may allow archaeologists to date even small and inexpressive artifacts collections, as well as to predict new sites in the future.

10. Acknowledgement:

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NEW GRAVETTIAN SITE IN LOWER SILESIA (SW POLAND)

T. Płonka and A. Wiśniewski

with contributions by: Z. Jary and A. Traczyk

Abstract

Site Henryków 15 (near Ząbkowice Śląskie, SW Poland) is so far the only evidence of the exploitation of the area situated so far to the north of the Sudetes by Gravettian groups. Contrary to other sites from SW Poland, the artefacts in Henryków were covered by loess deposits, whose thickness reached several metres. The site's profiles displayed 11 layers with three horizons of pedogenesis. The traces of the Palaeolithic settlement are connected with layers 8 and 9 and were deposited before sedimentation of loess in the upper (main) pleniglacial (before 20,000-18,000 BP).

The excavations so far have provided 1612 flint artefacts: 617 come from layers 1-7 and 995 occurred in layers 8 and 9. Three concentrations of artefacts were identified, visible against evenly distributed artefacts. Erratic flint occurring in local glacial deposits was mainly used in the production. The predominating method of acquiring blade blanks was the exploitation of single platform forms of different variants used to produce backed pieces, truncated pieces and end-scrapers, while flakes were used to produce other tools. The examination of the settlement remains indicates that the site in Henryków may be considered as evidence of a short-occupied and temporary encampment probably set up during the search for new sources of good-quality flint raw material. Its emergence is probably connected with the need to replenish the range of tools and the supply of blanks for their production.

KEYWORDS: Gravettian settlement, Sudetes Mountains

1. Introduction

Site 15 (formerly 12) in Henryków (near Ząbkowice Śląskie, SW Poland) is so far the only evidence of the exploitation of the area situated so far to the north of the Sudetes by Gravettian groups (Płonka and Wiśniewski 1997, 2000, 2001). The closest evidence of this type comes from the Nysa river-basin to the south-east of Henryków (Figure 1a; Kozłowski 1964, Ginter 1966, Dagnan and Ginter 1970, cf. Burdukiewicz 1999). Contrary to other sites, the artefacts in Henryków were covered by loess deposits, whose thickness reached several metres. In one of the layers, where Palaeolithic artefacts were discovered, and in two higher horizons, the traces of Pleistocene pedogenesis were recorded. Periglacial structures are visible in nearly the whole profile of Pleistocene deposits. These observations enable the reconstruction of palaeogeography and the age of the artefacts.

The site was discovered in 1996 during the programme of surficial excavations and ever since 1997 it has been examined by a team of archaeologists, geologists and geomorphologists[1]. Below are presented the results of archaeological and environmental studies carried out in 1997-2001 focusing on cultural material obtained during the systematic exploration.

Footnote 1. Archaeological excavations were supervised by T. Płonka and A. Wiśniewski. Z. Jary, D. Ciszek and A. Traczyk (Geographical Institute, University of Wrocław) took part in geomorphological examination of the site and its vicinity. Pedological researchwas performed by C. Kabała (Agricultural Academy in Wrocław) and petrological research was carried out by J. Michniewicz (Institute of Geology, Adam Mickiewicz University in Poznań). Petrological analysis of bedrock and the artefacts from coarse crystalline rock were carried out by A. Wójcik and S. Madej (Institute of Geological Sciences, University of Wrocław).

2. Location of the site and geology

Site 15 is situated on a culmination at 242 metres above sea level south-west from Henryków, near Ząbkowice Śląskie, province of Lower Silesia (Figure 1). The culmination is an island mountain situated within the Henryków Dale, a part of Niemcza-Strzelin Hills (Walczak 1970). The area is situated in the Tertiary tectonic basin stretching from Henryków to Starczówek near Ziębice. The bedrock of the tectonic depression is constituted by gneiss, mica schist and amphibolites of the metamorphic

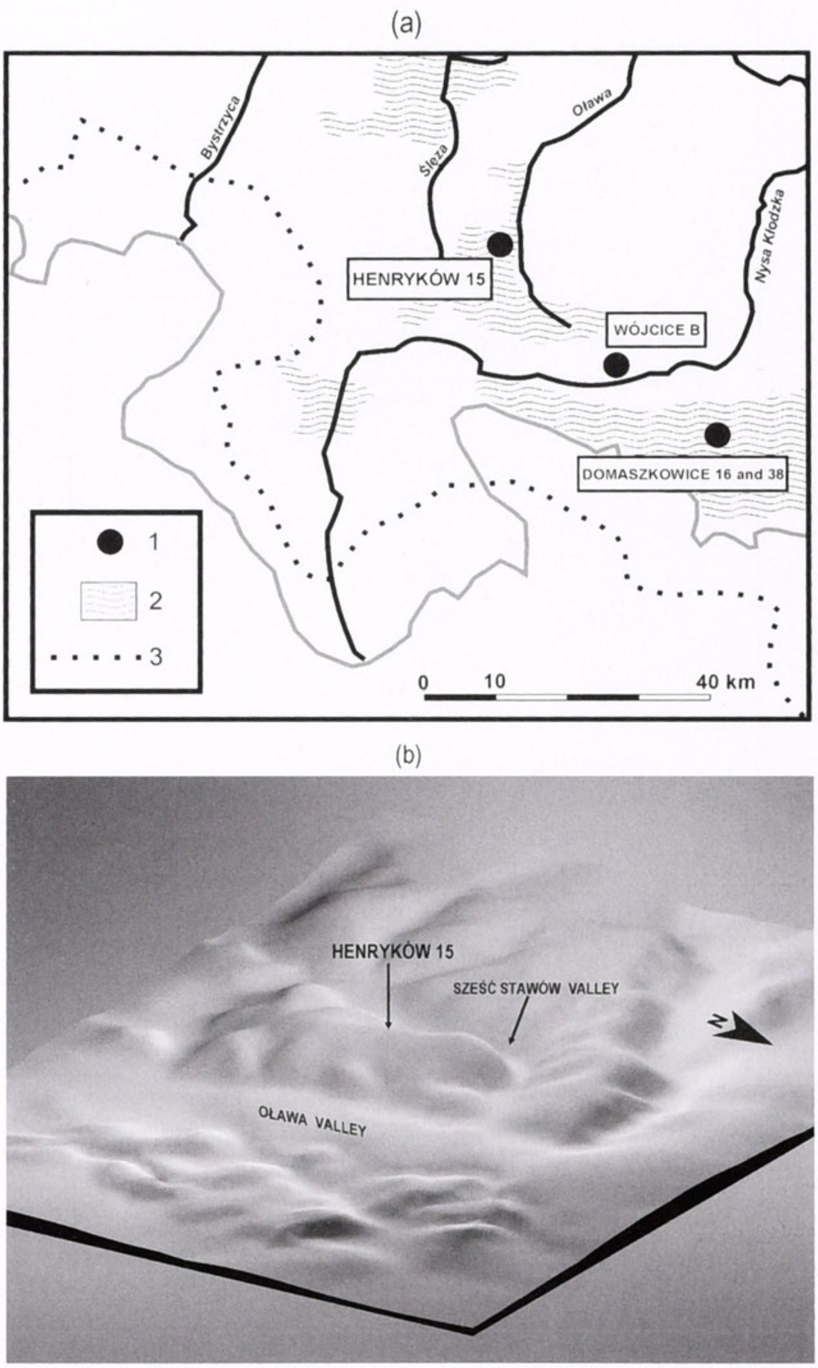

Figure 1. Location of site 15 in Henryków, near Ząbkowice Śląskie, province of Lower Silesia, SW Poland: a. location of Gravettian sites in the valley of the Nysa Kłodzka and the Oława; b. visualisation of Henryków Dale with the Oława valley (based on the topographic map 1:25 000 - M. Kurzydło and P. Trzepizur).

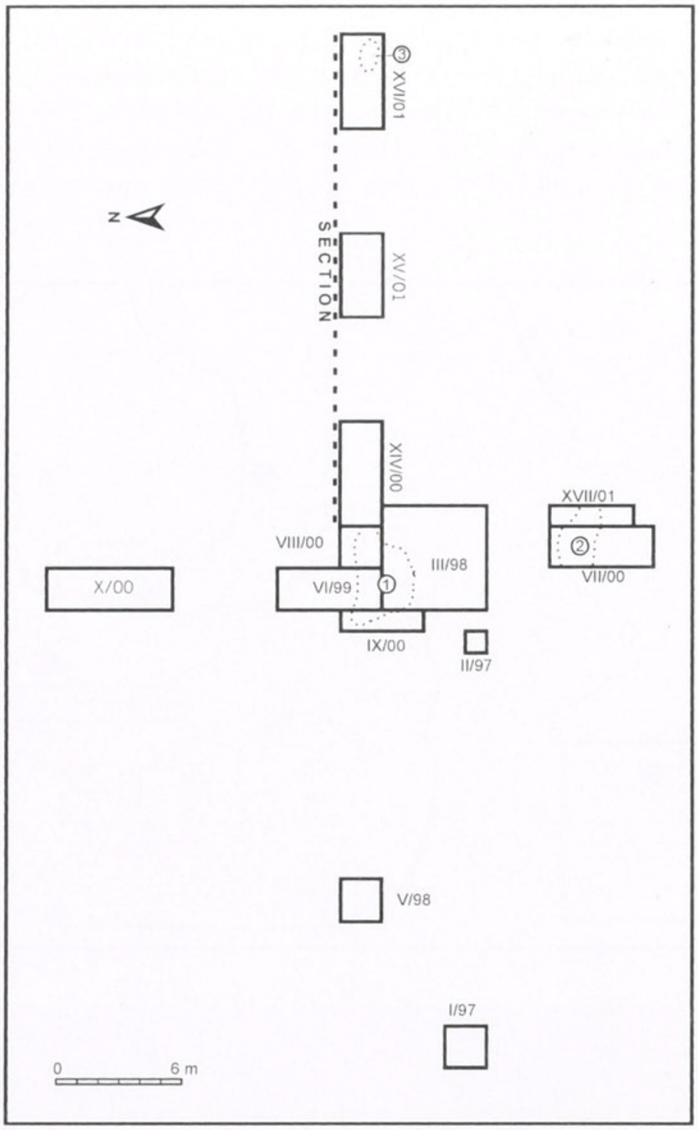

Figure 2. Henryków 15, SW Poland. Location of trenches with schematic range of stone artefacts concentrations (no. 1-3). The broken line denotes the position of the vertical profile presented in Figure 3.

Lipowe Hills series (Oberc 1966), while the basin is filled with sands, argil and Miocene silt as well as Quaternary sands, clays and fluvial, aeolian (loess) and slope deposits.

The hill where the site is situated rises ca. 30-60 metres above the bottom of the Oława valley. The culmination is accentuated by the river valleys surrounding it from the west, north (Sześć Stawów Valley) and east (the Oława valley). Distinct asymmetry in the east-west orientation is visible in the place where the site is situated (Figure 1a-b). Western slopes descend steeply towards Sześć Stawów Valley, while the slopes exposed towards the Oława are more gentle. The present form of the culmination has been modified due to sedimentation of silt covers (eolian and slope deposits) in the Upper Pleistocene and Holocene. Their thickness increases gradually towards the east, i.e. towards the Oława valley. Drilling and georadar examination with the *Ground Penetrating Radar* (RAMAC/GPR)[2] showed that their thickness is only 0.5 metres at the edge of the culmination, while at the bottom of the eastern

Footnote 2. Georadar examination was carried out by A. Szynkiewicz (Institute of Geological Sciences, University of Wrocław).

slope it exceeds 7 metres. The original appearance of the eastern elevation must have had a more contrastive character. Despite that, we are of an opinion that the place was selected due to an easy access from the Oława valley on the one hand, on the other - due to the possibility of visual control of the river's long section which it offered.

3. Stratigraphy and palaeogeography

The research carried out in 1997-2001 resulted in a construction of a model of the site's stratigraphy, whose main axis were the profiles of trenches extending to the east following the terrain's inclination from trench VI/99a to trench XVI/01 (Figure 2 and 3). Descending from the top, 10 layers were distinguished in the profile resting on the bedrock (layer 11)[3]: 1. contemporary humus; 2. grey-brown, non-structural dust; 3. pale, laminated, decalcified loess with traces of initial gleization in the bottom; this layer also displayed the ceiling parts of Neolithic pits; 4. red-brown dust; 5. brown dust with the admixture of fine sand and metamorphic debris (the layer filled the denudation basin); 6. light-brown carbonate loess with traces of tongue or layer solifluction; 7. grey-brown dust with single Palaeolithic flint artefacts; the layer also provided malacofauna (samples are being examined); 8. brown, massive carbonate loess with Palaeolithic artefacts, single bones (unidentified small fragments) and charcoal; 9. red-brown dust-sand clay with grey-blue streaks with admixture of weathered rock from the bedding and small erratic pebbles, the deposit was dislocated in the ceiling (tongue and layer solifluction); the horizon provided numerous Palaeolithic artefacts, single bones (unidentified specimens), charcoal and lumps of red sediment (clays and limestone of glacial origin) which, due to a low content of iron can not be considered a dye (J. Michniewicz - personal communication); 10 red-brown sandy clay with erratics and weathered metamorphic schist constituting the core of the culmination; the layer did not provide any artefacts.

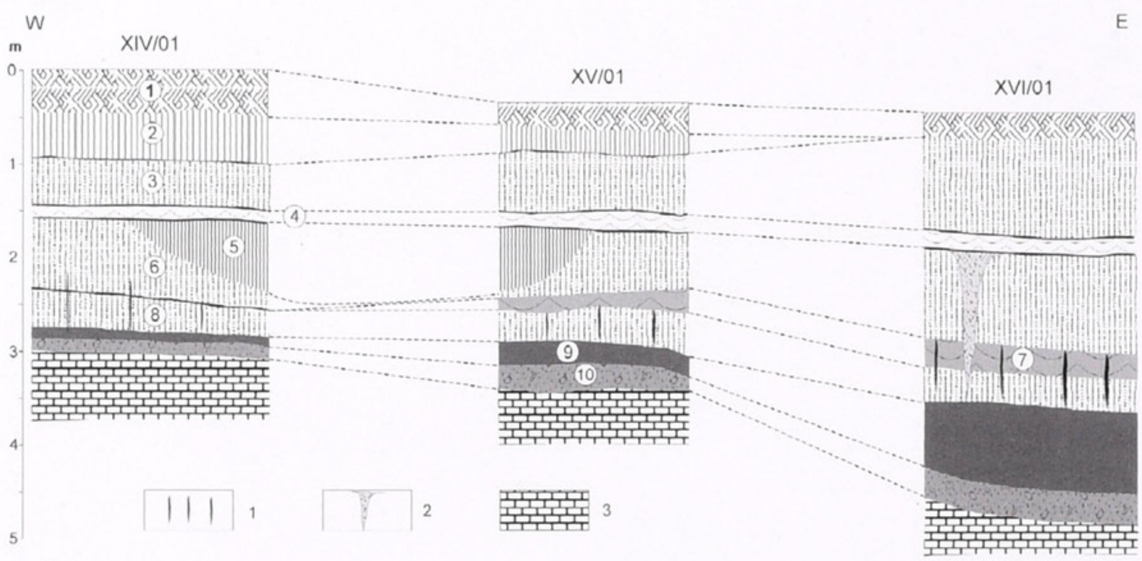

Figure 3. Henryków 15, SW Poland. 1. Synthetic geological profile of trenches XIV/01-XVI/01. Legend: 1- pseudomorphs after frost cracks; 2 - pseudomorphs after ice wedges, 3 - bedrock. Numbering of layers as in the text. Horizontal scale not preserved. Drawn by N. Lenkov.

Geomorphological and petrological examination carried out so far prove that three horizons with traces of pedogenesis were preserved under contemporary brown clay (layers 1-2) in trenches XIV-XVI/01. Two upper horizons, corresponding to layers 7 and 4, are probably the remains of tundra gley soils

Footnote 3. Earlier reports distinguished five geological horizons: I corresponds to layer 1, II - layer 2, III - layers 3+4, IV - layers 5, 6, 7 and 8, V - layers 9+10 (cf., e.g. Płonka, Wiśniewski 1999, p. 25-26).

developing in the upper pleniglacial and late glacial. The lowest horizon (layers 9-10), rich in colloidal argil and humus (concentration of organic compounds up to 0.27%), probably emerged earlier and may have poligenic character. Its development may have been initiated in the early glacial or lower pleniglacial. It may be assumed that accumulation of loess in the area of site Henryków 15 took place in two phases, similarly as in other areas of Lower Silesia, during the upper pleniglacial and late glacial (1 phase - layers 4-8; 2 phase - layers 2-3).

So far no horizon of lower loess which could have been destroyed by slope processes has been discovered. The stratigraphic scheme above is confirmed by the analysis of periglacial structures. Numerous congelifluction structures occurred in the profile's lower part (layers 7-9). Frost structures were represented by dislocations of the load-cast type (fold-like involutions and diapirs) and narrow contraction cracks refilled with calcium carbonate. The profile's middle part displayed pseudomorphs after ice wedges and traces of solifluction processes (layer 6). The highest part of the profile was predominated by the structures which emerged during flow processes (layer 4). The sequence of periglacial structures indicates that accumulation of dust deposits initially took place in the conditions of the cold and wet climate and later in the dry and cold climate.

The presented scheme of the phases of the development of dust deposits in the area of site 15 in Henryków is similar to the model elaborated for the loess profiles from the Głubczyce Plateau (Jary 1996) and for the loess profiles from the northern part of the Niemcza-Strzelin Hills (Ciszek *et al*. 2001a;

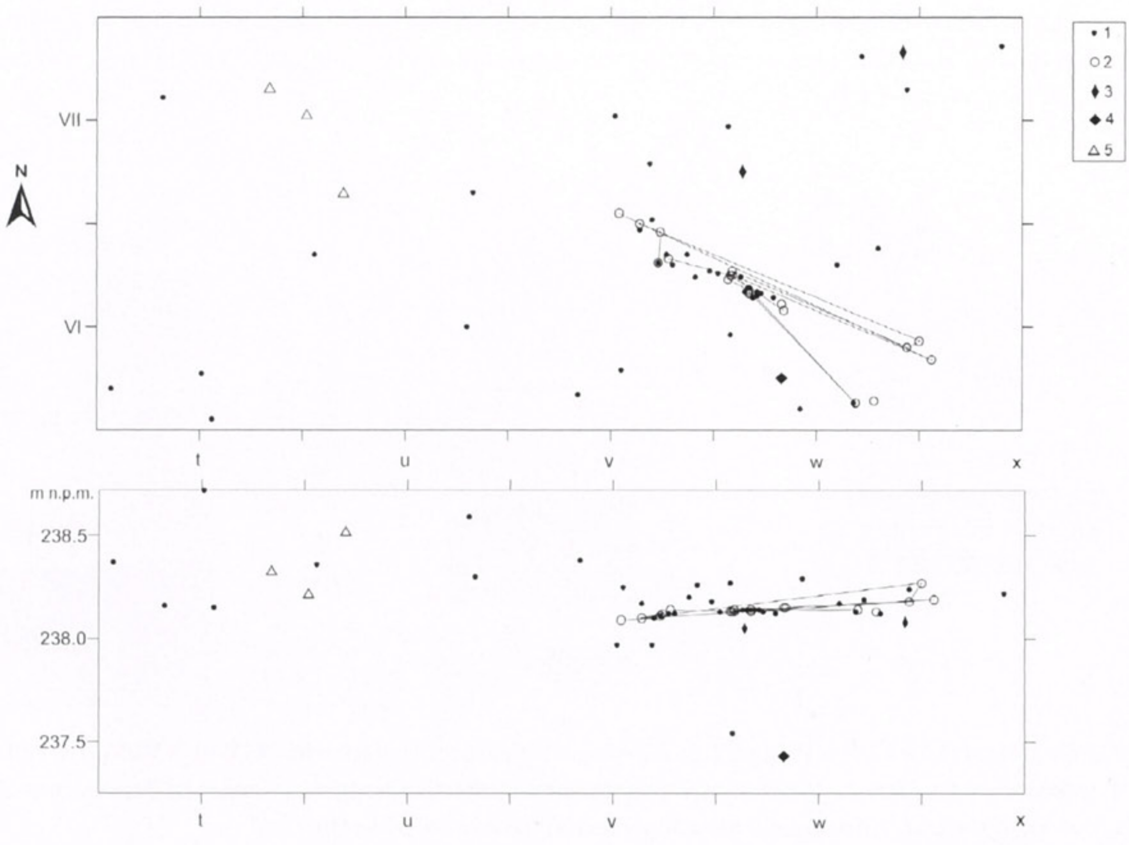

Figure 4. Henryków 15, trench XVI/01. At the top - arrangement of stone products in horizons IV and V; at the bottom - projection of stone products onto the northern wall of the trench. Legend: 1 - flakes, blades, chips and their fragments; 2 - refitted products or products from the exploitation of the same concretion; 3 - cores; 4 - strikers; 5 - chunks. Lines denote connections between the artefacts of the same block.

ARTEFACTS	POSITION		FROM LAYERS 8 AND 9	FROM THE SURFACE AND THE SUBSURFACE LAYERS	TOTAL
Precores			1	2	3
Cores	blade cores	1p	2	16	18
		2p	2	6	8
		zm	-	1	1
	flake cores	1p	3	10	13
		dis	-	1	1
		zm	-	2	2
	flake-blade core	1p	3	6	9
		zm	-	1	1
	fragments		12	20	32
Negative chunks			78	48	126
Flakes			467	277	744
Blades			121	104	225
Tools	endscraper		7	13	20
	burins		4	12	16
	sidescrapers		5	2	7
	knives		-	2	2
	backed pieces		4	4	8
	truncations		4	7	11
	leaf points?		1	3	4
	notched and denticulated		6	4	10
	perforators		-	1	1
	retouched blades		1	-	1
	other		21	22	43
	with usable retouch		2	2	4
	combined		2	3	5
Technical forms			17	25	42
Burin spalls			2	1	3
Unidentified			14	5	19
Chips			216	17	233
Total			**995**	**617**	**1612**

Table 1. Henryków 15. Frequency of Palaeolithic products. (p - platform; zm – changed orientation cores).

2001b). Two profiles situated in the Niemcza-Strzelin Hills (Dankowice, Biały Kościół) displayed 3 horizons with traces of pedogenesis separating pleniglacial dust deposits. The lower part included also similar solifluction and crioturbation structures. The results of the research carried out so far indicate that the stone artefacts discovered in layers 8, 9 and 7 were deposited before the sedimentation of loess in the upper (main) pleniglacial (before 20,000 - 18,000 BP).

4. Spatial distribution of artefacts

The trenches situated in the central and eastern part of the excavated area constitute the basis for the analysis of the spatial distribution of the Palaeolithic artefacts. The artefacts were deposited quite deeply (>1.5 m) in the trenches, therefore they were not dislocated by the Neolithic settlement or modern agricultural activities. At the current stage it is difficult to determine the actual range of the remains of the Palaeolithic settlement found in layers 7-9. The Palaeolithic artefacts were recorded in the ca. 30 m long section along the east-west axis (trenches III/98, VI/99-XVII/01). The distribution of cultural material along the north-south axis (ca. 29 m) was similar. In the vertical projection the artefacts concentrated within layers 9 and 8 and in their contact section. Single products were found higher in layer 7. The artefacts from layers 9 and 8 are usually covered with white-blue patina of varying intensity. The products from layer 7 are covered with intensive white-blue or white patina. The results of the technological and typological analyses carried out so far as well the results of the refitting method suggest that the Palaeolithic artefacts were originally placed in the ceiling of layer 9 and they were transported to layers 8 and 7 due to periglacial processes (tongue, layer solifluction, vertical dislocation of the banding system). It is assumed that the so-called *living floor* was constituted by consolidated layer 9 resting on the residuum of moraine clay directly on the rock bedding. Gravitational process in the area of the site did not have uniform character. The most serious consequences of the development of these processes were recorded in trench XV/01, where layers 8 and 9 were considerably inclined towards east and the vertical distribution of the artefacts was ca. 0.8 m. The smallest vertical distribution was recorded in the concentration in the eastern part of trench XVI/01 (Figure 4).

The excavations so far revealed three concentrations of artefacts visible against evenly distributed artefacts. The first was discovered in the area of trenches III/98, VI/99, VIII-IX/00 and XIV/01 (Figure 2), the second concentration (trenches VII/00-XVII/01) was recorded 6.5 m to the south and the third - 20 m to the east (trench XVI/01; Figure 4). The concentrations were elongated and their longer axes were copiing with the predominating direction of the slope's inclination (towards the east). They constitute the remains of cultural concentrations transformed by slope processes. It should be emphasized that the artefacts from these concentrations form refittings (up to 49 elements) in a block, including the specimens refitted from the chunks resulting from the blow against a weathered block of flint raw material. The most compact concentration was discovered in the eastern part of trench XVI/01 (Figure 4 concentration no. 3, size 1.45 x 0.3 m). Concentration no. 1 was most seriously transformed.

To conclude, it should be added that a great part of artefacts comes from the site's surface (layer 1). Their greatest concentration was found in the 20 m wide strip very close to the morphological edge of the culmination. Test trench IV/98 set up in this area showed that the bedrock is situated under contemporary soils at the depth of 0.3 m.

The research so far leads to the conclusion that layer 9 constitutes the surface used by the Palaeolithic population. Considering the spatial arrangement dislocated by slope or unstable gradient processes, it is difficult to state whether the recorded concentrations and the evenly dispersed artefacts constitute the trace of a single or repeated stay. Further study of refittings combined with the analysis of spatial arrangement of the artefacts will be of great importance in clarifying the matter.

5. Remarks on technology and typology

The excavations so far provided 1612 flint artefacts: 617 come from layers 1-7, and 995 occurred in layers 8 and 9 (Table 1). A certain number of stone pebbles display the traces of use as hammers and anvils (?). The flint assemblage provided 3 pre-cores, 85 cores, 42 technical forms which appeared during forming and repairing flaked surfaces and striking platforms, 126 chunks with single negatives of flaking, 744 flakes, 225 blades, 132 tools, 3 burin spalls, 19 unidentified fragments and 233 chips (Table 1).

Erratic flint was predominantly used for the production of blanks and tools. The flint was acquired, similarly as other lithic raw material, from glacial deposits from the Middle-Polish glaciation (moraines and fluvio-glacial deposits). These deposits form the slopes of the Oława valley occurring in the area of the culmination (especially in its southern part). On the basis of the refitting blocks and initial cores it may be assumed that concretions of various sizes and flint chunks 5-6 cm to at least 14 cm long were used during the production of blanks (Figure 5). However, the raw material blocks of decisively small and medium sizes predominate. Erratic raw material of similar size was used in Gravettian site Wójcice B, situated ca. 25 km to the south-east (Dagnan and Ginter 1970, 34). The shape of the raw material block is diversified: elongated concretions, oval pebbles, nodules and chunks.

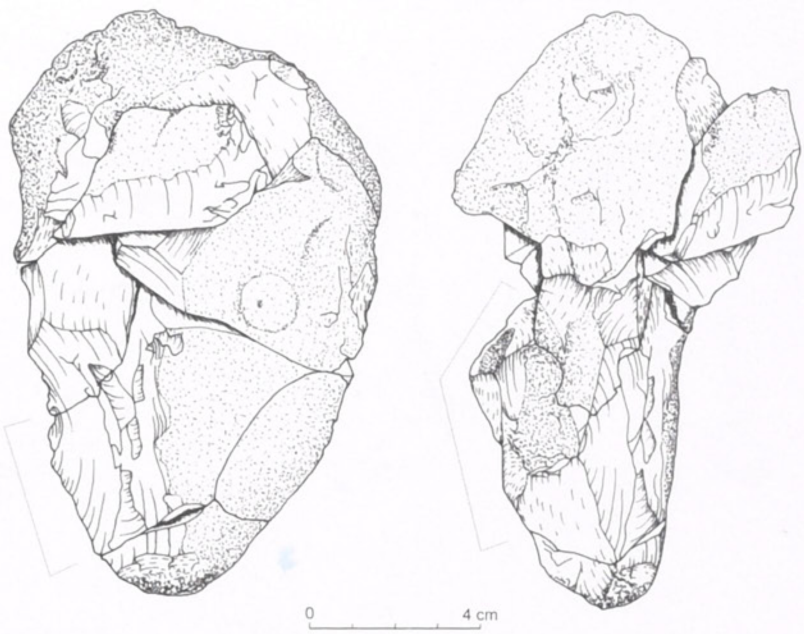

Figure 5. Henryków 15, SW Poland. Flint block from trench VII/00. The line denotes the location of the core with initial flaking. Drawn by B. Kufel.

Operational sequences connected with testing the raw material may have taken place within the campsite, which is substantiated by the blocks made up of chunks that display single traces of blows. Some blocks, split along the frost cracks, were abandoned on the spot without further working, while some were used to prepare cores. Pre-cores may also have been imported to the area of the site. Pre-cores were found on the site's surface (layer 1) and in layers 8 and 9. The proper stage of reduction was preceded by preparation of diversified character. Some cores display only the traces of butt preparation, some - the traces of butt preparation and lateral preparation of the flaked surface (along the technical axis) and some, apart from the traces of preparation of core's proximal part, carry the traces of forming the one-sided crests, less frequently bifacial crests and the back. At the current stage of the research we are unable to prove

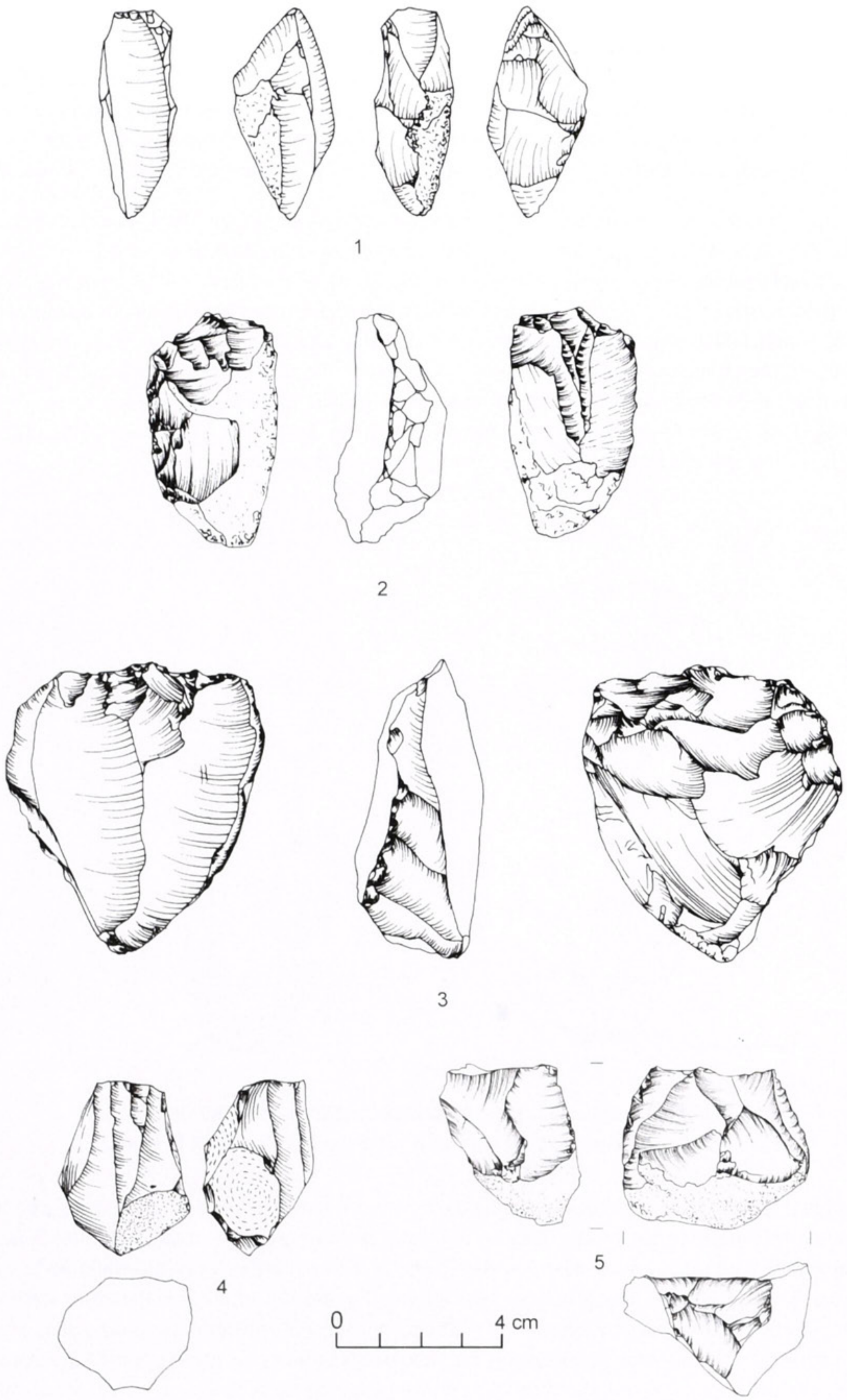

Figure 6. Henryków 15, SW Poland. Selection of cores (layers 9-8). Drawn by B. Kufel.

whether this diversified preparation, similarly as in other sites (Neruda 1995), was connected with the shape of the raw material block or was affected by the specific purpose of the cores. The preparation was executed with both hard (flake cores) or soft (blade cores) hammers. Consecutive stages of the production are less legible due to a small number of refitted elements of debitage. The assemblages display cores abandoned at various stages of working (Figure 6). It may be assumed on their basis that the predominating manner of acquiring blade blanks was the exploitation of uni-directional forms of various variants: 1. narrow flaking surface; 2. flat (board-like) wide flaking surface; 3. with rounded flaking surfaces (including conical forms). Bi-directional cores or cores with twisted flaking surface (a specimen from layer 1) are quite scarce. Similar technical tendency is found in most Gravettian sites (cf. e.g. Drobniewicz *et al.* 1992, Ginter 1966, Dagnan and Ginter 1970, Neruda 1995, Sobczyk 1995 and others). The exceptions are constituted by the complexes from Dolní Věstonice II-Western Slope (the area outside the settlement units: Svoboda 1991, 35) and from Spadzista street (areas Sp. C and D) in Kraków, where the predominance of bi-directional cores is recorded (Sobczyk 1995, 46, 64, 110, 113).

At present it would be difficult to define univocally the relation between the isolated types of cores and the type of obtained blade blanks. The preliminary analysis of negatives on cores and the features of blade blanks suggests that the first type of cores provided narrow and thick blades of trapeze-like cross-section, while the remaining types were used to obtain wide or narrow blades and thinner bladelets of triangular, lenticular or trapeze-like cross-sections. Majority of blades and bladelets are bent towards the ventral site, which suggests absence of special reduction techniques (e.g. anvils) and additional working in cores' distal parts (correctional platforms). Until now the dynamics of changes in morphology of cores and blade blanks during reduction has not been precisely determined. Maximum length of blade blanks is 9.2 cm; however, forms of the length of 5-6 cm and shorter predominate. The blades from site Wójcice B (Ginter 1966) had similar length. The features of cores' proximal parts (the manner of isolating the point of striking, the platform outline and the angle of coring) and features of blades' proximal parts indicate that a soft hammer was used at the advanced stages of exploitation, similarly as in other sites (cf. remarks by Neruda 1995). Abrasion of the core edge was also used. No evidence of wider use of faceted butts was found. Individual multi-directional cores for flake production are present in the material.

The relation between other flakes, blanks and retouched tools is also only partially recognised. Narrow blades and bladelets were used in the production of backed pieces and truncations (Figure 8:1-2). The wide forms of thick blades were applied more frequently. The material from layers 9, 8 and 7 and the artefacts from the surface (layer 1) show that they were used for the production of burins on retouched end, dihedral burins and end scrapers (Figure 8:3). Flat forms of wide blades carry marginal retouch or only useful retouch. It may be assumed that wide, massive blades were used for the production of bifacial tools, which is substantiated by leaf points discovered in the site's layer 1 (Figure 8:9). The flake material from various phases of reduction was used for the production of end-scrapers (Figure 8:4-8), burin, truncations, side-scrapers, denticulated pieces and notched tools as well as retouched flakes. Some specimens were used for the production of bifacial tools (leaf points and knives?).

The tools from the discussed assemblage occur in the forms encountered in the early- and late-Gravettian Moravian sites (Table 1). Jerzmanowice points are encountered in the context of the early Gravettian, while relatively numerous side-scraper and bifacial forms occur more frequently in the late-Gravettian complexes (Svoboda 1996, 290).

6. Site's function

Relatively good recognition of the site in Henryków justifies an attempt at determining its function within the Gravettian settlement pattern north of the Sudetes. The planigraphy of the artefacts - existence

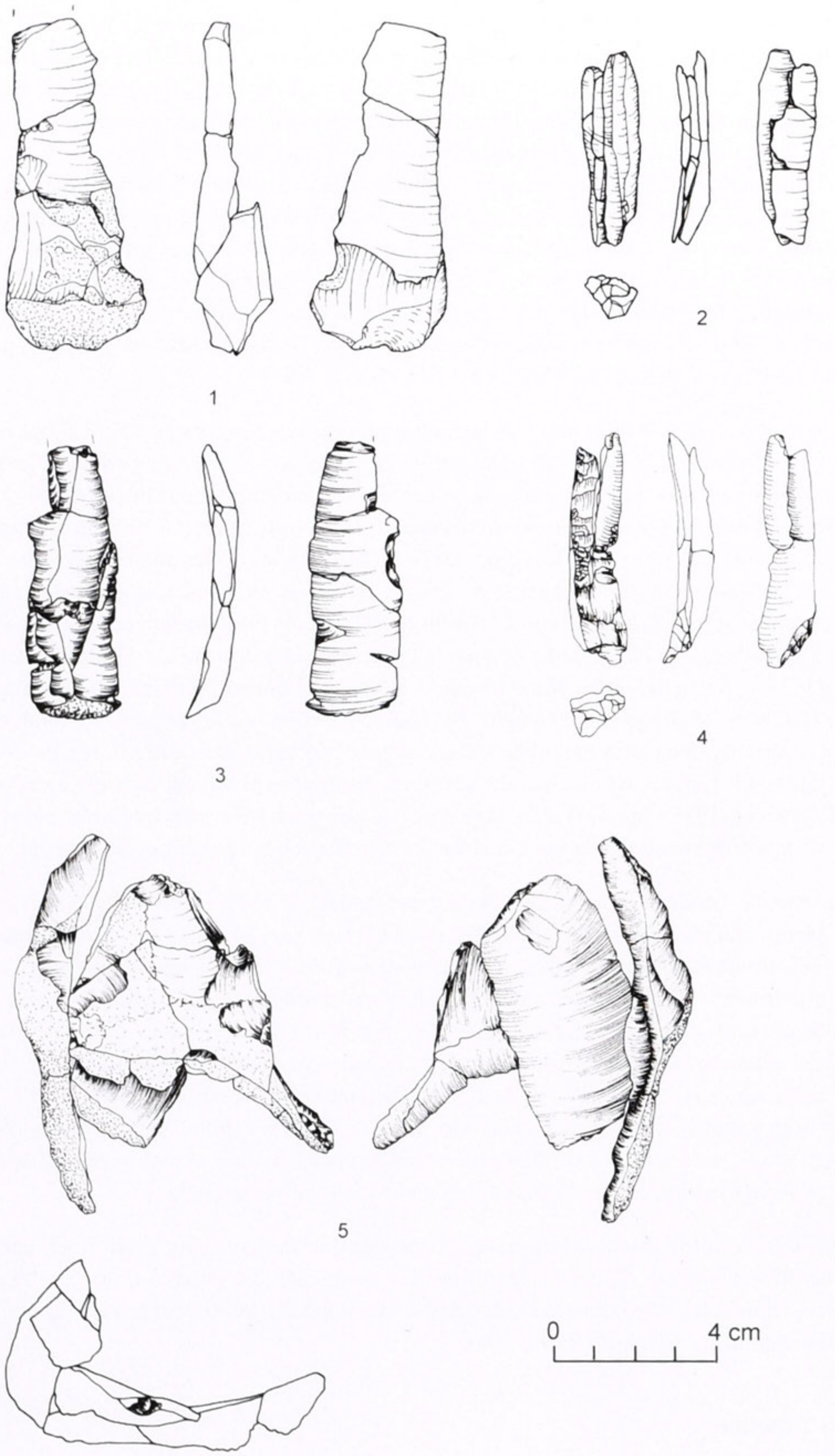

Figure 7. Henryków 15, SW Poland, layers 9-8. Blade (1-4), bladelet and flake refittings (5). elements 3 and 5 come from concentration no. 3; cf. Figure 4. Drawn by B. Kufel.

of flint product concentrations and refittings within them, prove that the site did not undergo considerable post-depositional destruction despite the recorded traces of solifluction. Thus, it may be assumed that a small number of artefacts discovered in the site and their composition reflect the manner of inhabiting and use of the campsite by the Gravettian hunters. We also believe that scarce bones found in the site do not result from their bad preservation but are related to the site's character.

The models of functioning of small Gravettian sites in central Europe, i.e. of the type discovered in Henryków, are not well recognised because they are known mainly from the surface assemblages (Svoboda *et al.* 1994, 151; Svoboda 1996, 292; Svoboda *et al.* 2000, 198). Some of these small sites, when excavated (e.g. Dolní Věstonice III), still seem more spacious and more permanent than the encampment in Henryków and they also occur in the area of very rich and multi-phased Gravettian settlement (Škrdla *et al.* 1996). The manner of organisation of residential space and its functional differentiation was the subject of more detailed analyses in the case of large, frequently visited Gravettian settlements with structures proving their permanent settlement (hearths, residential objects, graves, pits for cooking, etc.).

Gravettian settlement in Moravia concentrates in the areas situated at the height of 200-300 metres above sea level, in the valleys of big and medium water courses. The settlements and camps were situated in the areas enabling unrestricted observation of the terrain, mainly river valleys. Usually there are no outcrops of the raw material used for flaking; the exception here are the sites from northern Moravia situated in the area of occurrence of post-glacial deposits containing flint raw material.

Reconstruction of the function of Gravettian sites north of the Carpathians and the Sudetes should allow for two essential factors connected with considerable mobility of the Gravettian hunters:

- search for and acquisition of flint raw material;

- search for new settlement areas.

It should also be remembered that penetration into this area, situated to the north of the centres of early-Gravettian settlement, took place in different climate conditions and different geographical environment. The location of the site in Henryków refers to some of the Moravian models. The hill where the campsite is situated enables observation of the surrounding area, while potential sources of raw material are situated in the fluvio-glacial deposits neighbouring with the site in the south as well as situated ca. 1-2 km to the south-east, at the edge of the Oława valley.

The analysis of flint material, especially the products within concentrations no. 1-3, proves that the full cycle of flint production was performed on the spot, starting from testing concretions (concentration 1 and 2), to their processing (concentration 3), and to the acquisition of blade and bladelet blanks (concentrations 1 and 3). Interestingly, the forms connected with core preparation and other flakes resulting from the exploitation of cores predominate, while blade cores were intensively used. The blades and bladelets found at the site are characterised by a considerable degree of fragmentation (predominance of medial parts), which mainly results from the manner of reduction and the quality of the raw material. Massive forms made from flakes and big blades predominate among the tools. Scarcity of the assemblage, small frequency of hunting tools (backed pieces) and scarce bone finds indicate a relatively short period of the site's occupation.

On the basis of these observations, the remains of the Gravettian settlement in Henryków may be considered as trace of a short-lived, temporary campsite set up during a search for new sources of good-quality flint raw material. It was connected with replenishing the range of tools and the supply of blanks for their production (cf. Kozłowski 1996, 17, 20). No intensive hunting took place there as no traces

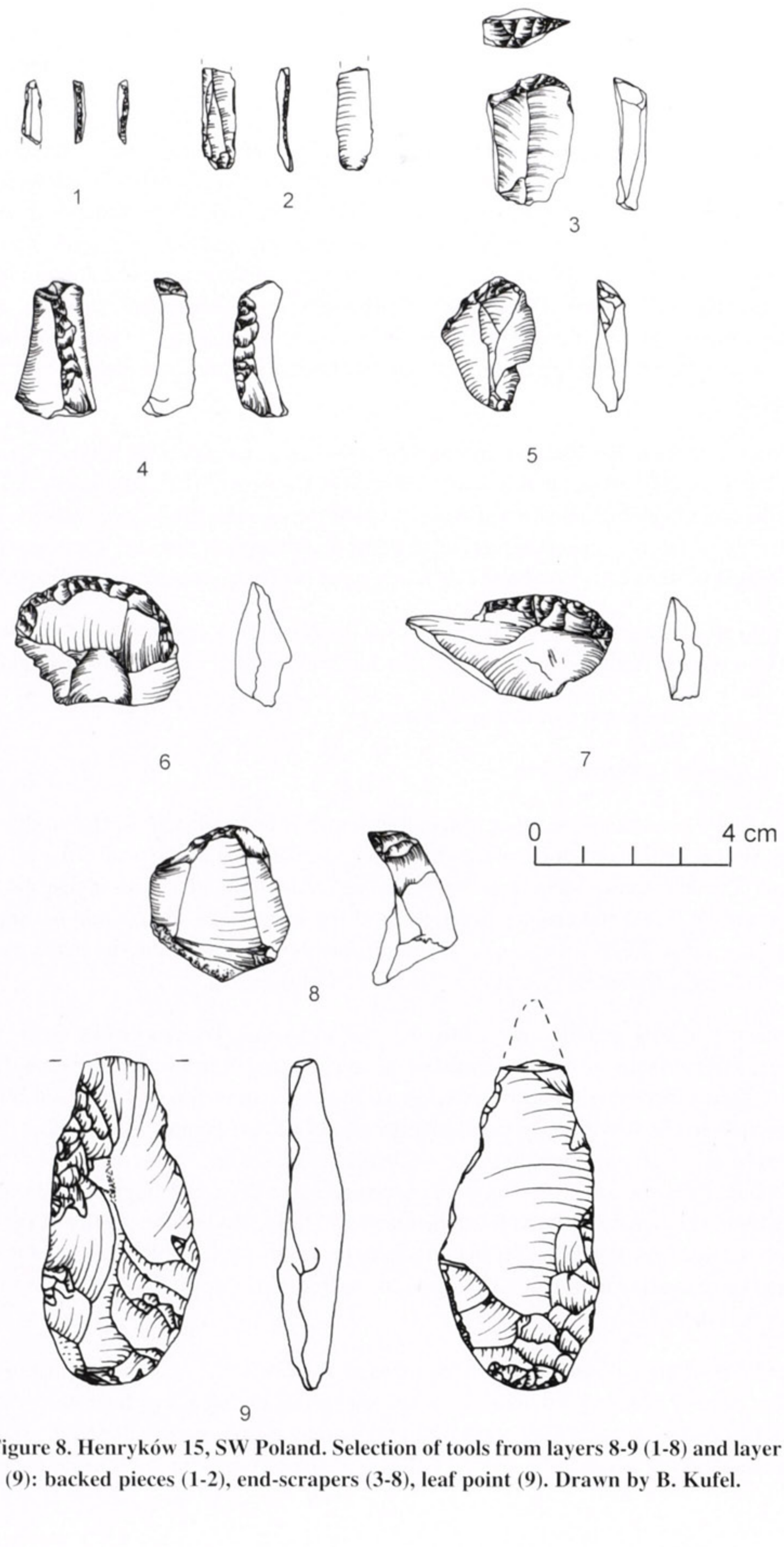

Figure 8. Henryków 15, SW Poland. Selection of tools from layers 8-9 (1-8) and layer 1 (9): backed pieces (1-2), end-scrapers (3-8), leaf point (9). Drawn by B. Kufel.

of killing animals were found. Similar type of settlement was discovered in Kraków, in Spadzista street, space CII, horizon IV (Sobczyk 1995, 49-57, 111-112). Both encampments share the following features: a small number of artefacts and considerable fragmentation of blades, yet they differ in terms of frequency of tool forms - these are small at the site of Spadzista street and relatively large at Henryków (Table 1). The site is interpreted as a short-lived campsite of a small group and it is possible that it is a periphery of a greater and richer concentration (Sobczyk 1995, 112). When comparing both sites, it should be remembered that the site of Spadzista street was discovered in the area of better and richer flint deposits, with more numerous evidence of the settlement from the middle phase of the Gravettian complex (Kozłowski 1996, 16-17).

When analysing the site in Henryków, the Gravettian site Wójcice B must also be mentioned, most probably belonging to the same chronological horizon. The stone assemblage found there (over 6600 artefacts) points to another function of the camp. Unfortunately, considerable disturbance prevented reconstructing of its spatial organisation (Ginter 1966, Dagnan and Ginter 1970, Kozłowski 1996, 16). A great number of artefacts and a high proportion of tools suggest repeated and extended settlement periods (hunting campsite and workshop). Both sites represent different manners of penetration into the area, and their different functions correspond to different exploitation systems along the northern border of the Gravettian settlement.

7. Concluding remarks

The discovery and excavations at the site of Henryków 15 provide new perspectives in research of the Gravettian settlement north of the Sudetes. For the first time the remains of a Gravettian settlement have been described in well-documented stratigraphic context enabling the correlation of the settlement and the changes of the environment where the human groups lived. Because the remains of the Gravettian settlement were covered with thick loess deposits, the original distribution of the artefacts has been preserved, which enables the reconstruction of the camp's function and its internal organisation. We hope that further excavations will bring new discoveries of sites complementing the pattern of penetration into the northern zone by Gravettian groups.

8. Acknowledgements

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NEW EXCAVATIONS AT KRAKÓW SPADZISTA STREET (B).

P. Wojtal

Abstract

The excavations at the Kraków Spadzista Street (B) site were conducted during 17 seasons, and approximately 150 sq m were studied. The radiocarbon dates of this site are clustered around 23 – 24 ky BP. During the excavations, approximately 7000 woolly mammoth bones and teeth were collected. As of year 2002, the remains of 86 mammoths have been found. The Kraków Spadzista Street (B) site represents a mammoth butchering locality and probably a mammoth hunting site as well. However, it is not yet possible to distinguish the mammoths killed by Gravettian hunters from those who died naturally and were scavenged by humans afterwords.

KEYWORDS: woolly mammoth, taphonomy, Gravettian, Poland.

In late autumn 1967 a new Upper Palaeolithic site was accidentally discovered in Kraków. In the course of building works near the ruins of a 19th century Austrian fortification some mammoth bones and flint artefacts were found. Regular excavations at this site, called Kraków Spadzista Street (B), began in 1968 and continued with few interruptions until 2002. The site is situated on the northern slope of Saint Bronisława Hill, about 50 meters above the Rudawa River valley; it is bordered from the north by a rocky cliff and from the west and east by gorges (Kozłowski *et al.* 1974). The site is situated just 2 km from the Wawel Castle and the Market Square in Krakow.

No more than 100 m from the Kraków Spadzista Street (B) site a few other Upper Palaeolithic sites were found. They are: (B) flint workshop, C and C2, D, E and F. These sites were exploited in the period 1973-1989.

The excavations at the Kraków Spadzista Street (B) site were conducted for sixteen years and the area of approximately 150 sq m were studied. The main cultural level, with mammoth bone accumulations and Gravettian artefacts, is connected with a blue grey loam – layer 6. Nowadays we have seven radiocarbon dates for the Kraków Spadzista Street (B) bone accumulation (Table 1).

Number of sample	Radiocarbon dates	Sample
Ly-631	20600 ± 1050 BP	collagen from mammoth bone
GrN 6636	23040 ± 170 BP	carbonized bone
Poz-242[a]	23020 ± 180 BP	collagen from mammoth bone
Poz-1248[a]	23750 ± 140 BP	collagen from mammoth bone
Poz-1251[a]	23770 ± 160 BP	collagen from mammoth bone
Poz-225[a]	23980 ± 280 BP	collagen from mammoth bone
Poz-268[a]	24000 ± 300 BP	collagen from mammoth bone

[a] The AMS dates were made in 2002 in Poznań Radiocarbon

Table 1. The Radiocarbon dates from Kraków Spadzista Street (B) site.

Nearly all radiocarbon dates cluster around 23-24 ky BP and suggest a prolonged period of mammoth bone accumulation at the site. At the Kraków Spadzista (B) site, one mammoth individual per approximately 2 m^2 was found. The very high density of mammoth bones per m^2 implies that the period of accumulation may have lasted for several years or even decades and suggests multiple visits of the mammoth, and their death at this site.

The Palaeolithic hunters may have visited the site more than one time as well. The large amount of flint tools could confirm this suggestion. However the second visit of people at Kraków Spadzista (B) was evidenced in southern part of the site. The second cultural episode connected with the main layer was found during the 1990s excavations (Escutenaire *et al.* 1999).

The thickness of cultural layer 6 ranges from 10 to 20 cm in the northern part of the site (near the rocky cliff) to about 50 – 70 cm in the southern part. Some mammoth bones were found in the lower layers, however they doubtless come from layer 6. The cultural layer includes large amount of stone tools mixed with mammoth bones. The archaeological finds contain many stone artefacts belonging to the Upper Palaeolithic industries of the Kostenki type (Kostenki knives, backed blades and Kostenki shouldered points) (Kozłowski *et al.* 1974, Sobczyk 1995).

Prior to 1994, about 9000 bone remains were found. Species and element identification was possible for 5860 specimens. At the Kraków Spadzista Street (B), 5845 remains belong to the woolly mammoth. Fifteen bones and teeth were recognized as belonging to the other mammals: polar fox (NISP=3, MNI=2), wolf (NISP=4, MNI=1), bear (NISP=2, MNI=1), horse (NISP=1, MNI=1), woolly rhinoceros (NISP=1, MNI=1) and reindeer (NISP=4, MNI=1) (Lipecki and Wojtal 1996, Wojtal 2001). Unfortunately only several mammoth bones were found in anatomical order. Human and carnivore activities as well as animal trampling may have disturbed the remains, but the main process responsible for the redeposition was solifluction. During the fieldwork, four solifluction lobes were observed in the site sediments.

All parts of mammoth skeleton are represented in the paleontological material. The presence of a high number of small and rare elements such as mammoth hyoid bones (MNE=36), caudal vertebrae (MNE= 106) or sesamoids (NISP=85) is a significant feature of the assemblage. During excavations in 2000, for the first time a mammoth deciduous tusk was found (Figure 1). It is the first case of this kind of specimen in Poland (Wojtal 2001).

Figure 1. Woolly mammoth milk tusk from Kraków Spadzista Street (B) site.

Since 1989, new excavations at the Kraków Spadzista Street (B) enlarged the Minimum Number of mammoth individuals from 60 (known in 1970s, Kubiak and Zakrzewska 1974) to 86. The age profile of this mammoth population is similar to the type A described by Haynes (Haynes 1991). Subadults predominate and other age classes are represented in decreasing proportions (Table 2).

Age	MNI	Percentage MNI
<12 AEY[1]	37	43 %
13 - 24 AEY	30	34,9 %
25 - 36 AEY	7	8,1 %
37 - 48 AEY	10	11,7 %
> 48 AEY	2	2,3%

AEY[1] – African Elephant Year

Table 2. The MNI of mammoths in age groups at Kraków Spadzista Street (B).

Haynes suggests that such a profile could be created by nonselective deaths of single animals or abrupt nonselective kills of complete herds (1991). At the Kraków Spadzista Street (B) site, single deaths are most likely represented, however we can not exclude the possibility of death of an entire herd. The very small area and a high number of mammoth individuals suggest that the bone accumulation took place for a longer period.

Not only Palaeolithic hunters visited this accumulation of bones. Also large Pleistocene carnivores scavenged mammoth bones and about 6 % (a few hundred) of all identifiable bones have gnawing marks. Characteristic damage caused by carnivores is described in Haynes (1980, 1983) and similar marks caused by carnivores were observed on the mammoth bones at the Kraków Spadzista Street (B). The dimension and morphology these marks indicate that they were made by hyenas or wolves gnawing articular surfaces, long bones shafts, carpal and tarsal bones (Haynes 1983). This suggests that the Pleistocene predators were returning to the site several times. Some bones (especially long bone epiphyses) are heavily gnawed and some of them are broken, probably by hyenas.

Human activities are predominantly evidenced by the presence of numerous artefacts and by only a few cut marks on the bones. In contrast to other Gravettian sites, at the Kraków Spadzista Street (B) site we have not yet found the "Venus" figurines. During studies of the paleontological material, only two bone fragments which could be described as art objects were found. Both were found during the 1990s excavations. The first is a rib fragment (probably of a woolly mammoth) with intentional notches on the both edges (Figure 2); the other is a rib fragment (also probably mammoth) with an engraving (Figure 3). A fragment a reindeer femur has very deep cut marks (localised in the middle of the shaft) suggesting that they were created in the course of the preparation of this bone during tool or art production, rather than during dismembering or filleting.

The state of the bone preservation at the Kraków Spadzista Street (B) is very good. Only small numbers of remains have root etching and most of the bones are unweathered.

However, it is possible that some of the bones were broken or destroyed by mammoth trampling. The trampling marks were found on bones and some of them were broken and moved into a vertical position.

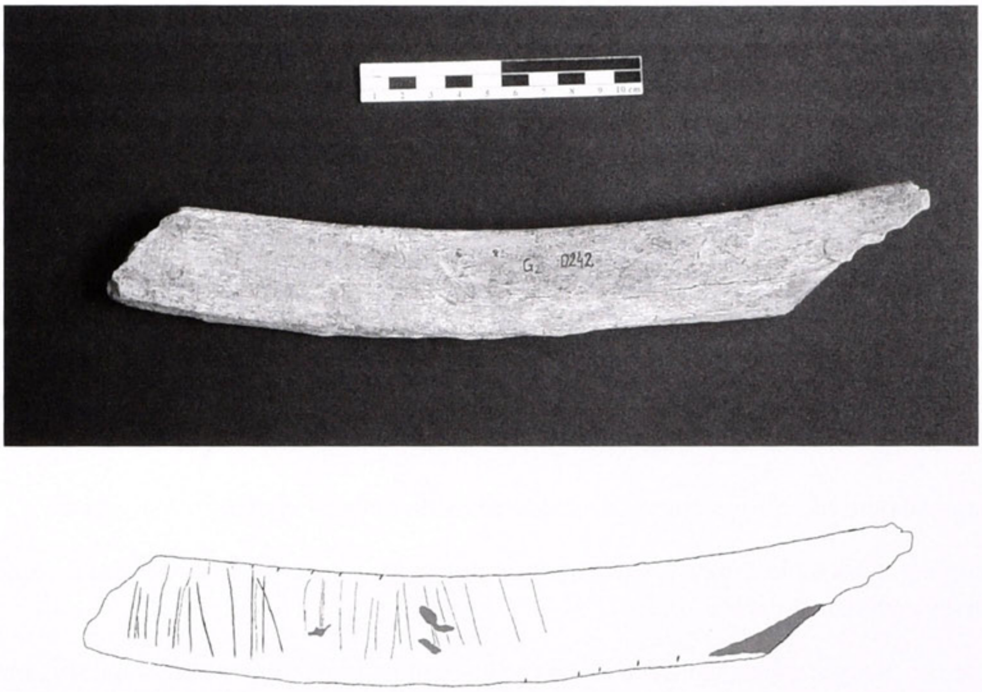

Figure 2a and b. Fragment of woolly mammoth rib with intentional notches.

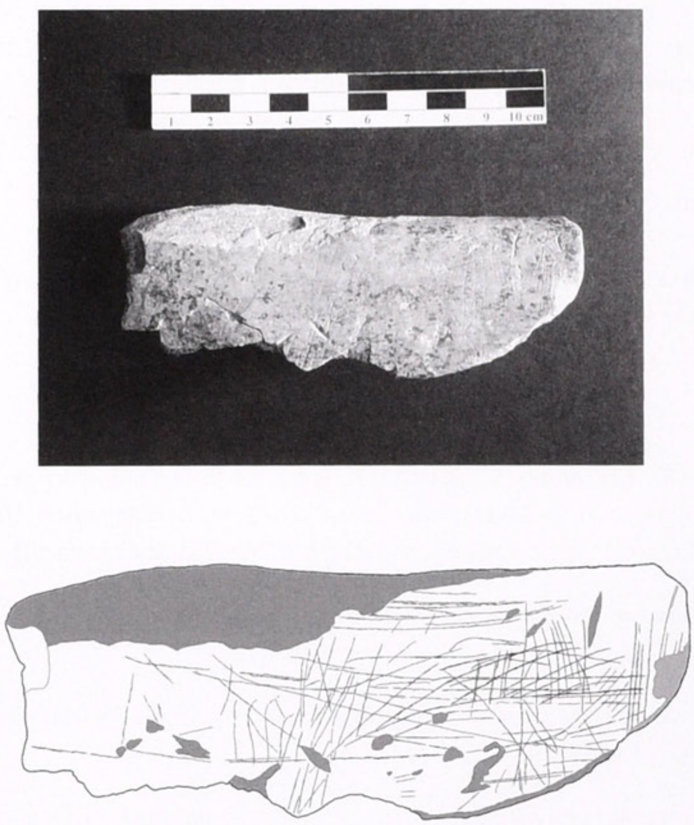

Figure 3a and b. Fragment of woolly mammoth rib with engraving.

In the first interpretation, the Kraków Spadzista Street (B) site was considered a Palaeolithic hunters' base camp with two or three dwellings made of mammoth bones. The "dwellings" were located in the eastern and central parts of the site and were thought to be build of bones of mammoths killed in the nearby Rudawa valley (Kozłowski *et al.* 1974, Kubiak 1980, Wojtal 1994).

However, one of the most important results of the new excavations and of new archaeological, taphonomical and archaeozoological studies is the proposed new interpretation of this bone accumulation. In the opinion of myself and K. Sobczyk (pers. comm.), the Kraków Spadzista Street (B) site is the place where mammoths died or a place very close to where they died.

A few arguments could confirm mammoths' death at the site Kraków Spadzista Street (B):

· All bones from mammoth skeleton are represented, including abundant "non-meaty" bones such as hyoid bones, caudal vertebrae, sesamoids or phalanges.

· A large amount of unfused epiphyses and shafts with unfused epiphysis were found.

· Trampling marks and bones broken by trampling suggest that mammoths could reach the site by themselves and visited several times.

· At the site many artefacts which could be used as cutting tools were found; some flint blades have broken tips suggesting that they were damaged from impact with bone.

The carcasses of mammoths were dismembered directly at this site. Unfortunately it is not possible to resolve whether the mammoths died naturally or were killed by people. The latter suggestion could be supported by the presence of shouldered points that may have been used as spear projectiles, and some of which even have broken tips. Therefore, we believe that the Kraków Spadzista Street (B) site was a mammoth butchering site and probably a mammoth killing site.

Acknowledgements

The Kraków Spadzista Street (B) site study was partly supported by the Grant No. 6 P04C 06418 of the State Committee for Scientific Research.

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TIME SPACE SYSTEMATICS OF GRAVETTIAN FINDS FROM CEJKOV I.

Ľ. Kaminská and S. Tomášková

Abstract

The greatest concentration of Gravettian and Epigravettian sites in Eastern Slovakia is on the eastern and northern slopes of the Zemplín Hills (Cejkov, Kašov, Kysta, Hrčeľ, Veľaty). The best-known site is Cejkov I on the Tokaj Hill. The site was discovered in 1932 by Š. Janšák. Bánesz (1996a) worked in the area for ten seasons from 1960 until 1988. In order to clarify the stratigraphic location of the previous finds, and to delineate the Upper Paleolithic stages of the settlements, we conducted a new research in 2001 (Kaminská *et al.* 2002).

The oldest dated layer at Cejkov I is the loess layer 5 with hearth in 1/2001, dated before the Tursac interstadial: 24 800 ±110 BP (Beta 159851), 23 820 ± 40 BP (Beta 159852), 23 440 ± 120 BP (Beta 159853), 24 240 ± 120 BP (Beta 159854) a 24 130 ± 130 BP (Beta 159855). The raw material (limnic quarzite and black obsidian) suggests contacts with the southern regions of the northeastern Hungary. The intensive occupation of the area occurred before the Laugerie interstadial: 19 600 ± 340 BC (KN 2124/526) and 19 755 ± 240 BC (Berlin 1414) (Bárta and Bánesz 1981, 24), during the late shouldered points horizon, when mainly the summit of the Tokaj Hill was settled. We suggest that the majority of the finds, whether the shouldered points, the tanged tools, or the horizons with engraved bone and reindeer antler tools belong to the period before the last glacial maximum. Newly acquired data about the stratigraphy and chronology of the Gravettian finds from Cejkov I in northern Carpathian basin form a connection, and allow a better correlation of well known dates from the Middle Danube basin with those from the east Carpathian area before the last pleniglacial.

KEYWORDS: Cejkov I, Eastern Slovakia, Gravettian, stratigraphy, chronology.

1. Introduction

The greatest concentration of Gravettian and Epigravettian sites in Eastern Slovakia is on the eastern and northern slopes of the Zemplín Hills. Among these are such Gravettian and Epigravettian sites as Kašov, Kysta, Hrčeľ a Veľaty. However, the site Cejkov stands out (Figure 1). Cejkov is located on the eastern slope of the Zemplín Hills, in the southern part of the East Slovak Lowlands, in the catchment of the Ondava river. Numerous localities with archaeological finds are known in the area, five among them with Paleolithic materials. Currently, the best-known site is Cejkov I, located north of the village of the same name, on the Tokaj hill (Figure 2:1).

The Tokaj Hill, 158 m above the sea level, is an eastern outpost of the Zemplín range formed by rhyodacite minerals. It is bordered on the north side by the Lagaš tributary of the Ondava river, with a source about 1 km to the north. Hill rises steeply about 30 m over the stream. Equally steep are the eastern and western slopes; only the southern slope has a moderate incline. The river Ondava, only a few kilometers away, is visible from the hill.

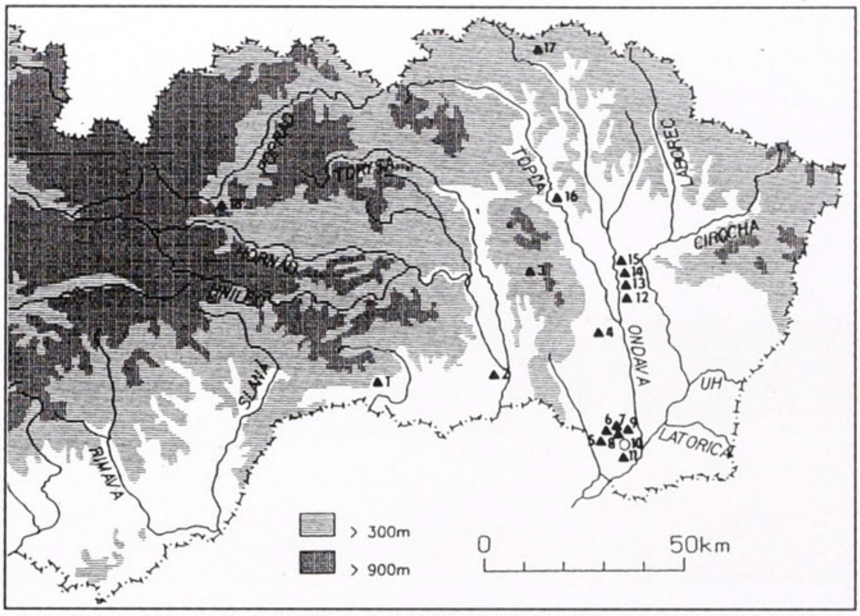

Figure 1. Map of Gravettian/Epigravettian sites in Eastern Slovakia: 1- Háj (Slaninová cave), 2- Košice-Barca, 3- Červenica, 4- Banské, 5- Veľaty, 6- Hrčeľ, 7- Kysta, 8- Kašov, 9- Zemplínske Jastrabie, 10- Cejkov, 11- Zemplín, 12- Nižný Hrušov, 13- Poša, 14- Nižný Hrabovec, 15- Kladzany, 16- Marhaň, 17- Kečkovce, 18- Gánovce.

2. History of the research

The site was discovered in 1932 by Š. Janšák (Janšák 1935). Prošek and Bánesz conducted research in the area in 1954 and 1957 (Bánesz 1959, 1961). Bánesz later worked in the area for ten seasons, with occasional breaks, from 1960 until 1988 (Bánesz 1969, 1984a, 1986a, 1987a, 1990a, 1996a, Bánesz and Pieta 1961). However, he did not record his sondages accurately, and currently we have only an approximate idea about their location. Documentation from the older excavations did not give us a sufficient and satisfactory background to evaluate the location and relationships between the different stratigraphic layers from this research. In order to clarify the stratigraphic location of the previous finds, and to delineate the Upper Paleolithic stages of the settlements on the Tokaj Hill, we conducted a new research in 2001 (Kaminská *et al.* 2002). In comparing the old finds with the results of our research, we attempted to create a more accurate picture of the settlements in the area during the last glacial maximum.

3. Research in 2001

In order to find out the stratigraphic location of the Paleolithic layers, we placed five different sondages in separate areas of Tokaj Hill (Figure 3). Sondage 1/2001 was the furthest from the top of the hill at 150 m to the south. Other sondages on the southern slope were 2-4/2001, sondage 5/2001 was located on the northern slope.

3.1. Sondage 1/2001 (Figure 4, 5)

Sondage 1/2001 is situated in the N-S direction and measures 5 x 2 m. Its northern edge is at 151 m above the sea level.

Figure 2. Cejkov. I- view of location I – Tokaj Hill; 2- hearth recovery in layer 5, excavation unit 1/2001.

Stratigraphy:

1. Layer (0-25 cm): plough zone, yellowish brown, noncalcerous, firm, fine-grained, sandy soil, with lithic finds.

2a. Layer (25-48 cm): transitional layer between the plough zone and layer 2.

2. Layer (48-96 cm): noncalcareous, yellowish brown loess. The layer is not clearly stratified as result of solifluction. The base of the layer is clearly delineated from the previous layer. This could

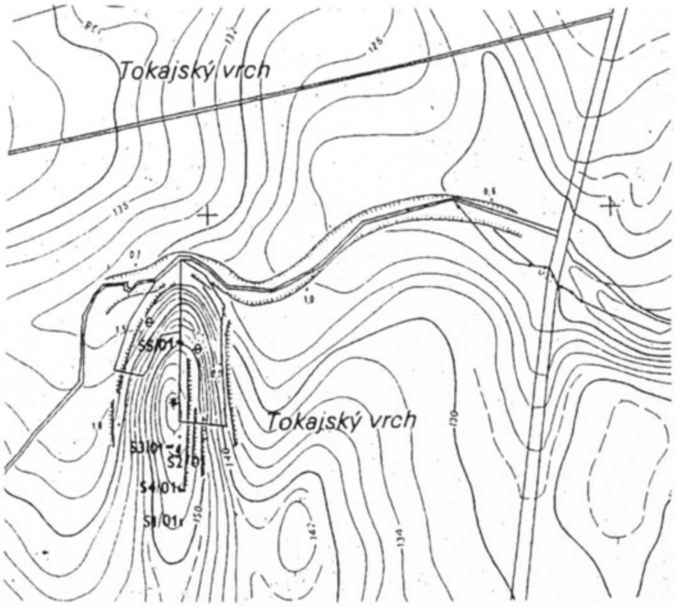

Figure 3. Cejkov I. Location of excavation units on the Tokaj Hill in 2001.

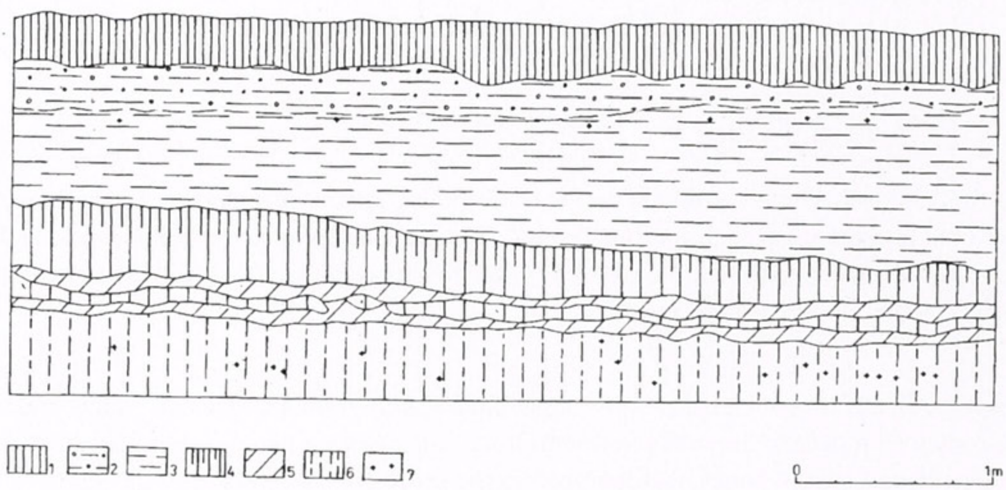

Figure 4. Cejkov I. Eastern profile of the excavation unit 1/2001: 1- plough zone, 2- transitional layer (2A) between the plough zone and layer 2; 3- decalcified loess, layer 2; 4- loess, layer 3, upper part distinctly calcified; 5- layer 4, 6 – calcified loess, layer 5; 7- lithic industry

be the consequence of sedimentary processes, of solifluction that affected the entire layer, or the result of a pedogenetic process (Kovanda 2001). Lithic finds were located at 50 cm.

3. – 4. Layer (96-148 cm): a layer formed by a calcareous loess, disturbed by solifluction. A porous fine-grained sandy clay material with small $CaCO_3$ concretions formed in the root canals, or in freely accumulated loess lumps. The layer starts with a strong 10 cm calcite deposit. Layer 3 is light olive brown (96-126 cm, 132-142 cm), and is interbedded by layer 4, which is light brown (126-132 cm,

142-148 cm). At the bottom of layer 4 in sectors 5 – 8, we found traces of a darker brown soil, entering from the west, and ending in the middle of the sondage. The soil was burnt red in several places, containing charcoal fragments. These were radiocarbon dated by AMS: 22 480 +/- 120 BP (Beta – 159856). The date and the nature of the sedimentation suggest temporal frame of the mild Tursac oscillation. There were no lithics in this layer.

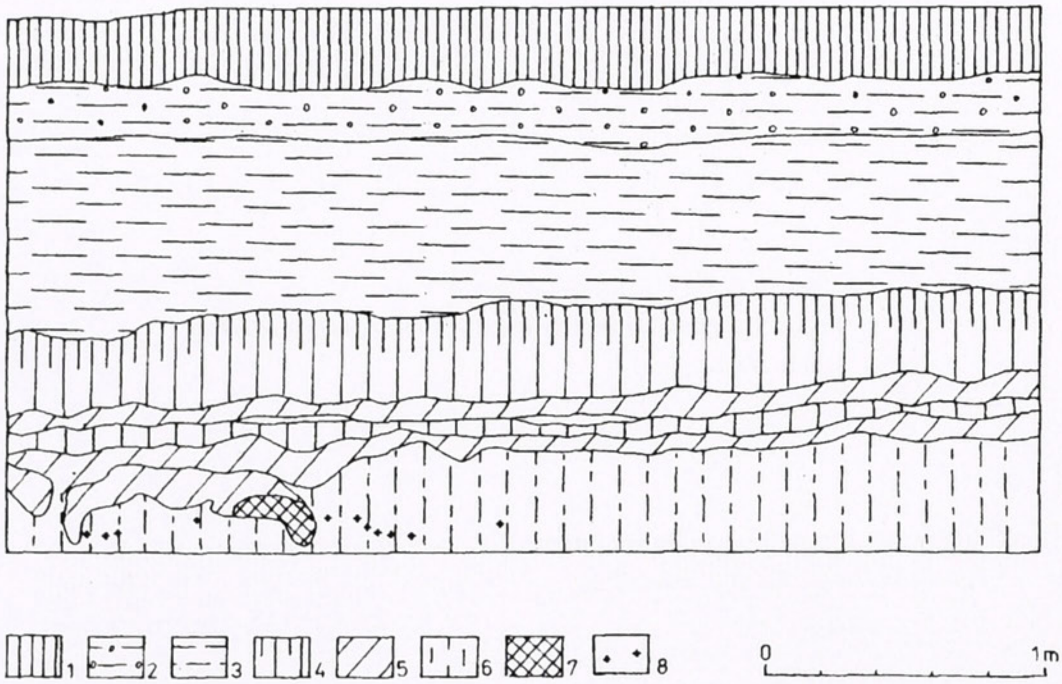

Figure 5. Cejkov I. Western profile of the excavation unit 1/2001: 1- plough zone; 2- transitional layer (2A) between the plough zone and layer 2; 3- decalcified loess, layer 2; 4- loess, layer 3, upper part distinctly calcified; 5- layer 4; 6 – calcified loess, layer 5; 7- location of charcoal dated 22 480 ± 120 BP; 8- lithic industry.

5. Layer (148-195 cm): is again a calcareous loess, reddish, gray-brown with small calcite concretions. This layer contained a hearth, lithic material with thick calcite encrustation, stones, substantial pieces of ochre pigment, and animal bones, that fell apart in the process of recovery.

Hearth was at the intersection of sectors 1-4. Its upper layer was at 160-166 cm, mainly as scattered charcoal. The hearth itself was oval, 75-80 cm in diameter, located at 169-190 cm. It was irregular in depth, stretched out in SE direction (Figure 2:2). It contained large pieces of charred wood, identified as *Pices abies* (Hajnalová M. 2001). Five samples of this wood were taken for dating. Besides the wood, the hearth also contained small pieces of burnt sandstone and slate. Thickly encrusted lithic material was found throughout the uncovered layer, accompanied by animal bones, small pieces of ochre and flat slate pieces (Figure 6).

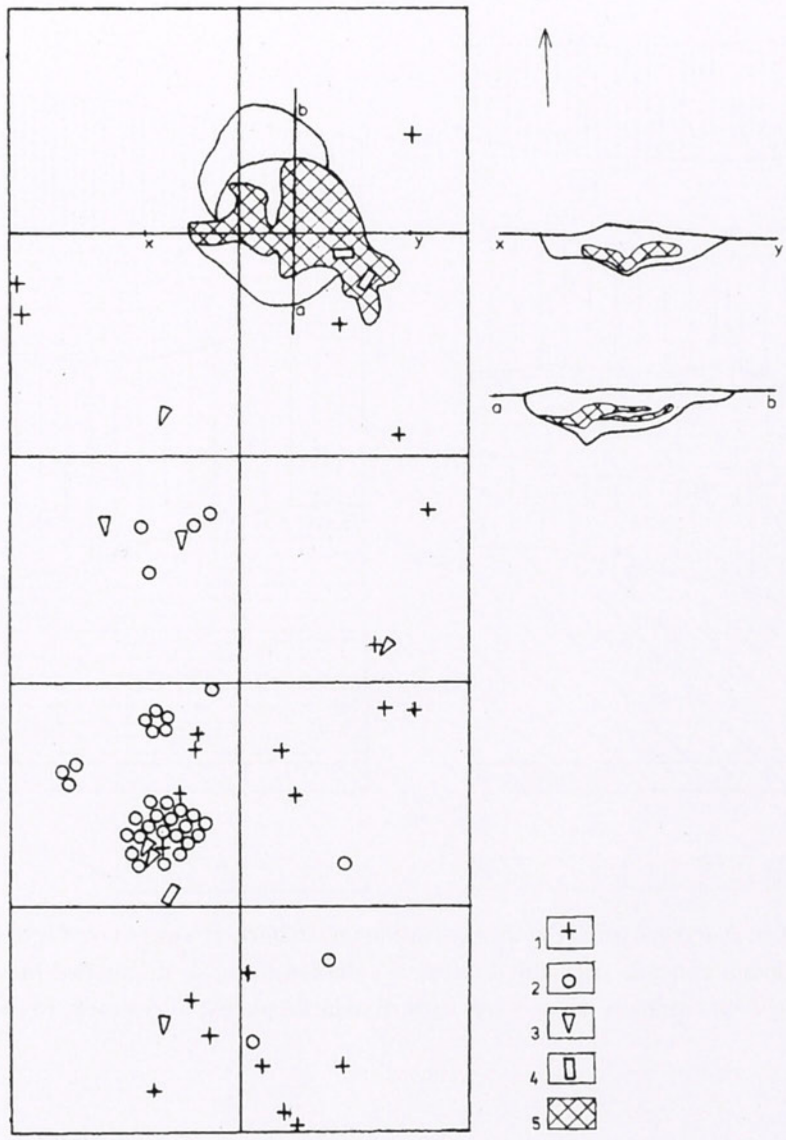

Figure 6. Cejkov I. Excavation unit 1/2001, horizon with archaeological finds in layer 5: 1-lithic industry, 2- ochre, 3- animal bones, 4- pieces of slate and sandstone, 5 – hearth and hearth profiles.

Dating: radiocarbon AMS: 24 800 ±110 BP (Beta 159851), 23 820 ± 40 BP (Beta 159852), 23 440 ± 120 BP (Beta 159853), 24 240 ± 120 BP (Beta 159854) a 24 130 ± 130 BP (Beta 159855). The dating of the hearth in the loess layer 5 is a clear evidence of a Gravettian settlement of Cejkov I before the Tursac Interstadial.

3.2. Sondage 2/2001 (Figure 7:1)

The sondage was located 50 m south of the top of the hill, at the edge of the modern field, at 155 m above the sea level. Its orientation was north south, and the dimensions were 5 x 2 m. The southeastern corner of the sondage contained remains of one of Bánesz's sondages.

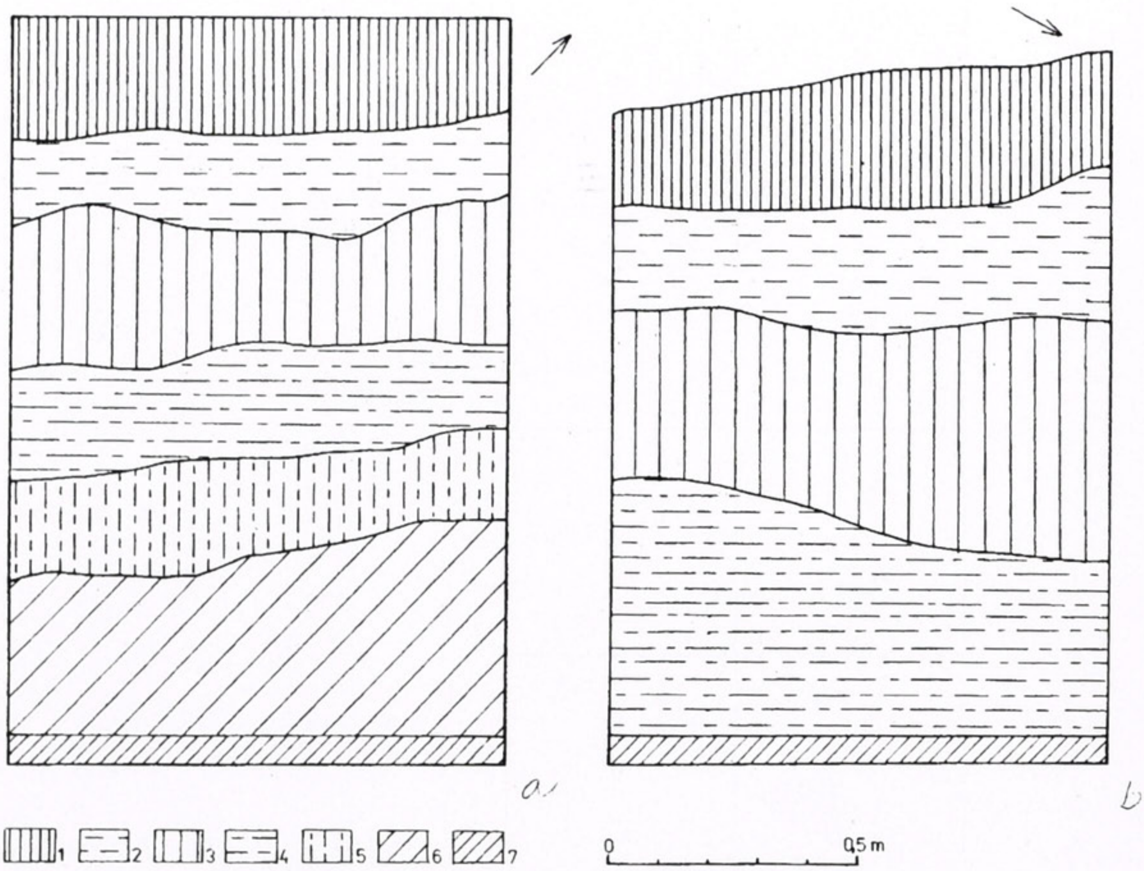

Figure 7. Cejkov I. a: Northern profile of the excavation unit 2/2001, b: western profile of the excavation unit 3/2001: 1- plough zone; 2- decalcified loess; 3- calcified loess; 4- decalcified loess; 5- calcified loess; 6-dark grayish brown loess or loess soil with rhyodacite pieces; 7- bedrock, rhyodacite.

Stratigraphy:

1. Layer (0-20 cm): plough zone, yellowish brown, noncalcerous, fine-grained sandy soil, with lithic finds.

2. Layer (20-35 cm): olive yellow loess soil, decalcified, with lithic finds.

3. Layer (35-65 cm): light yellowish brown calcareous loess, with lithic finds.

4. Layer (65-81 cm): light olive brown noncalcerous loess.

5. Layer (81-99 cm): light yellowish brown with $CaCO_3$ concretions

6. Layer (99-141 cm): dark grayish brown loess or loess clay with pieces of rhyodacites.

3.3. Sondage 3/2001 (Figure 7:3)

The sondage is located to the west of sondage 2/2001, at the same elevation, at the boundary of the ploughed field and a grassy terrain, near the top of the Tokaj Hill. Its orientation was east west, and

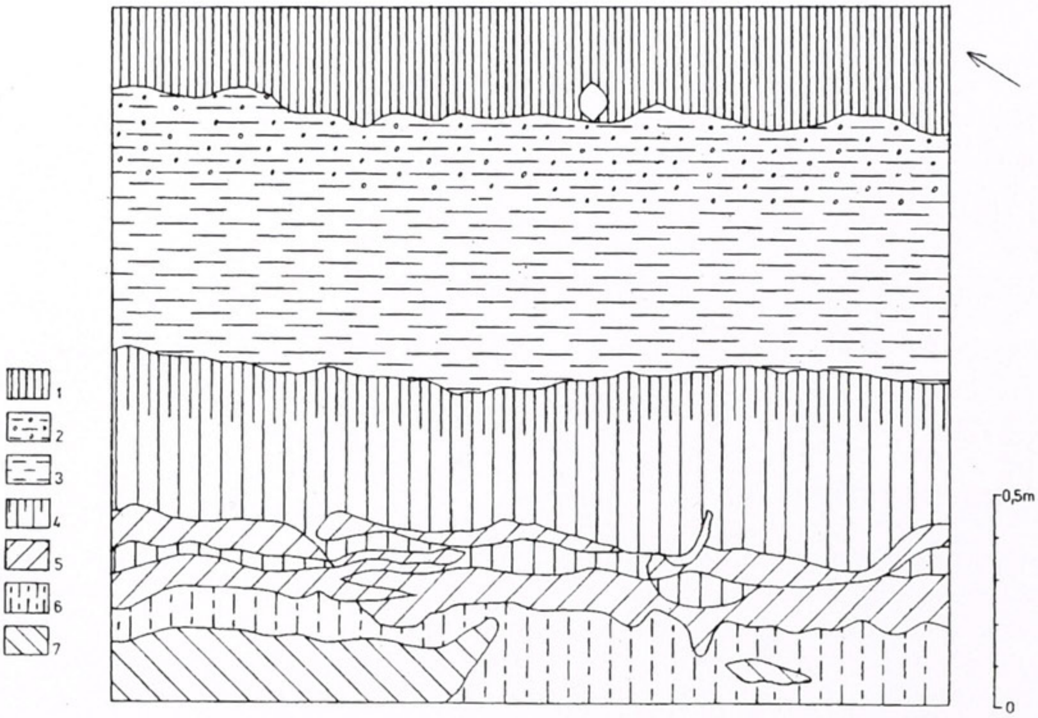

Figure 8. Cejkov I. Eastern profile of the excavation unit 4/2001. 1- plough zone; 2- transitional layer (2A) between the plough zone and layer 2; 3- decalcified loess, layer 2; 4- loess, layer 3, upper part distinctly calcified; 5- layer 4; 6 – calcified loess, layer 5; 7- calcified yellowish dark brown loess.

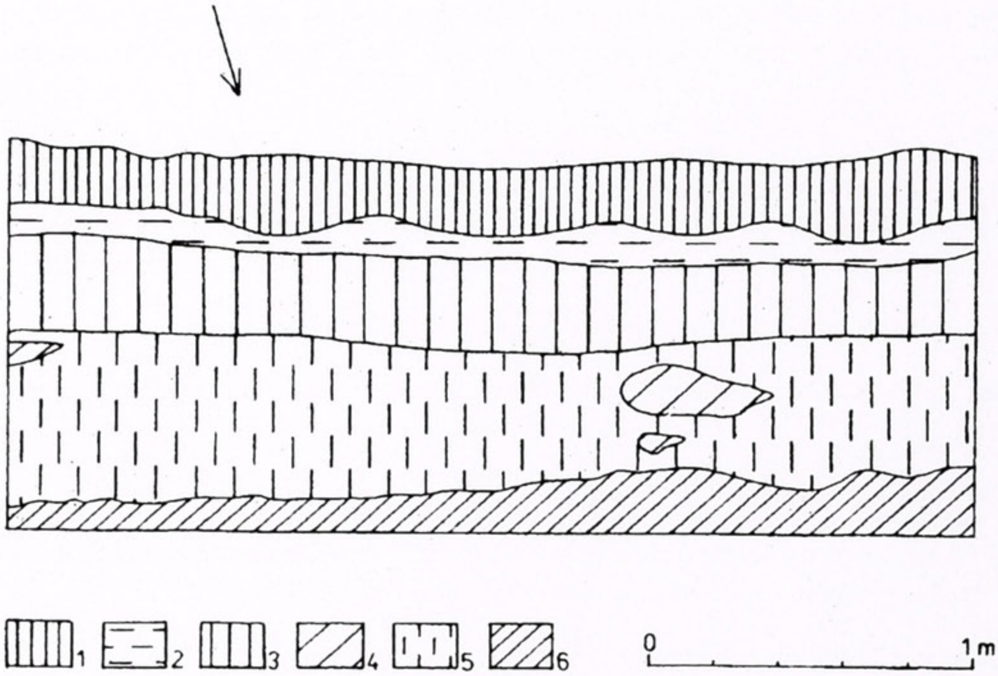

Figure 9. Cejkov I. Southern profile of the excavation unit 5/2001. 1- dark gray humic calcified soil; 2-grayish brown soil with a calcified horizon; 3- strongly calcified light grayish brown soil; 4- light grayish brown soil lenses with numerous $CaCO_3$ concretions, 5- calcified soil similar to loess; 6- bedrock, rhyodacit.

the dimensions were 5x2 m. The western profile was at the edge of a steep slope, and 0.5 m below the northern profile of the sondage 2/2001.

Stratigraphy:

1. Layer (0-23 cm): plough zone, yellowish brown, noncalcerous, fine-grained sandy soil, with lithic finds.

2. Layer (23-53 cm): decalcified olive yellow loess.

3. Layer (53-100 cm): light brown calcareous loess.

4. Layer (100-134 cm): light olive brown loess or loess clay with pieces of rhyodacites.

5. Layer (134- cm): bedrock, rhyodacite.

3.4. Sondage 4/2001 (Figure 8)

The sondage is located between sondages 1 and 2-3/2001, 115 m south of the top of the Tokaj Hill. Its orientation was east west, and the dimensions were 5x2 m. The eastern profile is at the boundary of the hill and its southern decline and the steep eastern slope.

Stratigraphy:

1. Layer (0-20 cm): plough zone, yellowish brown, noncalcerous, fine-grained sandy soil, with lithic finds. A Late Iron age (La Tène) urn grave was uncovered at the bottom of the plough zone.

2a. Layer (20-40 cm): transitional layer between layers 1 and 2.

2. Layer (40-81 cm): yellowish brown noncalcerous loess. The layer is slightly stratified as a result of solifluction, similarly to the boundary between layers 2 and 3. Lithic finds were recovered from the layer.

3.-4. Layers (81-141 cm): loess with numerous $CaCO_3$ concretions, which formed small lumps with the loess soil. The soil was porous with fine-grained sand inclusion. Layer 3 begins with a 10 cm calcareous stratum, similar to layer 3 in sondage 1/2001. Layer 3 is light olive brown (81-118, 128-134 cm), interbedded with less calcareous reddish gray brown layer 4 (118-128 cm, 134-141 cm).

5. Layer (141-149 cm): calcareous olive brown loess with scatters of charcoal.

6. Layer (149-162 cm): calcareous dark yellowish brown loess with scatters of charcoal and one obsidian flake.

3.5. Sondage 5/2001 (Figure 9)

The sondage is located on the northern slope of the Tokaj Hill, 75 m from the top, at 151 m above the sea level. Its orientation was east west, and the dimensions were 5x2 m.

Stratigraphy:

1. Layer (0-22 cm): dark grayish brown, cohesionless, fine-grained sandy, slightly humus, calcareous soil, with lithic material at the boundary between the layers.

2. Layer (22-40 cm): reddish grayish brown, cohesionless, fine-grained sandy, slightly porous soil. Once the profile dried, the calcareous stratum stood out quite visibly, similarly to layer 3 in sondages 1 and 4/2001. This layer contained numerous lithic artefacts.

3. Layer (40-74 cm): strongly calcareous light gray brown soil, porous with small calcite concretions. The layer contained one artefact.

Light gray brown lenses with numerous $CaCO_3$ concretions which begun in layer 3, and are apparent throughout layer 5 as well.

4. Layer (74-110 cm): light brown gray, strongly porous calcareous soil resembling loess. The lower part contained pieces of rhyodacite from the bedrock.

5. Layer (110- cm): rhyodacite bedrock.

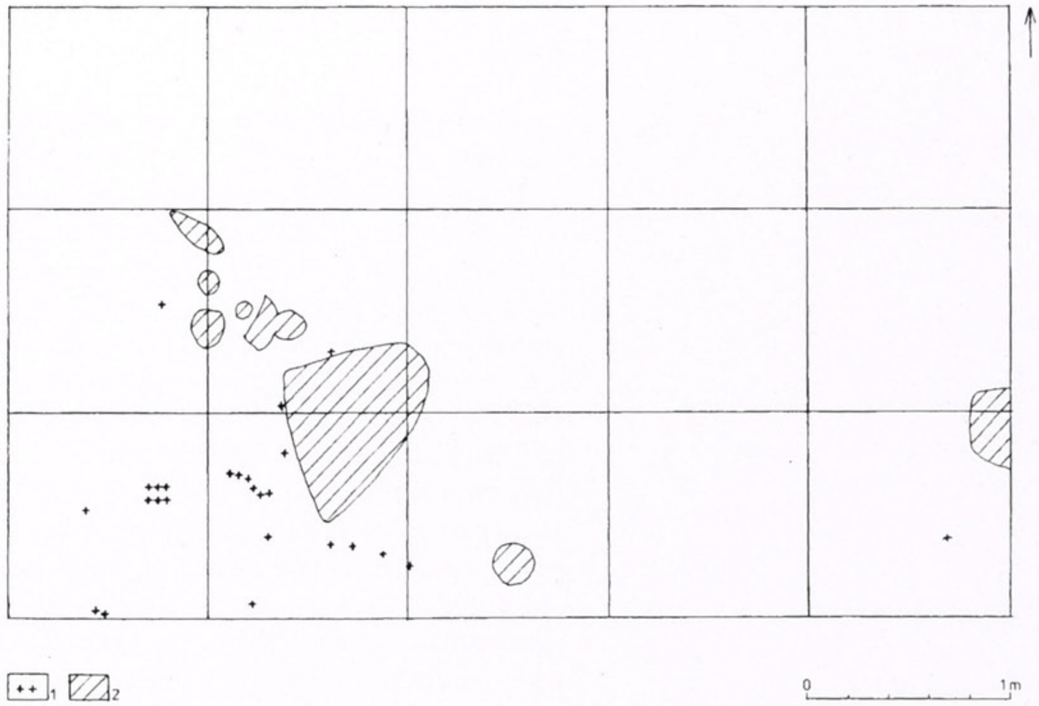

Figure 10. Cejkov I. Excavation unit 5/2001. 1-location of lithic industry in layer 2; 2-lenses of layer 4 in layer 2.

4. Earlier stratigraphy and finds in view of the current research (Figure 10).

According to Bánesz's research at the Tokaj Hill, the plough zone should be at the top, followed by loess that reached all the way to the bedrock. The bedrock was at 60 cm in the central part of the slope, at the top of the hill it was at 150 cm, on the eastern and western slopes it went down to 170 cm. The same stratigraphy was noted near the summit, in sondages 2 and 3/2001. The more western sondage 1/1961 had a 20 cm layer of fossil soil above the bedrock, similarly to sondage 1/88 that was located on the eastern slope. Bánesz did not divide the loess layers any further. Yet judging by the results of the stratigraphic analysis from sondages 2 and 3/2001, this loess layer can be divided into 4 or even 5

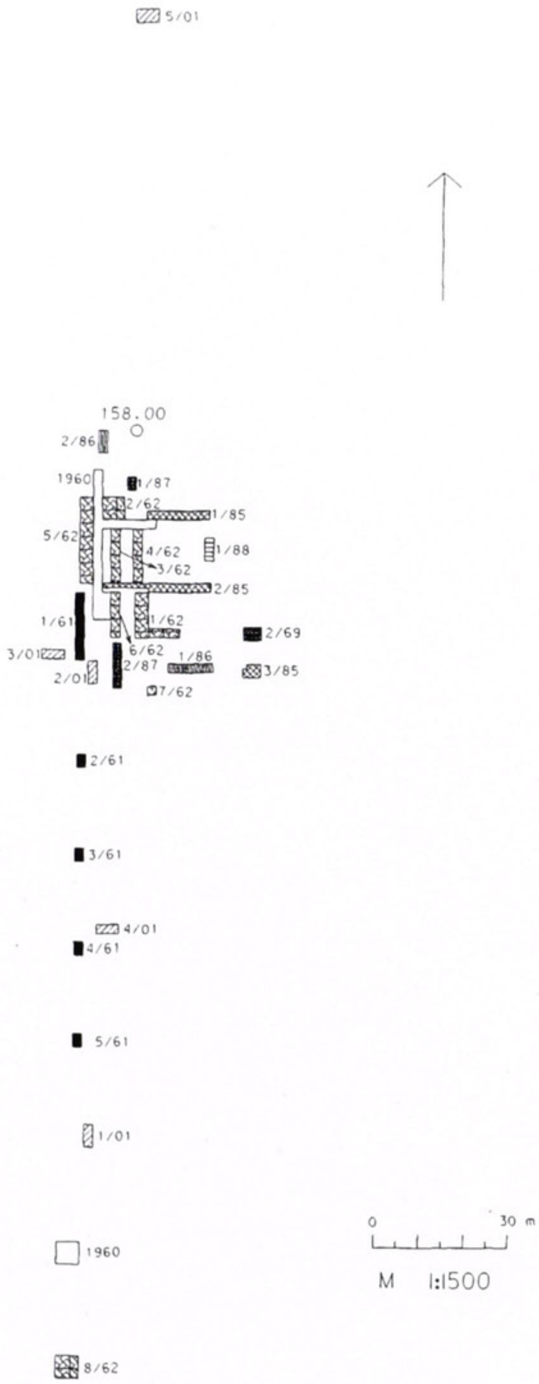

Figure 11. Cejkov I. Location of excavation units in 2001, together with test pits of L. Bánesz from 1960-1988.

strata, and the lowest layer in sondage 2/2001 could be considered a weakly developed fossil soil. None of the layers on the slopes or near the summit on the southern side has a developed Ca horizon.

No lithic material was located in the plough zone at the summit. The highest position of finds is in the loess layer, described by Bánesz as finds from the top or middle part of the youngest loess. Bánesz (1969a, 9) considers the finds (11 obsidian flakes, 4 limnic quartzite artefacts, as well as animal bones) from sondage I/85, found in a loess layer at 45-55 cm, to be the oldest, while the bedrock is at 50-60 cm. The same stratigraphy was described in sondage II/86, 6 m west of the summit. Yellowish green loess with a few artefacts was under the plough zone, and the bedrock was at 55-70 cm (Bánesz 1987b).

Finds recovered in the 1960 excavations are important chronologically as well as typologically. At the time a T shaped sondage was dug on the slope, measuring 34 m in a north-south direction. Two Paleolithic and one ancient feature were uncovered. Feature 2 was a pit with brown to brownish gray fill, recovered in the loess layer immediately under the plough zone, possibly previously disturbed by farming activities. The shape of the pit was irregular, measuring 300 x 160 cm. The bottom of the feature was at 30 cm in the loess layer (approximately 55 cm from the present surface). The pit contained bone fragments and lithic artefacts, mainly obsidian but also radiolarite, flint, opal, chert, and quartzite. Blades, transverse burin and microblades were the most common types of stone tools. The artefacts were encrusted with calcite. Two animal bone concentrations (horse and wolf) with a few stone artefacts were found in the loess layer near the feature, as well as a separate mammoth vertebrae column (Bánesz and Pieta 1961, 14-16).

Feature 3, located in the southern portion of the longer segment of the sondage, was a remnant of a Paleolithic pit, possibly with three postholes on its southern side. Most of the feature was destroyed by more recent damage (Bánesz and Pieta 1961, 16-29). The original fill of the feature was brown, and the feature was apparent immediately beneath the plough zone. The feature ended at 100 cm, the more recent damage could be traced all the way to the rhyodacite bedrock at 160 cm.

The pit contained more than 1000 stone artefacts, a stone tablet, numerous animal bones and charcoal. Gravettian artefacts were mainly on obsidian, but also chert, radiolarite, quartzite, opal and northern flint. Some of these lithics were retouched tanged tools.

E. Hajnalová (1979) analyzed the charcoal from feature 3 and identified 50 pieces as *Picea abies* (originally determined as *Picea excelsa*). Radiocarbon dating of the charcoal from feature 3 set the dates as 19 600 ± 340 BC (KN 2124/526) and 19 755 ± 240 BC (Berlin 1414) (Bárta and Bánesz 1981, 24), placing it in the last glacial maximum, between Tursac and Laugerie interstadials.

Sondage 1 excavated in 1961 (Bánesz 1962) is most likely located near the T shaped sondage described above. The stratigraphy of this sondage was as follows: plough zone, followed by a 60-70 cm thick calcareous loess, with lithic artefacts with calcite encrustations. Approximately 25 cm above the bedrock, which was located at about 150 cm, the loess turned brown.

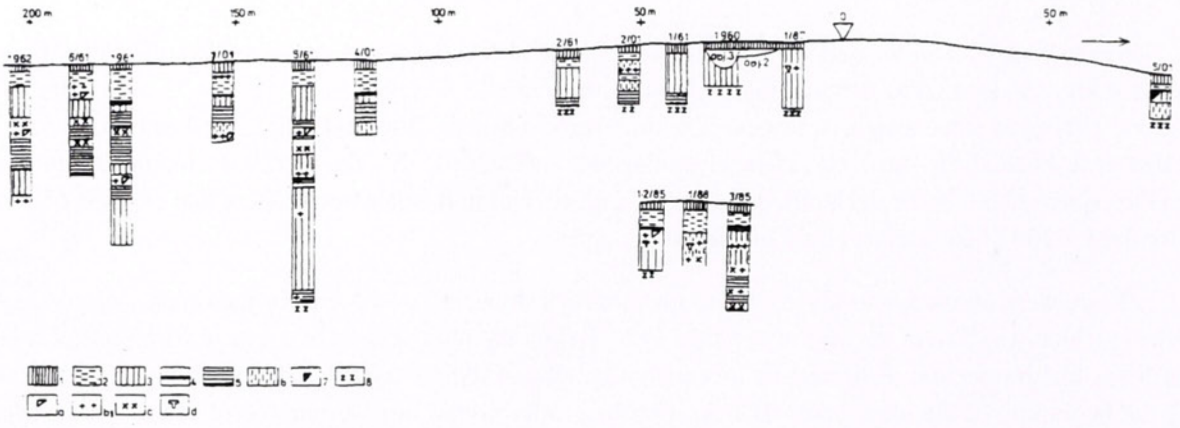

Figure 12. Cejkov I. Reconstruction of the sequence of layers in the excavation units on the Tokaj Hill according to the 2001 research, and according to L. Bánesz's 1960-1988 records.

In 1962 Bánesz placed seven sondages on the top of the Tokaj Hill (Bánesz 1971). Judging from the site maps, the sondages were placed so as to fill in the blank spots around the T shaped pit dug in 1960. Stone artefacts were recovered from the youngest loess beneath the plough zone at 35-50 cm. Loess-like layer above the loess itself was absent in the central part of the slope, but appeared in the eastern portion of the hill. Six hundred stone artefacts were recovered, 30 of them were stone tools, classified as 21 separate types. Obsidian was the dominant raw material, in addition to chert, flint and radiolarite.

The most common stone tool type was endscraper (8 pieces) and burin (6 pieces), in addition to a possible obsidian Chatelperronian point, a unilaterally retouched tanged blade, made on radiolarite, a possibly bilaterally retouched tanged endscraper on a chert blade, a broken obsidian blade, and a backed microblade among others.

Closer to the summit was sondage 1/87, which contained in its loess layer at 50-55 cm mostly obsidian artefacts, as well as a hoe like implement made on a reindeer antler (Bánesz 1996a, 19). The bedrock in this sondage was at 160 cm.

Sondages that cut across the western, central, and eastern part of the summit of the Tokaj Hill contained artefacts in several loess layers. Bánesz (1996a, 9-13) claims that in sondage II/85 a brown soil was located beneath the plough zone, followed at 80 cm by loess, which ended in a fossil soil above the bedrock. The bedrock was in the western part of the slope at 130-140 cm, in the central part at 125 cm, and in the eastern part at 175 cm. The uppermost layer with finds was at 35 cm below the plough zone, and it contained stone artefacts, as well as bovine and horse bones. The next layer with finds was in the western portion at 80 cm, containing stone artefacts and horse teeth. Another layer with stone artefacts was beneath at 100 cm in a loess layer. This layer continued into the central part of the sondage, reaching 100-110 cm, with stone artefacts, horse and bovine bones, as well as an engraved animal bone fragment, which Bánesz later published as an evidence of human depiction (Bánesz 1996a, 15; 1996b).

A sondage I/88 located nearby contained a first find at 5-10 cm into the loess layer (105 cm below the surface). This was a two pronged implement made out of a reindeer antler. The next layer with obsidian artefacts and charcoal was at 150 cm (Bánesz 1990a; 1996a, 19-21).

Sondage I/86 had the following stratigraphy: plough zone, loess starting at 45 cm, with charcoal and stone artefacts appearing at 70-75 cm. Traces of fossil brown soil with charcoal were found at 170-175 cm (Bánesz 1987a, 1987b).

Sondage II/86 was located 10 m to the west of the above described sondage I/86, and its horizon with finds was located at the same depth and in the same loess layer as above (70-75 cm). Besides calcite encrusted stone artefacts, Bánesz also uncovered a hearth (Bánesz 1988). The last two sondages must have been at the same elevation as sondages 2 and 3/2001. Sondage 2/2001 contained artefacts in the plough zone, in the decalcified loess soil beneath, and in the calcareous loess that reached 65 cm. Sondage 3/2001 had artefacts only in the plough zone.

There were numerous sondages on the steep eastern slope, but we have information only on sondage III/85, which was 5 m to the east of sondage I/86. Below the plough zone in sondage III/85 was a layer of loess-like brown soil, followed by loess. Photographs of the stratigraphy clearly show a Ca horizon at the beginning of the loess layer (Bánesz 1986b), similar to the one we uncovered at the top of layer 3 in sondages 1 and 4/2001. The upper part of the loess layer under the Ca horizon at 120 cm contained 11 artefacts (some heavily patinated), made on obsidian, radiolarite, flint, and limnic quartzite. This layer also contained a black burnt clay piece, a two pronged reindeer antler implement, and a juvenile mammoth tusk (Bánesz 1986a, 43).

Excavations continued in 1986 in sondage III/85. A patinated limnic quartzite blade endscraper, three obsidian blades, a flint flake and a small obsidian core with cortex were all recovered from 110-115 cm. Then the loess layer continued without any finds until 170 cm. The next artefact horizon was found at the bottom of the loess layer. It contained 17 obsidian, four flint, three limnic quartzite, and three quartzite artefacts. The soliflucted horizon is below the loess layer (170-260 cm), forming brown sediment layers that follow the slope incline. Bedrock fragments are included in the soliflucted soil. At 205-215 cm, clearly in the fossil soil affected by solifluction, wood charcoal, considered by Bánesz to have been a remnant of a hearth, appeared together with six artefacts (five obsidian and one limnic quartzite). At 260 cm another hearth with charcoal appeared in the central portion of the sondage.

In evaluating the stratigraphic context, it appears that on the eastern, southern, and northern slopes with mild incline stone artefacts and animal bones were found in the loess layer above the bedrock. The depth of the finds varied from 35 cm (1960, I/1961, 1962, II/85, 2/2001, 3/2001), 45-55 cm (I/85, II/86, I/87, II/87, 3/2001), 75-80 cm (II/85, I/86), 100-120 cm (II/85, I/88), to 150 cm (I/88). The steep eastern slope contained artefacts in a loess layer at 110-120 cm (III/85). A fossil soil starts appearing at 130 cm on the western slope (I/1961). On the southeastern slope it is associated with charcoal at 170 cm (I/86), and on the eastern slope it appears at 170-260 cm (III/85). Two features were located at 205-215 cm, that included wood charcoal and stone artefacts, and another hearth with charcoal was found at the bottom of the layer.

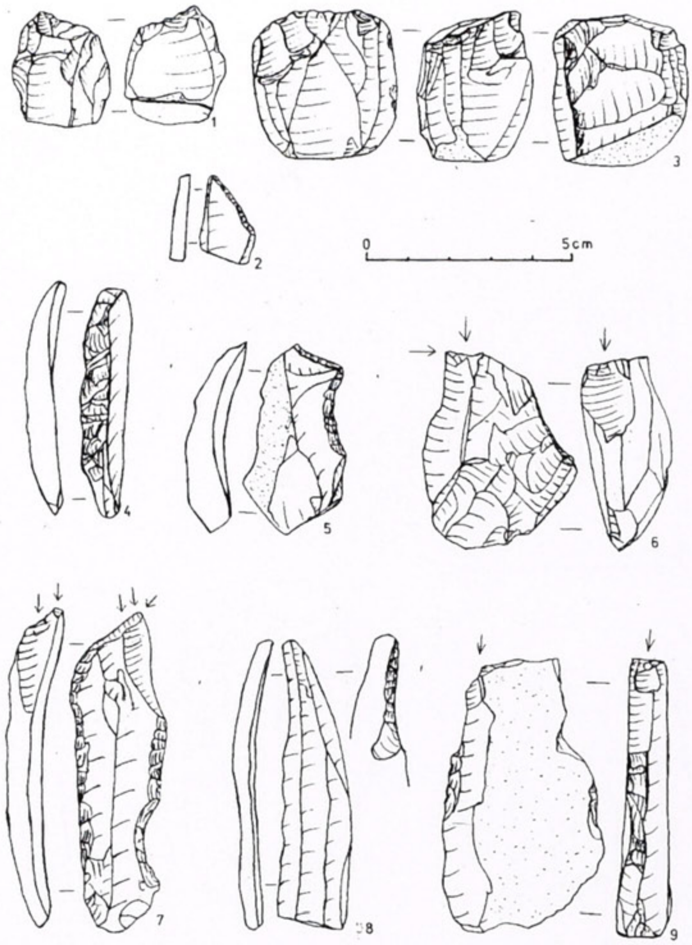

Figure 13. Cejkov I. Lithic industry from the surface collections: 1- a Kostenki knife; 2- a blade fragment with an oblique retouch; 3- a core with a changed platform orientation; 4- a blade from a core edge; 5- a notched retouched blade; 6, 7, 9- dihedral burins; 8- an atypical borer. Raw material: 1-5, 8, 9 – obsidian, 6- opal, 7- limnic quartzite.

5. Evaluation of the 2001 stratigraphy and finds

On the northern slope of the Tokaj Hill, seven meters below the summit, we found stone artefacts that included stone tanged tools in sondage 5/2001. The most numerous artefacts were directly at the boundary between the plough zone and the subsequent layer. Occasional finds were in layer 3. A distinct Ca horizon appeared in layer 2 when the profile dried out, similarly to those found in sondages on the southern slope (1/2001 and 4/2001). Sondage 4/2001 was located 115 m from the summit and 1/2001 was 150 m away. Stratigraphy in both these sondages was similar, only the top layer was higher in 4/2001 due to its location. The plough zone with surface finds was succeeded by a transitional layer (2a), which was followed by a decalcified loess soil. This layer contained several obsidian artefacts at 50 cm in 1/2001.

Both sondages contained a calcareous loess layer 3, with a distinct 10 cm Ca horizon, which is sharply delineated from layer 2. Layer 3 is interbedded by layer 4, which is a remnant of a fossil soil, moved by solifluction. The radiocarbon date for charcoal from layer 4 in 1/2001 (Beta 159856: 22 480 ± 120 BP) places it in the Tursac interstadial. Below this layer was layer 5, which contained a hearth and

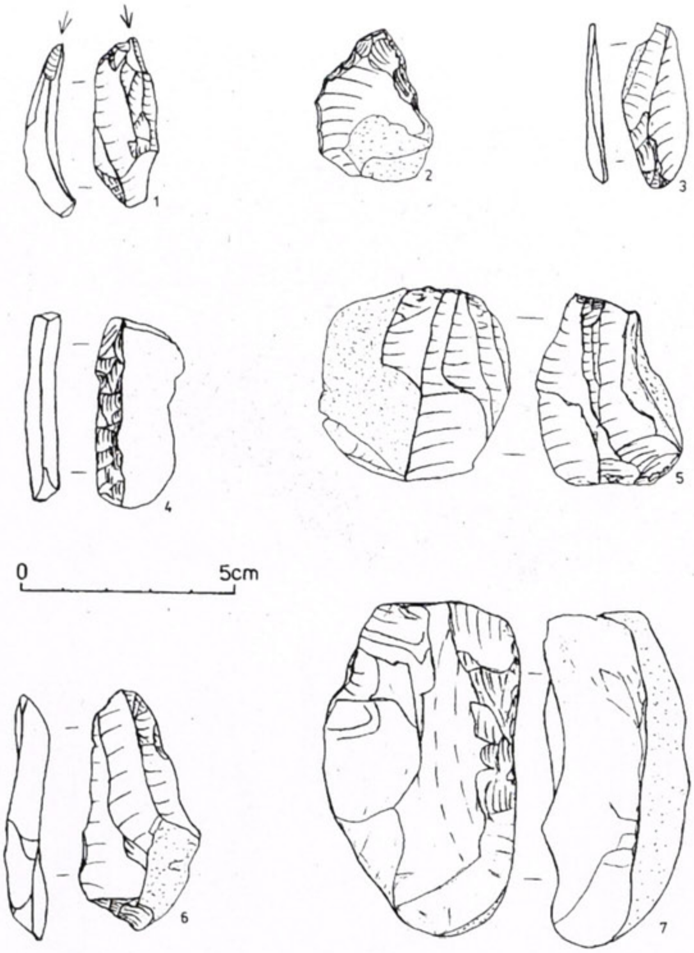

Figure 14. Cejkov I. Lithic industry from layer 1 from the excavation unit 2/2001: 1- a burin on an obliquely retouched blade, 2- a retouched flake, 3, 6 – blades, 4- a blade from a core edge; 5- a double-platform core, 7- a single-platform core. Raw material: 1- patinated flint, 2, 3 - chert, 4, 6 – obsidian, 5, 7- quartzitic sandstone.

associated artefacts. The hearth was dated between 24 800 ±110 BP (Beta 159851), and 23 440 ± 120 BP (Beta 159853), a period that preceded the Tursac interstadial. Sondage 4/2001 contained scattered charcoal in layer 5, and these continued in layer 6, which also contained one artefact.

We are assuming that Bánesz's deep sondage from 1960 was located in the vicinity of our sondage 1/2001. His excavation from 1962, judging by his site plans, was 50 m to the south of our sondage 1/2001. A precise location of sondage 6/1961 is not known. The description of the stratigraphy of the northern profile of this excavation reads as follows (Bánesz and Pieta 1961, 6; Figure 3): below the plough zone at 10 cm starts a loess like soil in two horizons B1 and B2, continuing into 113 cm. Below that is a 15 cm Ca horizon of a loess like soil. Solifluction appeared in a green/yellow loess with brown lenses at 128 cm. This changed at 135 cm into a yellow loess with brown lenses, and continued with humic layers of Paudorf soil to 260 cm. Below this horizon was a greenish yellow loess (260-308 cm), which had patinated obsidian artefacts and an animal bone at its bottom. Remains of rusty red interglacial (R-W), or interstadial (W1-W2), soils on top of a Riss loess were located at 308-340 cm. This layer and the one below both contained strongly developed pseudogley. The lower layer (340-457 cm) is a greenish yellow loess probably of Riss origin.

The stratigraphy recorded by Bánesz and ours from 1/2001 are comparable. The presence of the Ca horizon approximately 20 cm lower suggests that Bánesz's 1960 location was further to the south of 1/2001. Bánesz labeled layers below the plough zone as B1 and B2 Holocene loess like soils. According to Kovanda's analysis (2001) of a comparable layer 2 from 1/2001, no signs of loess like soil were detected.

A bowl shaped, stone lined hearth, 110-120 cm in diameter was found in the central part of the 1960 sondage in a Paudorf horizon at 170-190 cm. It was filled with ashes and charcoal. Krippel identified the wood as *Picea* and *Pinus* (Krippel 1979). No stone artefacts were associated with the hearth, but one obsidian flake was found at 163 cm and 192 cm respectively. The charcoal from the hearth was dated in 2000 to 23 460 ± 200 BP GrN-25427 (Verpoorte 2002, 317). This date corresponds with the dates obtained for 1/2001, indicating a Gravettian occupational phase at Cejkov I at the beginning of the last glacial maximum. The earlier interpretation, based on the presence of the Paudorf fossil soil, suggested interstadial W2/3 as the time frame, approximately 27-28 000 BP, about one interstadial older then our dating indicates.

Bánesz considered the second occupational layer with patinated obsidian artefacts at 300-310 cm, in the loess below the fossil soil with a hearth, to have been a W2 loess. Dates from the hearths sampled in 2001 and 1960 suggest that it is most likely a loess layer dating between the Tursac and the Denecamp interstadials. Bánesz (1989:246, fig. 6) interpreted the finds from the greenish yellow loess, mainly flakes and cores, as evidence of a Middle or even Lower Paleolithic occupation of Cejkov. This interpretation cannot be currently supported.

The deep sondage 6 excavated by Bánesz in 1961 is only known from his excavation notes (Bánesz 1962). The notes include the following description of stratigraphy and finds: the plough zone with a few finds was followed by a loess like soil. This layer contained numerous obsidian and two flint artefacts at 50 cm. The layer was followed by loess that contained a broken microblade and fragments of animal bones at about 25 cm below the loess like soil. Further Bánesz notes that a unilaterally retouched blade endscraper and a combination burin/endscraper tool were recovered from the upper part of the loess. A Paudorf brownish soil with a hearth and charcoal followed at 190-200 cm. An obsidian blade fragment was recovered from this layer at 195 cm. An additional comment is included in the notes, stating that '… sondage 6 reached in places a red (R-W) layer' (Bánesz 1962). We cannot deduce from these notes the exact depth or the extent of any of the layers.

The hearth was located in a decalcified soil, a part of the base of a humic subsoil that was located below the youngest loess. Charcoal from the hearth was later dated to 28 900 ± 900 BP and 27 400 ± 1 400 BP (Bánesz 1993, 22). According to this date the hearth would have been in the Denecamp interstadial fossil soil. Yet if the depth of the layer is correct, it should belong to the Tursac interstadial. It is possible that the excavation of 6/1961 was on a steeper slope, further to the east or west of the deep sondages. This would result in a different stratigraphy, which we cannot deduce from the notes. It is also possible that the charcoal samples were contaminated, considering the length of time between their recovery and the actual dating.

According to the preserved sketch of the location (Bánesz 1971), the deep sondage 8 from 1962 was 200 m south of the summit, which is 50 m lower than 1/2001. The plough zone contained numerous, mainly obsidian Paleolithic finds. The loess like reddish brown layer below did not contain any artefacts. A blue patinated flint flake was found at the bottom of the loess layer at 150 cm. A Paudorf layer that followed revealed several possible features with wood charcoal. The uppermost scatter was at 170 cm, and only 10 cm below were animal bones and seven flakes. The middle Paudorf horizon contained two

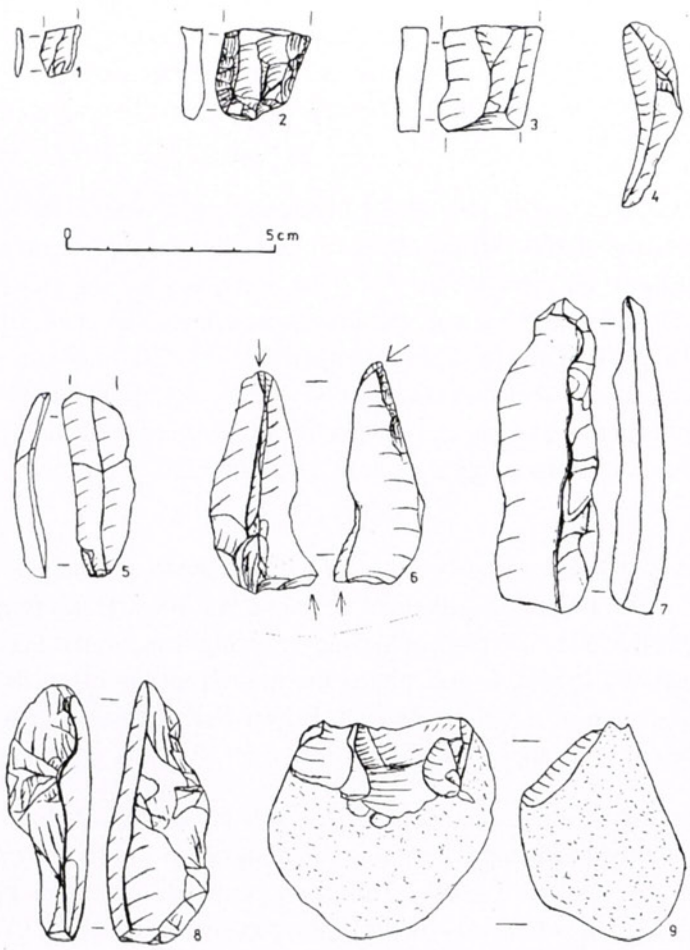

Figure 15. Cejkov I. Lithic industry from layer 1 from the excavation unit 3/2001: 1- a proximal end of a microblade; 3- a mesial part of a blade; 6- a multiple burin; layer 1 in the excavation unit 4/2001: 2- a proximal end of a blade with retouched edges; 4- a burin spall; layer 5 in the excavation unit 1/2001: 5- a blade, 7, 8 – blades from a core edge; 9- a partially used core. Raw material: 1, 3-5, 9 – obsidian, 2- quartzitic sandstone, 6 – opal, 7, 8 – limnic quartzite.

continuous strata of charcoal with no artefacts. There was no charcoal in the lower lighter Paudorf layer. A loess layer with patinated obsidian tool and several other stone artefacts at 350 cm followed. Bánesz considered them a proof of a W2, Aurignacian-Szeletian, occupation of the locality.

6. Artefact context

The loess horizon in sondage 1/2001, containing artefacts associated with the hearth, located below the soliflucted layer, was securely dated to 24 800 ± 110 BP and 23 440 ± 120 BP. The bottom of the soliflucted layer with charcoal scatters, the lower level of layer 4 in 1/2001, was dated to 22 480 120 BP. Bánesz's hearth from the 1960 sondage, located in the soliflucted layer was dated to 23 460 ± 200 BP, obviously the same time period, before the Tursac interstadial. The fossil soil in 8/1962 probably also belongs to the Tursac interstadial. The upper feature of the pit contained lithics and animal bones (Bánesz 1971).

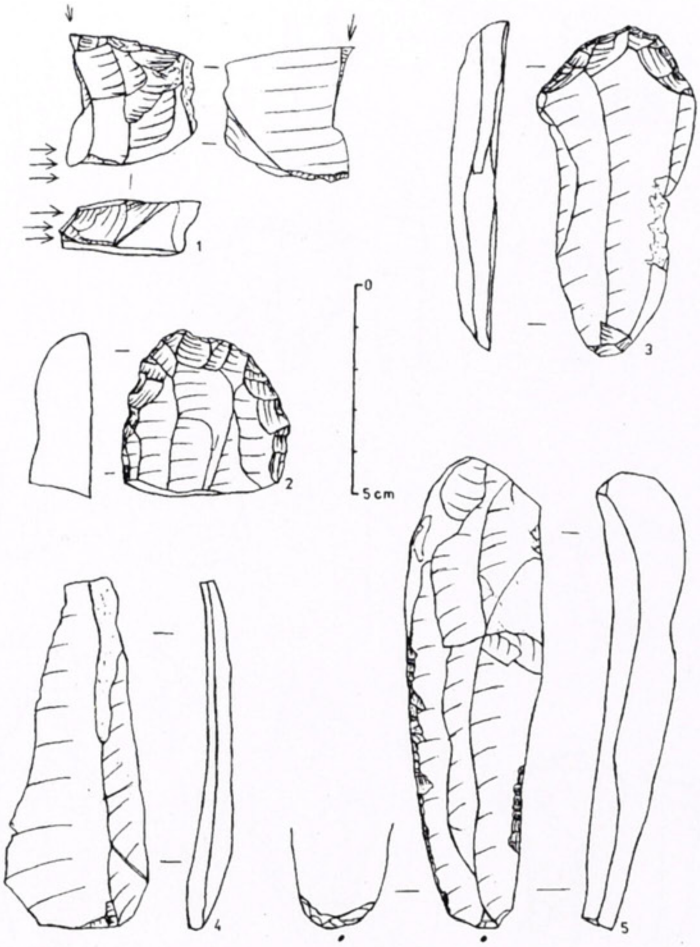

Figure 16. Cejkov I. Lithic industry from the excavation unit 5/2001: 1- a multiple dihedral burin, 2- the end of a blade scraper, 3- a blade endscarper, 5- a blade, 6- a massive blade with partially retouched edges. Raw material: 1, 3 – grayish brown limnic quartzite, 2, 4 – chert, 5 – yellowish brown limnic quartzite.

Further up the slope was the Tursac interstadial detected in layers 3-5 in 4/2001 (at 81-149 cm), and possibly also in layer 6 (99-141 cm) in 2/2001 below the summit the layer could be considered as a weakly developed fossil soil. To the west of this sondage a fossil soil was located at 130 cm in I/1961, at 170 cm with charcoal on the southeastern slope (I/86), and on the eastern slope at 170-260 cm (III/85). There were two features in the fossil soil in II/85; the first one at 205-215 cm, had lithic artefacts associated with charcoal, while the bottom of the layer had a hearth with wood charcoal. Thus we conclude that the southern slope of the Tokaj hill was intensively occupied before and at the beginning of the Tursac interstadial, as shown by the presence of the lithic artefacts, animal bones and the hearths.

An important stratigraphic observation is the presence of the Ca horizon in the upper loess, above the fossil soil scattered by solifluction, sharply delineated from the subsequent loess layer. This horizon was observed in the most southern location 1/2001 (layers 2 and 3), as well as Bánesz's deep sondage from 1960. Further up the slope the same occurrence was observed in 4/2001, and it can be seen in the photographic documentation of the stratigraphy in III/85. The Ca horizon was not observed in the sondages at the summit (2 and 3/2001), yet it was detected on the northern slope in 5/2001 in layer

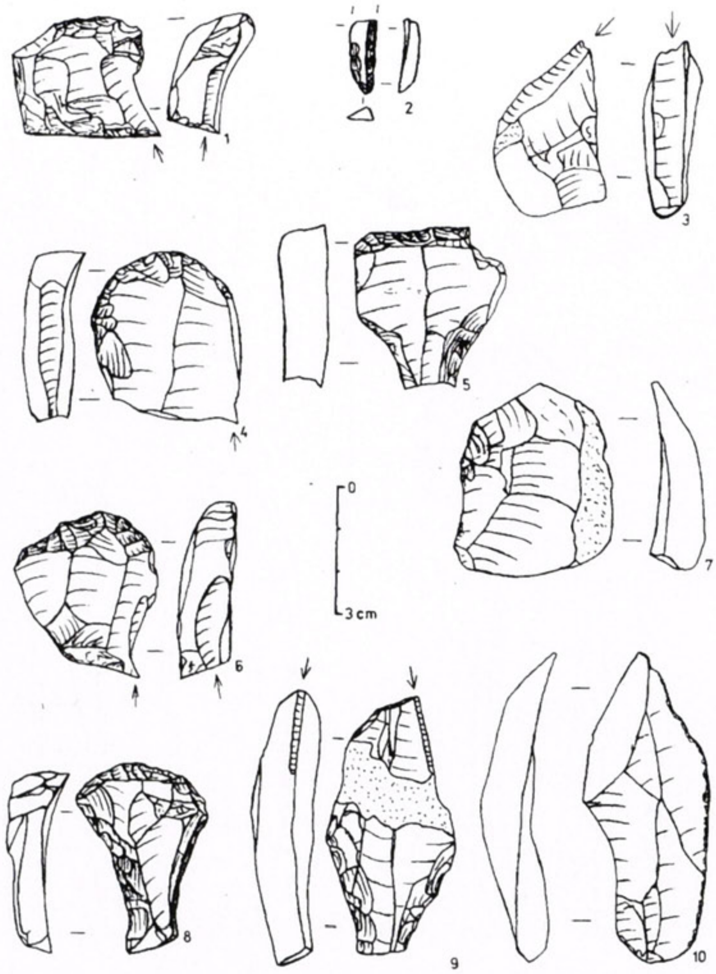

Figure 17. Cejkov I. Lithic industry from the excavation unit 5/2001: 1, 4, 6 - endscraper - burin combinations, 2- a proximal end of a backed microblade, 3 - a dihedral burin, 5, 8 - a tanged endscraper; 9- a tanged burin, 7, 10 - blades. Raw material: 1, 4, 6, 10 - brown chert, 2, 3, 8 -yellowish brown limnic quartzite, 5, 9 - grayish brown limnic quartzite, 7 -chert.

2. The stratigraphic break could be attributed to a possible break in sedimentation that could have occurred during the Laugerie interstadial, at 20-19 000 BP.

There was no evidence of human settlement in the loess layers in the more southern locations 4 and 2/2001, or in the excavations from 1960. Bánesz did not mention any Ca horizon above the fossil horizon in 6/1961, only that stone artefacts and animal bone fragments were found in the loess layer. However, it is unclear from the excavation notes whether we are dealing with one or two artefact horizons. The fossil soil below the loess was radiocarbon dated to the Denecamp interstadial. Since the location of this sondage is unclear, we are not in a position to evaluate its interpretation. A bluish patinated flint artefact was found at the bottom of the loess layer above the soliflucted horizon in sondage 8/1962, located 50 m to the south. The main artefact layer was below the Ca horizon at 100-120 cm in III/85, located on the eastern slope. Charcoal and lithic artefacts were also found in I/86, west of III/85, in the loess at 70-75 cm (though it is unclear whether this was the total depth from the surface or just within the loess). The more northern locality II/85 had its lowest artefact layer at 100-110 cm, while in the western corner another artefact was located at 80 cm, and a third one, the highest of them, was at 55-60 cm. Further north, closer to the summit, sondage I/85 contained lithic artefacts associated with animal bones in a loess at 45-55 cm.

Sondages from 1960, 1961 and 1962 were located in the middle section of the hill, south of the summit, below 2 and 3/2001. Feature 2, as well as the disturbed feature in the southern section of the T shaped sondage from 1960 were right below the plough zone and their upper portion was most likely disturbed through ploughing. The bottom of feature 2 was in the loess layer at 30 cm, and feature 3 reached 100 cm. Both features contained numerous lithic artefacts. Feature 3 was radiocarbon dated using charcoal to 19 600 ± 340 BC and 19 755 ± BC. The two dates derive from one sample divided for two laboratories and suggest the presence of a younger find horizon at about 21,5 ky BP (Verpoorte 2002, 318). These dates are crucial for determining the age of artefacts from loess at the localities on the slopes. Numerous locations are an indication of a repeated short-term human occupation before the end of the last glacial maximum, before the Laugerie interstadial. Only the plough zone follows loess near the top of the hill, but this occurs only at the summit. The illustration of the eastern profile of the sondage that contained the reindeer antler in the loess, suggests another layer between the loess and the plough zone. This layer vanished towards the summit of the hill but increased in the eastern direction. Bánesz originally identified this layer as 'loess like', or as brownish yellow decalcified loess of Holocene horizons B1 and B2 (Bánesz and Pieta 1961, 6), and later labeled it as initial brown soil.

In 1962 a sondage was placed to the south and north of the eastern side of the sondage from 1960. The loess, in the eastern portion covered by a 'loess like' soil, contained lithic artefacts. This loess like layer was absent in the central portion of the hill (Bánesz 1971). It does appear though in the notes on the southeastern slope of the hill, for example under the plough zone in II/85 (Bánesz 1996a: 13). It seems apparent from the notes that Bánesz was referring to a noncalcerous, yellowish brown loess soil that we labeled as layer 2 in our sondage. Due to solifluction, layer 2 is diffusely layered and no loess like process was detected (Kovanda 2001). Six obsidian artefacts were uncovered from the upper portion of layer 2 in 1/2001. There were no artefacts in the transitional horizon between layer 2 and the plough zone. The plough zone contained numerous surface finds on the southern slopes of the Tokaj Hill.

7. Lithic industry (Table 1, 2)

There were 377 artefacts recovered in surface assemblage on the southern slope (Figure 13). Among the seven tool types the most numerous were burins, such as an obsidian dihedral lateral burin (Figure 13: 9), a dihedral burin on a notched retouched limnic quartzite blade (Figure 13: 7), and a dihedral burin made on opal (Figure 13: 6). A borer (Figure 13: 8), a blade with an obliquely retouched end (Figure 13: 2), a notched retouched blade (Figure 13: 5), and a Kostenki knife (Figure 13: 1), all made on obsidian, were uncovered one piece each. Thirty-two blades, three blades from core edges (Figure 13: 4), and four microblades were all made on obsidian as well. One burin spall was made on limnic quartzite. The majority of the collected artefacts were flakes, 318 of the made on obsidian, 6 on limnic quartzite, 3 on chert, 2 on opal, and one on menilitic flint.

The upper layers of 1-5/2001 contained the following artefacts: In terms of formal tools only two incomplete obsidian blades were recovered, in addition to three obsidian cores - a flat core, a core with a changed orientation (Figure 13: 3), and a residual microcore. Flakes were the most numerous, 43 of them were made on obsidian and one on limnic quartzite.

The upper part of layer 2 in 1/2001 contained a broken obsidian blade and five obsidian flakes. Obsidian from both layers (1 and 2) was grayish black with fluid texture, a type that is most common in the Zemplín area sources. The plough zone in 2/2001 contained cores, blades, flakes, and one stone tool. The cores are single-platform (Figure 14: 7) and double-platform (Figure 14: 5), made on quartzitic

	technological categories						raw material									
sondage and layer	cores	blades	microblades	flakes	burin spall	retouched tools	total	obsidian	limnic quarzite	quartzitic sandstone	radiolarite	opal	brown chert	menilithic chert	chert	flint
surface collections		35	4	330	1	7	377	365	6			2		1	3	
S1-1.layer	3	2		44			49	48	1							
S1-2.layer		1		5			6	6								
S1-5.layer	2	4		18			24	13	10	1						
S2-1.layer	6	9		52		1	68	57	1	5	2					3
S2-2.layer		1		5			6	5		1						
S2-3.layer			1	9			10	4	1		1	4				
S3-1.layer		3	1	9		1	14	12	1			1				
S4-1.layer				24	1	1	26	21		3					2	
S4-2.layer				6			6	4		2						
S4-6.layer				1			1	1								
S5		2		15		13	30	1	13		5		6		3	2
total	11	57	6	518	2	23	617	537	33	12	8	7	6	1	8	5

Table 1. Cejkov I, lithic industry 2001 research season.

sandstone; one obsidian core displays a change of orientation. A residual obsidian core and obsidian nodules were uncovered from this layer as well. The only tool was represented by a burin made onan obliquely retouched patinated flint blade (Figure 14: 1). A broken blade made on chert (Figure 14: 3), a complete blade (Figure 14: 6), as well as 4 broken blades, and 3 core edges were all made on obsidian. Retouched flakes were made on obsidian (2 pieces) and chert (1 pieces, Figure 14: 2); unretouched flakes were mainly obsidian (43 pieces), 3 quartzitic sandstone, 2 radiolarite and 1 limnic quartzite.

Layer 2 in 2/2001 contained a middle section of an obsidian blade, 5 flakes made on obsidian (4 pieces) and quartzitic sandstone (1 piece). Layer 3 in 2/2001 contained a proximal end of a microblade made on limnic quartzite, and flakes made on obsidian (4 pieces), opal (4 pieces), and radiolarite (1 piece).

Layer 1 in 3/2001 contained a multiple burin made on opal (Figure 15: 6), a proximal end of an obsidian microblade (Figure 15: 1), a medial part of a wide obsidian blade (Figure 15: 3), two blades from the edge of an obsidian core, and flakes. Seven of these were made on obsidian, another on a heavily patinated obsidian, and a light blue patinated limnic quartzite.

The plough zone in 4/2001 contained a proximal end of a bilaterally retouched blade made on quartzitic sandstone (Figure 15: 2), an obsidian burin spall (Figure 15: 4), and 24 flakes. Twenty of these were made on obsidian, 2 on patinated chert, and 2 on quartzitic sandstone. Layer 2 of this sondage contained 4 obsidian flakes and 2 quartzitic sandstone flakes. Layer 6 in 4/2001 had a single obsidian flake.

Sondage 5/2001 had in a relatively small area between layers 1 and 2, and in layer 2 itself, 29 stone artefacts and a piece of red ochre. Layer 3 contained 1 stone tool, a massive blade endscraper made on grayish brown limnic quartzite (Figure 16: 3). Raw materials were dominated by limnic quartzite (13 pieces), represented by two shades, brown chert (6 pieces), red radiolarite (5 pieces), 3 chert pieces of unknown origin, and two partially patinated Kraków-Jura flint pieces. Artefacts made on limnic quartzite were moderately patinated, as were those made on brown chert.

There was not a single core among the 30 artefacts recovered. One of the blades (Figure 16: 5) had a preserved prepared striking platform on its distal end, suggesting use of double-platform cores. A half of the artefacts in this sondage were flakes, most of them massive, with tools made on long, thick and wide blades. Among the tools was a thick blade endscraper made on grayish brown limnic quartzite (Figure 16: 3), a proximal end of a blade endscraper on chert of unknown origin (Figure 16: 2), three combination tools, endscraper – burin, all made on brown chert (Figure 17: 1, 4, 6). Two of the combination tools were initially made on a single blade, and after a break the facefront was secondarily retouched (Figure 17: 1, 6). A dihedral lateral burin was made on a yellowish brown limnic quartzite (Figure 17: 3), and a multiple dihedral burin was made on grayish brown limnic quartzite (Figure 16: 1). The brown chert blade (Figure 17: 10), as well as the blade of chert of unknown origin (Figure 17: 1), had retouched edges. The proximal end of a backed microblade was made on a yellowish brown limnic quartzite (Figure 17: 2).

Some of the tool types from 5/2001 are unique for the east Slovak Gravettian, such as a combination tanged endscraper (2 pieces), or a tanged burin. Proximal ends of the endscrapers were not pronounced. One of the tanged endscrapers was made on yellowish brown limnic quartzite (Figure 17: 8), while the other was on grayish brown limnic quartzite (Figure 17: 5), as is the tanged burin (Figure 17: 9). Both pieces were initially made on a thick blade with retouched ends – a endscraper and a burin. After a notch was made on both sides of the blade, the piece was broken and two tanged tools were created.

In addition to the tools, two blades were recovered - an irregular blade made on chert (Figure 16: 4) and a thick blade on yellowish brown limnic quartzite (Figure 16: 5). Fifteen flakes were dominated

Stone tools	sondage 2 layer 1	sondage 3 layer 1	sondage 4 layer 1	sondage 5		surface collection	total	raw material						
				layer 2	layer 3			obsidian	limnic quartzite	quartzitic sandstone	opal	brown chert	chert	flint
endscraper				1	1		2		1				1	
endscraper-burin				3			3					3		
borer						1	1	1						
dihedral burin				1		2	3	1	1		1			
bipolar dihedral burin				1			1		1					
lateral burin	1						1							1
multiple burin		1					1				1			
blade						1	1		1					
retouched blade			1	2		2	5	2		1		1	1	
stemmed scraper				2			2		2					
stemmed burin				1			1		1					
Kostenki knife						1	1	1						
backed microblade				1			1		1					
total	1	1	1	12	1	7	23	5	8	1	2	4	2	1

Table 2. Cejkov I, lithic industry.

by red radiolarite, in addition to both types of limnic quartzite, brown chert, patinated flint, and one obsidian flake with preserved cortex.

Tanged artefacts appeared in Cejkov I before. They were initially found in feature 3 in the T shaped sondage 1960. These were a broken tanged obsidian point, a chert point with constricted sides, a mesial part of an obsidian blade with an indication of constricted sides in the lower portion, and an artefact described as a pointed, backed blade, possibly a broken tanged tool (Bánesz and Pieta 1961, 18-22, obr. 14, 15). Feature 3 (1960) had more burins (11), than endscrapers (8), which were frequently thick. In addition hydroquartzite cores were present here as well. Research in 1962 rendered a bilaterally retouched tanged endscraper made on flint, and an unilaterally retouched tanged blade made on radiolarit (Bánesz 1971). Surface collections on the southern slope of the Tokaj hill in 1983 recovered a tanged point made on gray chalcedony with a broken distal end. In addition there were also 15 Kostienki type knives and other stone tools, such as 26 burins, 10 endscrapers, retouched blades and backed microblades. The raw material was mainly represented by obsidian, in addition to flint, radiolarite, limnic quartzite and chert (Bánesz 1984a). Besides tanged tools, shouldered points were found at Cejkov I as well. Bánesz found the first one in 1960 (1961, 771, obr. 268). Another distinct shouldered point, measuring 110 x 25 x 7 mm, made on limnic quartzite was found in 1982 (Bánesz 1984b).

Besides Cejkov I, tanged points appear in Slovakia only in Nitra-Čermáň, together with shouldered points, in a layer dated to 22 860 ± 400 BP (Bárta 1965, 127). This is a lithic collection from a younger Gravettian stage in western Slovakia, usually labeled as a shouldered point horizon, dated to 24-20 000 BP (Kozłowski 1996, 18). Tanged points are also known in the Moravian Gravettian, associated with shouldered points, in sector G in Milovice. The layer with the points was dated to 25 220 ± 280 BP GrN-14824 (Oliva 1988). Tanged points were also recovered from Předmostí (Absolon and Klíma 1977, tab. 94), and their appearance is attributed to the shouldered points horizon as well (Svoboda *et. al.* 1994, 133). Valoch recently noted a patinated tanged endscraper made on gray chert in the lithic collection of the Moravian cave Pekárna (1999, 16, 22, obr. 4: 13).

Central European Perigordian/Gravettian sites in Germany contain Font-Robert tanged points, e.g. Salching where a complete but damaged point was found (Weißmüller 1987, Abb.4:8). Mania (1981) reports 5 complete and 15 partial points from Bilzingsleben. Eight such tools, though several broken, came from Feldberg, from the Steinacker site (Pasda 1995).

A surface collection from Kamenica nad Cirochou in eastern Slovakia contained an obsidian tanged point, which Bárta (1985) considers to be closer to the Lyngby type than a Kostienki type. In a survey near salt springs in Soľ near Vranov nad Topľou, two tanged obsidian points were found, and attributed to the Lyngby type (Šiška 1991, 98). A first Gravettian site was located recently in the Topla river valley in Marhaň (Machnik, Mačala and Šiška 1993, 83).

North of the Carpathian mountains the shouldered points horizon is known from the Gravettian site Kraków-Spadzista C2, layer III of the oldest phase (Kozłowski and Sobczyk 1987). To the south, in the Hornád river valley, is the well-known Hungarian site Hidasnémeti, where 90% of the Gravettian lithic industry, including shouldered points, is made on local hydroquartzite. Other raw materials at the site were Hungarian obsidian, quartz porfiric from the Bükk mountains, radiolarite, Volyn area flint, and a northern Baltic flint (Siman 1989).

Limnic quartzite is very common at Cejkov I, appearing in all layers in numerous color variants. Limnic quartzite sources are known in eastern Slovakia (Kaminská 1991, 20) but the raw material used in Cejkov I resembles the closest limnic quartzites from northeastern Hungary. Similarly, the nontransparent black obsidian, found alongside the grayish black variety, is from Hungarian sources.

The brown chert, used in the majority of the stone artefacts, is known from the central Ondava river valley, concentrated near Nižný Hrabovec. The presence of numerous middle to upper Paleolithic localities in the area suggests exploitation of the local source (Kaminská *et al.* 2000). At the same time, it may be suggested that the river Ondava served as a connection of eastern Slovakia with areas to the north and the south. This connection seems to have been established during the middle Paleolithic, and was kept active during the Gravettian as well. The presence and use of foreign raw materials brought to eastern Slovakia from Hungary and Poland supports the claim. Other raw materials were brought from the Ukraine, using eastern Ondava river tributaries.

On the basis of a comparison with other sites in the region, we suggest that the tanged lithic artefacts from 5/2001 in Cejkov I are Gravettian, belonging to the late shouldered points horizon. The charcoal from feature 3 from the 1960 excavation was dated to 19 600 ± 340 BC and 19 755 ± 240 BC (21,5 ky BP), the last glacial maximum before the Laugerie interstadial.

7.1. Sondage 1/2001, layer 5 (Figure 15)

The lithic industry in this layer consisted mainly of cores, flakes and blades, all of them with a thick calcareous crust. One piece was a partly extended, nontransparent black obsidian core with preserved cortex (Figure 15: 9), the other an obsidian nodule. Nine obsidian (one heavily patinated), 8 limnic quartzite and 1 quartzitic sandstone flakes and four blades completed the collection. The blades were made on nontransparent black obsidian (2 pieces, Figure 15: 5), and light blue patinated, layered, limnic quartzite from the edge of a core (2 pieces, Figure 15: 7, 8). This type of limnic quartzite is not known from Slovak sources, but is known in Hungary, in the Korlat area. Similarly, the nontransparent black obsidian is from Hungarian sources. The layer was dated, using charcoal from the hearth, to the time period preceding the Tursac interstadial (24 800 ±110 BP, 23 820 ± 40 BP, 23 440 ± 120 BP, 24 240 ± 120 BP, and 24 130 ± 130 BP).

8. Conclusion

It has been accepted that the Gravettian/Epigravettian of eastern Slovakia emerged due to the movement of hunting groups into the area from regions north of the Carpathian basin during the last glacial maximum. The presence of numerous Baltic flint pieces in the lower layer of Kašov was suggested as a proof (Bánesz 1969, 287). This layer was later dated to 20 700 ± 350 BP (Bánesz *et al.* 1992), corresponding approximately with the Laugerie interstadial. Baltic flint dominated over other raw materials in the lithic collection from Cejkov II as well (Bánesz 1959). The younger Epigravettian, dated in the upper layer at Kašov to 18 600 ± 390 BC (Gd-6569), was completely dominated by obsidian from local sources in the Zemplín hills (Bánesz 1992, 16).

Bánesz (1969, 289-290) initially claimed that Gravettian finds from Cejkov I were different from those recovered from the lower layer of Kašov. Later he accepted the age of the hearth from feature 3 in the loess layer of the Tokaj Hill (19 600 ± 340 BC and 19 755 ± 240 BC) as satisfactory for dating the fossil soil with a hearth in the sondage in 1960, and introduced it in the literature as a so-called 'Cejkov interstadial', that should be used for the entire north-eastern Carpathian Basin at 20-19 000 years BP (Bánesz 1990b, 10). Yet later still Bánesz considered the finds from Cejkov as older (Bánesz *et al.* 1992,19). In the end Bánesz (1996a, 23) concluded that the Cejkov I material, particularly the stone tools, and the associated two pronged reindeer antler implements (III/85, I/88), a hoe-like reindeer antler implement (I/87), a burnt modeling clay (III/85), and an engraved animal bone (II/85), all belonged to the Epigravettian, 18-17 000 BC, and could be correlated with the Hungarian Ságvár industry.

His conclusion led to the acceptance in the professional literature of the view that central Europe from 19 000 on was occupied only by Ságvár groups, with a similar industry in lower Austria. At the same time, the Kašov and Cejkov industries, together with the material from the Hungarian site Arka, were considered Epigravettian with Aurignacian features (Djindjian, Kozłowski and Otte 1999, 240-1). Tolnai-Dobosi (2001) pointed out that the term Ságvárian is not used correctly. In a geochronological sense Ságvárian is composed of 2 short interstadials (Dunaújváros and Tápiosuly) that are separated by a loess layer more than 1 m tick. In archaeological sense the term Ságvárian should only by used for the "Pebble Gravettian" in 18 – 19 000 BP. Contemporaneous with the Ságvárian, small hunting camps or workshops (Arka) existed along the river Danube and in the northern part of Alföld (Jászág), that belong to the younger blade industries.

Site	C-14 lab	Date	Climatic phase
Kašov, upper layer	Gd-6569	18 600 ± 390 BP	Lascaux
Kašov, lower layer		20 700 ± 350 BP	Laugerie
Cejkov I, feature 3/1960	KN 2124/526	19 600 ± 340	
	Berlín 1414	19 755 ± 240	
Cejkov I, S1/2001 layer 4	Beta-159856	22 480 ± 120 BP	Tursac
Cejkov I, S1/2001 hearth	Beta-159851	24 800 ± 110 BP	
	Beta-159852	23 820 ± 40 BP	
	Beta-159853	23 440 ± 120 BP	
	Beta-159854	24 240 ± 120 BP	
	Beta-159855	24 130 ± 130 BP	
Cejkov I, 1960, hearth	GrN-25427	23 460 ± 200 BP	
Cejkov I, S6/1961		28 900 ± 900 BP	
		27 400 ± 1400 BP	
Slaninová cave Háj	GrN-14832	27 950 ± 270 BP	Stillfried-Masières

Table 3. C-14 dates Gravettien and epigravettien sites in Eastern Slovakia

It is clear at this point that occupation of eastern Slovakia appeared at least from the earliest stages of the Gravettian, as research at Slaninová cave in Háj has shown with dates 27 950 ± 270 BP Grn-14832 (Kaminská 1991, 10; 1993). The site is located near the Hungarian border in the Hornád river valley. There are several Gravettian sites in northeastern Hungary, dating to 28-26 000 BC, e.g. Bodrogkeresztúr-Henye (Dobosi 2000, 105, 106). Hunting groups must have moved further north to the present day eastern Slovakia from this well established Gravettian region (Older Blade Industry/Pavlovian/MUP according to Dobosi 2000) during the Stillfried- Masières interstadial. Using the route of the Hornád river valley, the groups could have reached not only the area of Slaninová cave but even further north the region of present day Košice.

Bánesz (1967, 290-4) excavated a Gravettian feature with lithic industry made on flint, chert, radiolarite and obsidian in Barca-Svetlá III. A number of the flints had white or even yellow patination, suggesting their possibly being limnic quartzites. Bánesz generally considered artefacts with this type of patination to have been flint, yet as the analysis of the patinated material from the Aurignacian site Kechnec showed, this was actually a limnic quartzite from the Hungarian source at Arka (Kaminská 1991, 30-31). The analysis of an artefact from Tibava showed that Aurignacian groups used Hungarian obsidian sources (Williams Thorpe, Warren and Nandris 1984, 195), in addition to the limnic quartzites from Hungary, and from sources in the border region between Slovakia and Hungary. At this point the oldest dated layer at Cejkov I is the loess layer with hearth in 1/2001, dated before the Tursac interstadial. The Gravettian settlement was concentrated on the southern foot of the Tokaj Hill. The raw materials from layer 5 in 1/2001 suggest contacts with the southern regions of northeastern Hungary.

The most intensive occupation of the area occurred before the Laugerie interstadial, during the late shouldered points horizon, when mainly the summit of the Tokaj Hill was settled. We suggest that the majority of the finds, whether the shouldered points, the tanged tools, or the horizons with engraved bone and reindeer antler tools, belong to the period before the last glacial maximum.

Reindeer antler tools, shaped as points and a mallet, appeared in later Gravettian in Slovakia in the Váh river valley at the site of Moravany-Lopata II, dated to a time period around 21 000 BP (Kozłowski 1998, 128-130). In addition other objects such as a mammouth tablet with engraved grooves were found at the site as well (Kazior, Kozłowski and Sobczyk 1998, 87-96). Faunal remains are represented by reindeer, mammoth, horse etc. (Lipecki and Wojtal 1998), species well adapted to life in cold steppe and tundra climate. Botanical remains consist of pine and indicate the presence of a pine or mixed forest in the vicinity of the site (Lityńska-Zając 1998).

Typologically the artefacts from the excavated sites, as well as the surface assemblages, are dominated by burins over endscrapes, similarly to the sites from this time period in western Slovakia, e.g. Moravany nad Váhom–Noviny, sondage A, or Banka, sondage IV (Kozłowski 2000, 174). In Hungary at the Hidasnémeti site burins and end-scarpers are almost even, with slightly more common burins (Simán 1989, 11). There were no Aurignacian features in the assemblage, unlike at the Epigravettian sites in the Zemplín region, dated by the upper layer at Kašov, where endscrapes were dominant (Bánesz *el al.* 1992, 7).

Some of the raw material at Cejkov I, limnic quarzit in particular, further indicated southern contacts. On the other hand, the most common raw material was obsidian, particularly from surface assemblages, suggesting that Gravettian groups knew well, and extensively used, the local sources. Other raw materials were from east Slovak sources as well, such as the radiolarites, or the brown or menilitic chert. The source of the quartzitic sandstone is currently not known but it is assumed to be from the Carpathian region. As suggested earlier, the white patinated flints from Cejkov III are most likely patinated limnic quartzites (Bánesz 1959, 774). It is precisely here that we would expect some of the oldest Gravettian settlements.

Any further development of the Gravettian groups in the Zemplín hills was most likely affected by the last glacial maximum, when worsening climate forced the hunting groups to move eastward, away from the Kraków region (Kozłowski and Sobczyk 1987, 67). Some of these groups came through Slovakia and brought northern flint, as has been recorded in the upper layer in Kašov and possibly in Cejkov II. The lower layer un Kašov is layer 5, a dark brown soil sediment, formed before the last loess formation that occurred around 20 000 – 23 000 BP (Bánesz *et al.* 1992, 6, 7). A numerically small lithic industry in layer 2 sondage 1 and 4/2001 suggests a low intensity of occupation of the southern slope of the Tokaj Hill before the Lascaux interstadial.

Transition to Epigravettian has been recorded in Hrčeľ, at Nad Baňou locality (Bánesz and Kaminská 1984). Epigravettian with Aurignacian elements has been recorded in the upper layers of Kašov (Bánesz *et. al.* 1992), which is artefactualy similar to lithic assemblages from Hrčeľ-Pivničky (Kaminská 1986a, 1995) and Veľaty (Kaminská 1986b).

The analysis of the Gravettian materials from Cejkov I does not refute the possibility of other Gravettian and Epigravettian stages at this locality, since Cejkov has at least 5 Gravettian and Epigravettian settlements known at present. The research at Cejkov I has shown that the site was intensively occupied during at least two different stages. Adjacent villages in the region have known obsidian collections, e.g. Zemplínske Jastrabie, Kysta, Kašov, Hrčeľ, Veľaty to the north of Cejkov, and Zemplín to the south. The Zemplín region was most likely occupied by smaller hunting groups that produced stone tools for their own use, and particularly during the Epigravettian, obsidian tools for exchange. These tools traveled through known communication routes into the neighboring regions, and similarly foreign materials found their way to eastern Slovakia. Successful adaptation to the natural environment during the last glacial maximum in the Zemplín hills with its river valleys, low hills, abundant animals, and raw material sources, created an ideal setting for the Gravettian and Epigravettian settlements. Newly acquired data about the stratigraphy and chronology of the Gravettian finds from Cejkov I in the northern Carpathian basin form a connection, and allow a better correlation of well known dates from the middle Danube basin (Willendorf II, Dolní Věstonice, Pavlov) with those from the east Carpathian area (middle Prut and middle Dniester basins) before the last pleniglacial.

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GRAVETTIAN OCCUPATION IN THE LOWER LAYER OF KAŠOV I.

M. Novák

Abstract

The Upper Paleolithic settlement of eastern Slovakia during the Gravettian and Epigravettian was concentrated in the surroundings of the Zemplín Hills. An important locality in this area is the open-air site of Kašov I, where two cultural layers (Gravettian/Epigravettian) were found. According to the analysis of lithic industry, radiocarbon dating and lithostratigraphical position, the lower layer is dated to the Late Gravettian horizon with rare shouldered points, to the period directly preceding the LGM. Characteristic features of the lithic industry are the high proportion of chips and small flake fragments, in the group of tools higher proportion of burins than end-scrapers and a relatively high proportion of retouched blades. In raw material composition we observe a domination of extra-local, "northern" flint from southern Poland over the local obsidian. This phase of the site occupation is interpreted as a seasonal and short-term base camp, probably connected with migration of the Late Gravettian groups in connection with hunting seasonal shifts between the territory north of the Carpathians and the interior part of the Carpathian Basin.

KEYWORDS: Late Gravettian, Eastern Slovakia, Kašov I, lithic industry, site models, seasonal shifts

1. Introduction

The Upper Paleolithic settlement of eastern Slovakia during the Gravettian and Epigravettian was concentrated in the surroundings of the Zemplín Hills (Zemplínske vrchy), in the north-eastern part of the Carpathian Basin. This territory represents a core settlement area of eastern Slovakia in the time of the Gravettian and Epigravettian, and there are numerous Gravettien/Epigravettian sites with typical obsidian industry situated mainly on the eastern or northern slopes of the hills such as Cejkov, Hrčeľ, Veľaty, Kysta, Zemplínske Jastrabie, Zemplín. An important locality is also the open-air site Kašov I.

This site is located about 2 km to the south-west from the village Kašov (Figure 1). It is about 20 km to the south from the town Trebišov. In terms of geomorphology the site has a preferable location. It is situated on one of the northern slopes of the Zemplín Hills, 200 m above sea level. To the north, it is delimited by a steep fall to the stream of Ortováň (in some references called Javorový potok), to the east and to the west it is bordered by parallel valleys which join the same stream, and to the south it is connected with the main mountain range. The distance of the site from the stream is about 100-150 m and relative elevation over the present stream makes about 30 m.

The site was discovered by Š. Janšák in 1932, during survey of the obsidian sources in the region of Zemplín Hills (Janšák 1935). Systematically the site was excavated by Ladislav Bánesz between 1967 and 1984 (Bánesz 1969, 1980, 1981, 1982, 1983, 1984, 1985). During the excavation, an area of about 5600 m² (240 x 40 m) was uncovered and more than 44,000 stone artefacts were collected, made predominantly of obsidian, accompanied by grinding artefacts, lumps of mineral dye, charcoal and a few ceramic pieces. The last excavation was conducted in 1991, when L. Bánesz, J.K. Kozłowski and J. Hromada checked the stratigraphy of the site (Bánesz *et al.* 1992, 6, 7).

The excavations unearthed five lithostratigraphical units with two cultural layers. The upper layer, partially published by Bánesz *et al.* (1992), is chronologically dated to the Epigravettian, to the beginning of the post-pleniglacial. Radiocarbon date of this layer is 18 600 ± 390 years BP. The lower layer, with radiocarbon date 20 700 ± 350 years BP (Bánesz 1993), is dated to the Late Gravettian horizon with rare shouldered points, to the period directly preceding the LGM (Bánesz *et al.* 1992). The analysis presented here was originally a subject of my master thesis, later published in *Slovenská archeológia* (Novák 2002).

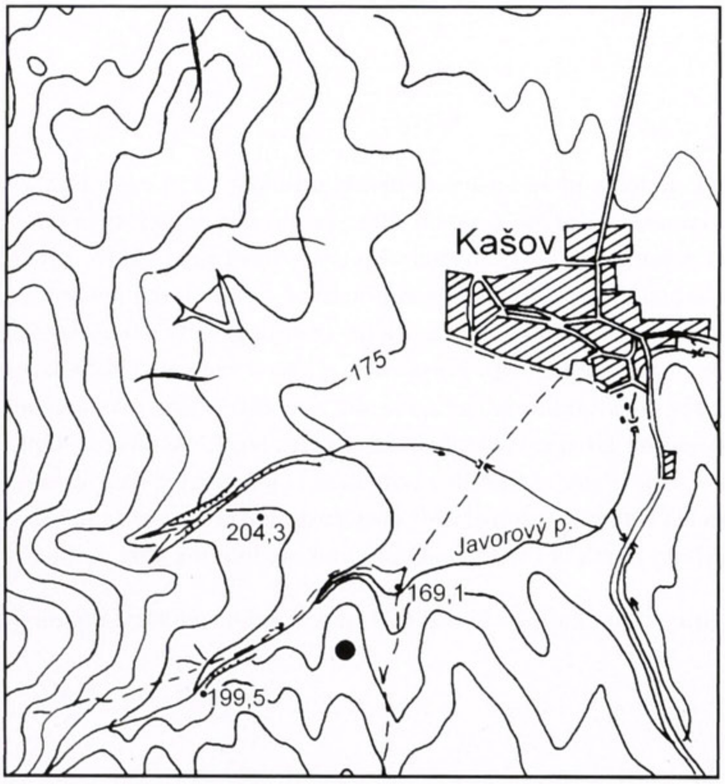

Figure 1. Kašov I. The site location.

2. The find situation

In the lower layer a total of 968 stone artefacts were found. This number includes 959 pieces of chipped industry and 9 pieces of other artefacts, which can be described as worked or unworked stones. No bones were discovered (due to the soil quality, unfavourable for organic preservation), nor traces of dwelling structures and compact hearts.

All artefacts were concentrated in the area 12 x 8 m (Figure 2, Bánesz 1967), in the northern part of the site. Spatial distribution of the artefacts created just one concentration, with the highest density in the center and in the western part of the area. Towards the periphery there was a gradual decrease of finds, more gradual in the northern and in the southern part and sharper in the eastern and in the western side. Scatter and density of individual technological, typological and raw material groups of artefacts is showed on Figure 3.

According to the excavation report (Bánesz 1967) there were 11 ash-coloured spots (Figure 2), creating thin irregular lenses with average of 0,5-1,5 m. In some spots the burnt artefacts or charcoals were found. Some spots were concentrated at one place and so originally they could have belonged to the same concentration, disturbed by post-depositional processes. These locations form a certain spatial pattern with one concentration in the center and individual spots on the periphery, in the northern, eastern, southern and western part of the area.

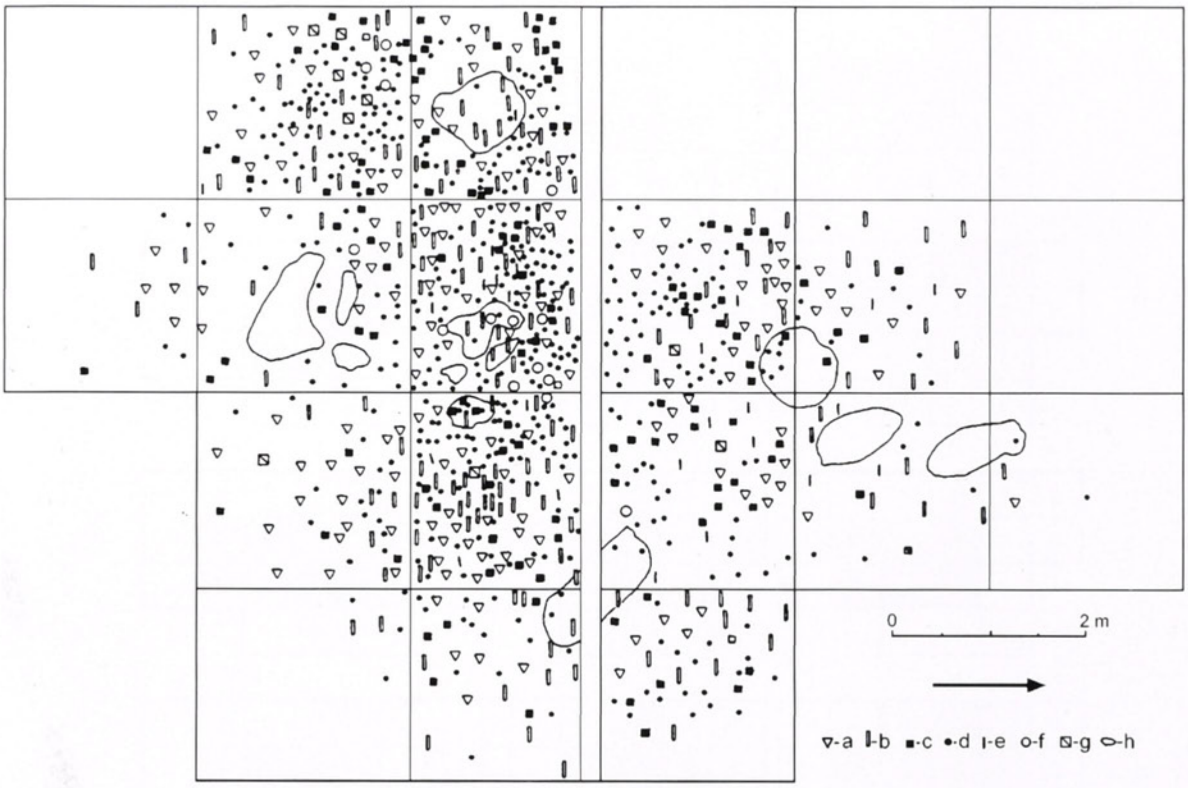

Figure 2. Kašov I, the lower layer. Map and spatial distribution of artefacts (Bánesz 1967). Key: a – retouched tools; b – blades; c – flakes; d – fragments and chips; e – burin spalls; f – cores; g – worked and unworked stones; h – ash-coloured spots (hearths?).

3. The lithic industry

3.1. Raw material analysis

The analysis of raw materials (Table 1; Figure 4, 5), based on the macroscopic determination, has shown that the dominant raw material are flints, composing nearly one half of all artefacts (473 pieces, 49 %). Flints represent imported extralocal raw material. Their provenance is not precisely determined (majority is patinated), but most of them are probably Cretaceous "northern" flints, deriving from the glacial and fluvioglacial deposits of southern Poland, and some are Volhynian flints from Dnester basin.

The second important raw material are obsidians from local sources, which compose about one third of all artefacts (319 pieces; 33 %). The nearest occurrences are directly in the area of the Zemplín Hills, where 4-5 primary sources are recorded up to the present (Kaminská and Ďuďa 1985). Other nearby sources (to 50 km) are in the Tokaj Hills in Hungary (Biró 1987; Williams Thorpe, Warren, Nandris 1984).

In addition, there are smaller quantities of other raw materials such as limnoquartzite, including opal and chalcedony (86 pieces; 9 %), hornstone (52 pieces; 5 %), as well as reddish-brown or brown coloured radiolarite (22 pieces; 2 %). Few pieces of jasper and quartz are also recorded. The sources of these materials are local or they were transported from close distance (up to 80 km).

3.2. Technology and typology

Technological analysis is based on the composition of major technological groups (Table 2, Figure 6) such as cores, fragments and chips, flakes, blades, retouched tools and burin spalls. Typological determination of retouched tools is based on classification by D. de Sonneville-Bordes and J. Perot (1953).

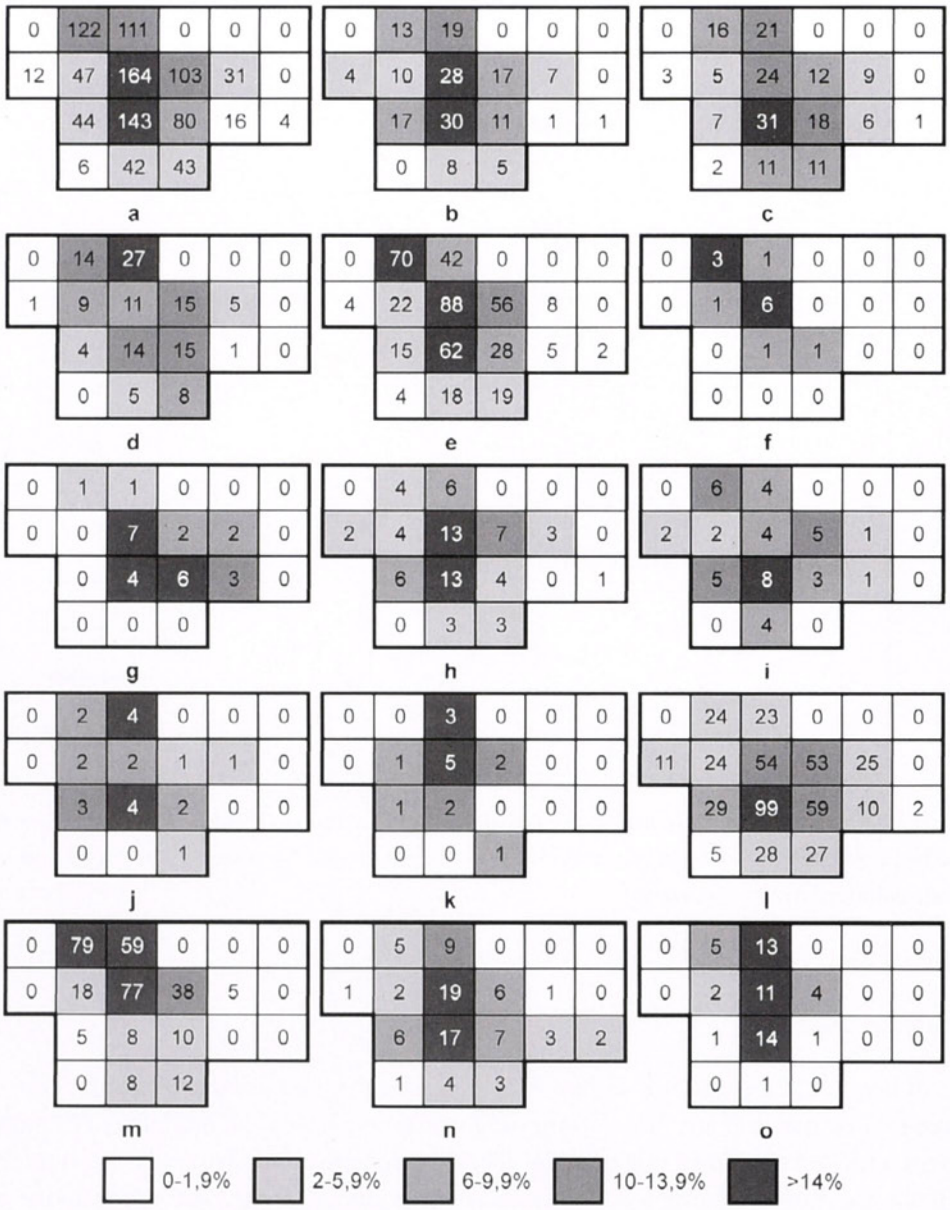

Figure 3. Kašov I, the lower layer. Scatter and density of individual technological, typological and raw material groups of artefacts. Key: a – all artefacts; b – retouched tools; c – blades; d – flakes; e – fragments and chips; f – cores; g – burin spalls; h – burins; i – retouched blades and bladelets; j – end-scrapers; k – combined tools; l – flint; m – obsidian; n – limnoquartzite; o – hornstone.

Cores - Generally, the cores are represented by a small number of pieces and they are the least numerous technological group. Only 13 pieces have been recorded (Table 3) which makes only 1,4 % of all artefacts. The majority of the cores (11 pieces) are small exhausted residual pieces and two cores are in the advanced reduction stage. No initial cores nor pre-cores were found. Single platform cores predominate (7 pieces), 3 pieces are cores with changed orientation, 2 pieces are double platform cores and the last piece is undetermined. Nearly all cores (12 pieces) are made of obsidian, only one core is of flint. This is interesting, when compared to the raw material structure for all artefacts, dominated by the flint.

Fragments and chips - This group is the most numerous category in the whole assemblage: 443 pieces (46,2 % of all artefacts) were recorded. The majority of pieces (220 pieces; about 50 %) are small

	Cores	Fragments and chips	Flakes	Blades	Retouched tools	Burin spalls	N	%
Flint	1	203	43	106	99	21	473	49,32
Obsidian	12	186	57	44	19	1	319	33,26
Limnoquartzite	-	31	14	12	27	2	86	8,97
Hornstone	-	16	14	7	14	1	52	5,42
Radiolarite	-	3	-	8	10	1	22	2,29
Jasper	-	3	-	-	2	-	5	0,52
Quartz	-	1	1	-	-	-	2	0,21
Total	**13**	**443**	**129**	**177**	**171**	**26**	**959**	**100**

Table 1. Kašov I, the lower layer. Raw material composition in individual technological groups of the chipped industry.

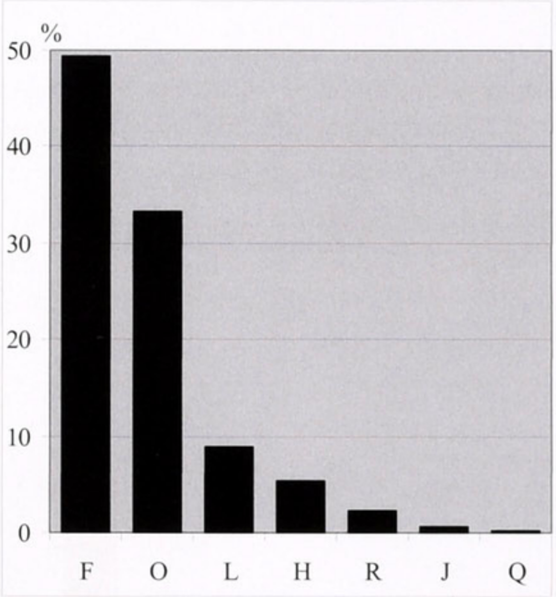

Figure 4. Kašov I, the lower layer. Raw material composition of the chipped industry. Key: F – flint; O – obsidian; L – limnoquartzite; H – hornstone; R - radiolarite; J – jasper; Q – quartz.

chips and irregular flakes representing the fine waste from core processing or tool retouching. The remaining part are undetermined flake fragments (155 pieces; 35 %) and flakes smaller than 1,5 cm (68 pieces; 15 %). In the raw material composition of this category we observe a slight predominance of flint (46 %) over obsidian (42%). All the other raw materials are less frequent.

Flakes - Flakes are represented by 129 pieces (13,4 %). The dominant raw material in this group are obsidians (57 pieces; 42 %), followed by flints (43 pieces; 33 %), hornstones (14 pieces; 11 %), limnoquartzites (13 pieces; 10 %) and by single pieces of opal and quartz.

The majority of flakes (73 pieces; 57 %) are without cortex and they come from an advanced stage of core reduction. There are also flakes with cortex covering 25-75 % of their dorsal surface (50 pieces;

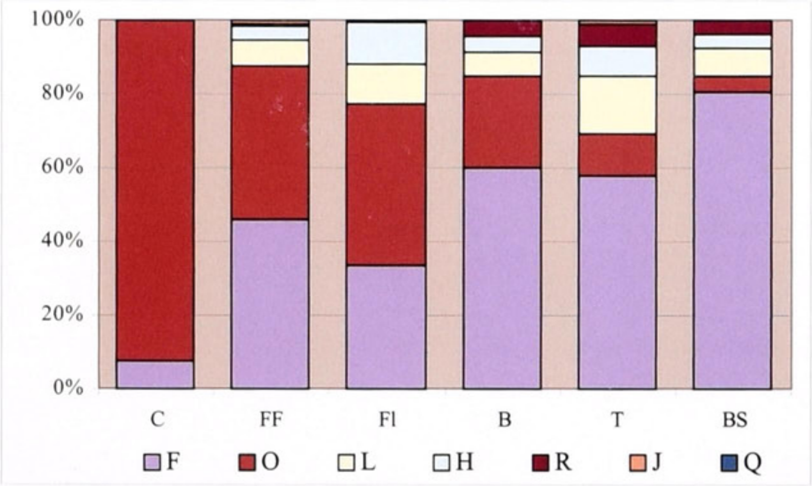

Figure 5. Kašov I, the lower layer. Raw material composition in individual technological groups of the chipped industry. Key: C – cores; FF – fragments and chips; Fl – flakes; B – blades; T – retouched tools; BS – burin spalls; F - flint; O – obsidian; L – limnoquartzite; H – hornstone; R – radiolarite; J - jasper; Q – quartz.

38 %) and a small number of fully cortical flakes (6 pieces; 5 %). These flakes are mostly of obsidian and originate from the initial stage of core reduction. Nearly half of all flakes (47 %) have unidirectional scars on dorsal face and come from unidirectional reduction. Other flakes have transverse (28 %), opposed (11 %) or other scars.

The length of flakes varies from 14 to 75 mm, average length is 33 mm and the most frequent one about 20-40 mm. Average width is 24 mm, minimal is 6 mm and maximal 72 mm, and the most common is from 15 to 30 mm. The thickness ranges between 2 to 31 mm and the average is 8 mm.

	N	%
Cores	13	1,4
Fragments and chips	443	46,2
Flakes	129	13,4
Blades	177	18,5
Retouched tools	171	17,8
Burin spalls	26	2,7
Total	**959**	**100**

Table 2. Kašov I, the lower layer. Major technological groups of the chipped industry.

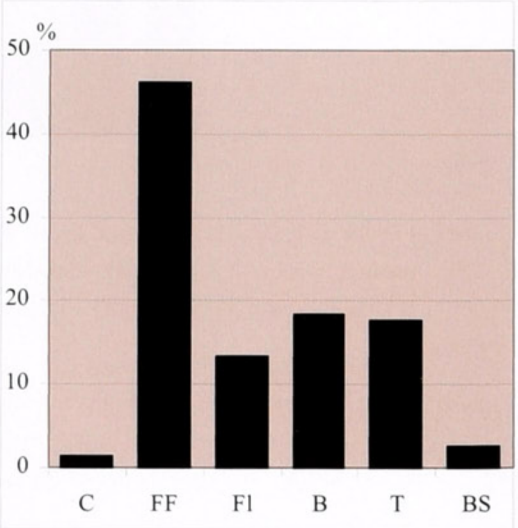

Figure 6. Kašov I, the lower layer. Composition of the major technological groups of the chipped industry. Key: C – cores; FF – fragments and chips; Fl – flakes; B – blades; T – retouched tools; BS – burin spalls.

Type of core	Initial cores	Advanced reduction stage	Residual cores
Single platform	-	-	7
Double platform	-	-	2
Changed orientation	-	2	1
Undetermined	-	-	1
Total	**-**	**2**	**11**

Table 3. Kašov I, the lower layer. Cores.

Blades - Blades compose the second largest category in the lithic assemblage. 177 pieces of non-retouched blades (complete pieces or fragments) were found, most frequently made of flint (106 pieces, 60 %) and obsidian (44 pieces, 25 %). Other raw materials occur in the small quantities: limnoquartzite – 12 pieces, radiolarite – 8 pieces, and hornstone – 7 pieces.

The majority of blades are non-cortical (147 pieces, 83 %), 20 blades (11 %) have cortex on lateral side and there is also a small number of blades with lateral-distal or distal cortex, and cortical blades. The blades with parallel scars on the dorsal surface (116 pieces, 66 %), originating from single platform cores, predominate over blades with opposed scars from double platform cores (31 pieces, 18 %). Primary and secondary blades from core edges are least represented, while some fragmented pieces remain undetermined.

From the morphological point of view, the majority of blades have parallel (34 %) or irregular lateral edges (31 %). Less frequent are the convergent forms (21 %) while the divergent edges are rare (8 %). The cross-sections are mainly irregular (45 %), triangular (32 %), and trapezoidal (23 %). Profile of blades is straight (43 %), irregular (33 %), or convex (24 %). Straight profile is typical for blades with parallel edges, convex for irregular blades, and irregular profile is typical for blades with irregular edges and with irregular cross-section.

Only 59 blades (34 %) are preserved completely. The rest (66 %) is represented by various fragments, where the proximal parts predominate (36 pieces, 31 %), followed by medial (30 pieces; 25 %), distal (22 pieces, 19 %), proximal-medial and medial-distal parts (15 pieces, 13 %).

Length of blades varies between 13-76 mm, average length is 33 mm and the majority of items range between 20-40 mm in length. Width varies from 3 to 43 mm, most commonly between 3-12 mm, the average being 10 mm. About 1/3 of the blades represent bladelets with the width to 8 mm in maximum, often preserved as fragments. The thickness ranges between 1 to 12 mm, and the average is 4 mm.

Retouched tools - The category of retouched tools consist of 171 pieces. The general structure of retouched tools is shown on Table 4 and Figure 7, composition of individual tool types on Table 5. The largest group are burins – total of 69 pieces were found, making about 40 % of all retouched tools. Retouched blades and bladelets are the next group (40 pieces, 23 %), followed by endscrapers (22 pieces, 13 %), combined tools (15 pieces, 9 %) and some backed implements (13 pieces, 8 %). The other tools are represented by one or two pieces and 3 pieces are not typologically classified.

Endscrapers represent relatively less frequent types among the retouched tools. Only 22 pieces have been recorded, represented mostly by blade endscrapers (15 pieces, Figure 8). Among the other types

	N	%
Endscrapers	22	12,9
Burins	69	40,3
Combined tools	15	8,8
Backed implements	13	7,6
Retouched blades	40	23,4
Other tools	9	5,3
Undetermined	3	1,7
Total	**171**	**100**

Table 4. Kašov I, the lower layer. General structure of retouched

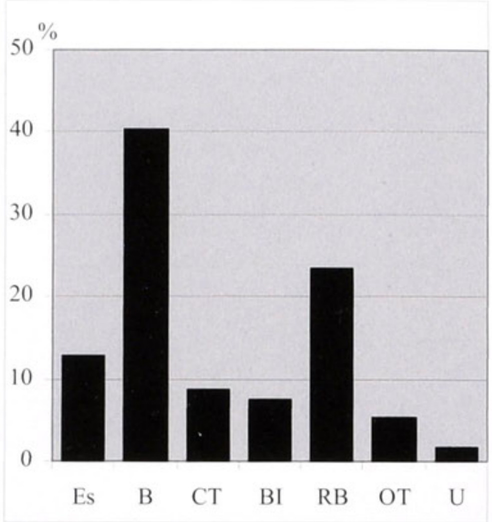

Figure 7. Kašov I, the lower layer. General structure of retouched tools. Key: Es - endscrapers; B – burins; CT – combined tools; BI – backed implements; RB – retouched blades and bladelets; OT – other tools; U - undetermined.

are 2 flakes (Figure 9: 1, 2) and 2 carinated forms (Figure 9: 3, 6), 2 endscrapers made on cores (Figure 9: 4, 7) and 1 thumbnail piece (Figure 9: 5). The pieces of obsidian are the most numerous (9 pieces), followed by flints (8 pieces), a few pieces being made of hornstone and limnoquartzite.

The largest proportion among retouched tools show the burins dominated by dihedral forms. The most numerous group are straight dihedral burins (18 pieces; Figure 9: 8-10; 10: 1-15), followed by angle dihedral burins (11 pieces; Figure 11: 3, 4, 6-14) and multiple dihedral burins (11 pieces; Figure 12: 4, 5, 7-13, 15). The next are dihedral burins on broken blade (8 pieces; Figure 11: 15-18; 12: 1-3, 6) and asymmetrical dihedral burins (3 pieces; Figure 11: 1, 2, 5). Other types are represented by mixed multiple burins (8 pieces; 13: 7-13, 15), busked burins (3 pieces; 12: 14; 13: 1, 2), core-shaped burins (3 pieces; 13: 14; 14: 1, 2) and truncation burins (4 pieces; Figure 13: 3-6). Majority of burins were made of flint (43 pieces), limnoquartzite (14 pieces) and hornstone (9 pieces). Burins from obsidian, radiolarite or jasper are represented by one piece each.

The group of combined tools consists of 11 combinations of burin and endscraper (Figure 14: 3-13) and 4 burins on truncated pieces (Figure 15: 1-4). Dihedral forms predominate among the burins. In this group, the flint was the most frequently used raw material, other pieces were made of limnoquartzite, hornstone and radiolarite.

The backed implements are represented by 13 pieces, mostly preserved as broken fragments. 5 pieces are fragments of La Gravette points (Figure 15: 5-9), 2 pieces are microgravette points (Figure 15: 11, 12) and one is an atypical La Gravette point (Figure 15: 10). Following is a backed blade (Figure 15: 13), a partially backed blade (Figure 15: 14), and 3 pieces of backed bladelets (Figure 17: 9-11). Backed implements were made of flint predominantly, but pieces of radiolarite, limnoquartzite and hornstone occurred as well. No obsidian was recorded in this category.

Retouched blades and bladelets represent the second largest group of retouched tools. Altogether 40 pieces have been discovered, represented by 6 types. The most numerous are blades with unilateral

	Type	N	% of tools
1	Endscraper on blade	7	4,09
5	Endscraper on retouched blade	8	4,68
8	Flake endscraper	2	1,17
10	Thumbnail endscraper	1	0,58
11	Carinate endscraper	2	1,17
15	Core endscraper	2	1,17
16	Rabot	1	0,58
17	Burin-endscraper	11	6,43
19	Burin on truncated piece	4	2,34
23	Borer	1	0,58
27	Straight dihedral burin	18	10,53
28	Asymmetrical dihedral burin	3	1,75
29	Angle dihedral burin	11	6,43
30	Dihedral burin on broken blade	8	4,68
31	Multiple dihedral burin	11	6,43
32	Busked burin	3	1,75
35	Burin on oblique retouched truncation	2	1,17
36	Burin on concave retouched truncation	1	0,58
37	Burin on convex retouched truncation	1	0,58
41	Mixed multiple burin	8	4,68
43	Core-shaped burin	3	1,75
48	La Gravette point	5	2,92
49	Atypical la Gravette point	1	0,58
50	Micro-Gravette point	2	1,17
58	Backed blade	1	0,58
59	Partially backed blade	1	0,58
60	Blade with straight retouched truncation	2	1,17
61	Blade with oblique retouched truncation	1	0,58
62	Blade with concave retouched truncation	1	0,58
65	Unilateral retouched blade	24	14,04
66	Bilateral retouched blade	9	5,26
74	Notched piece	2	1,17
76	Chisel	2	1,17
77	Side scraper	1	0,58
78	Raclette	2	1,17
85	Backed bladelet	4	2,34
90	Bladelet with inverse retouch	2	1,17
	Undetermined	3	1,75
	Total	**171**	**100**

Table 5. Kašov I, the lower layer. Composition of the individual tool types.

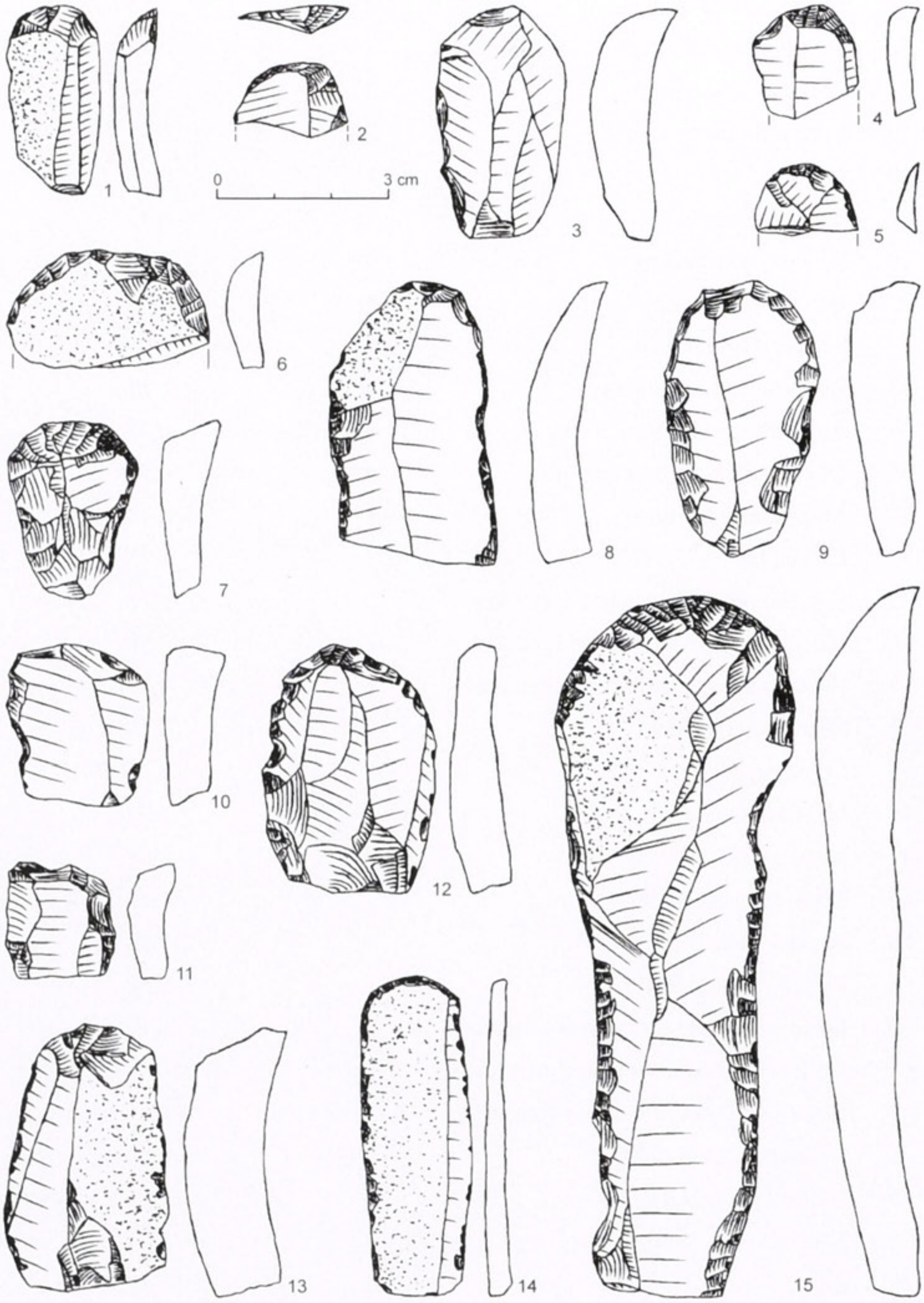

Figure 8. Kašov I, the lower layer. Endscrapers.

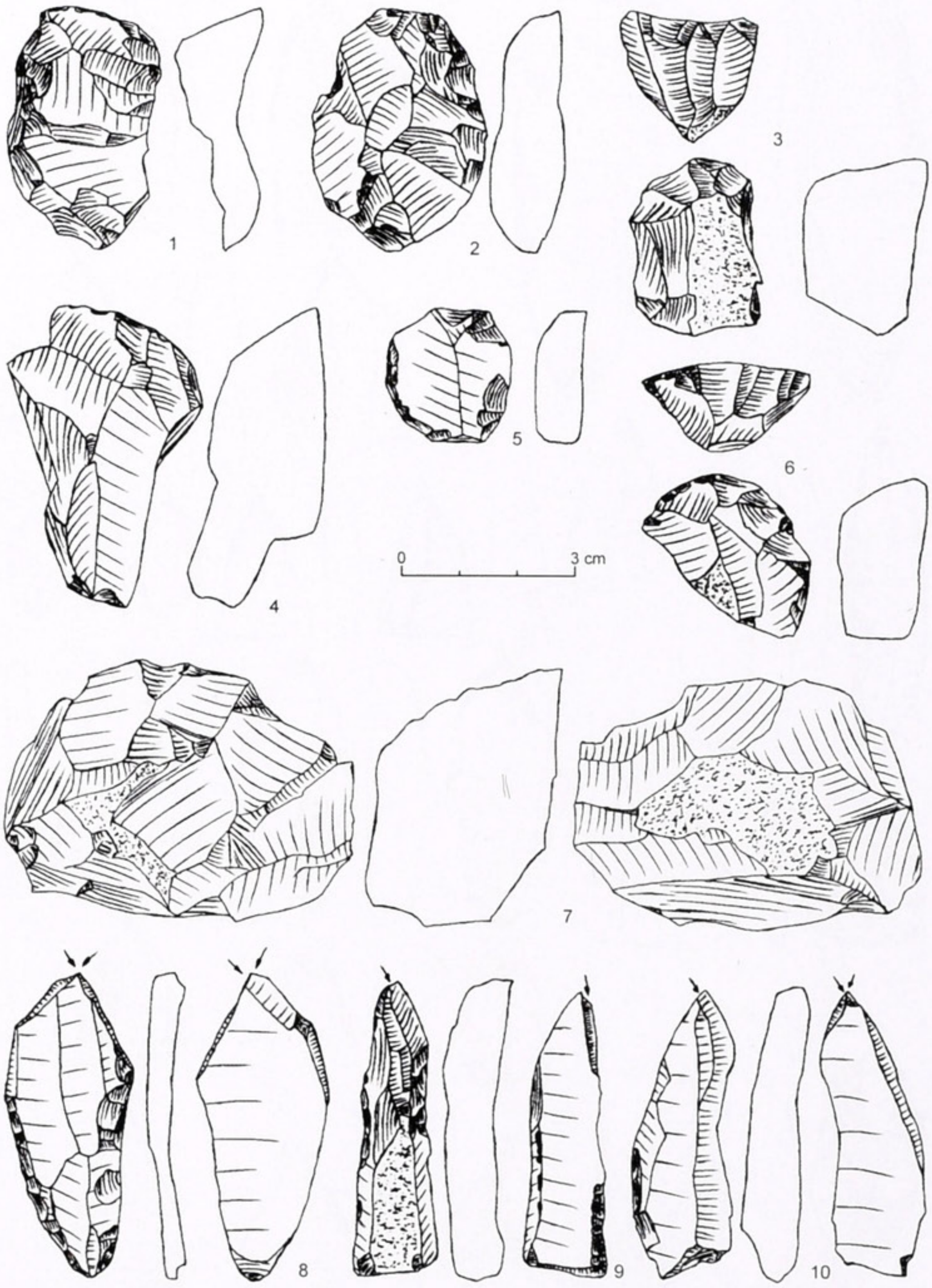

Figure 9. Kašov I, the lower layer. 1-7 – endscrapers; 8-10 - burins.

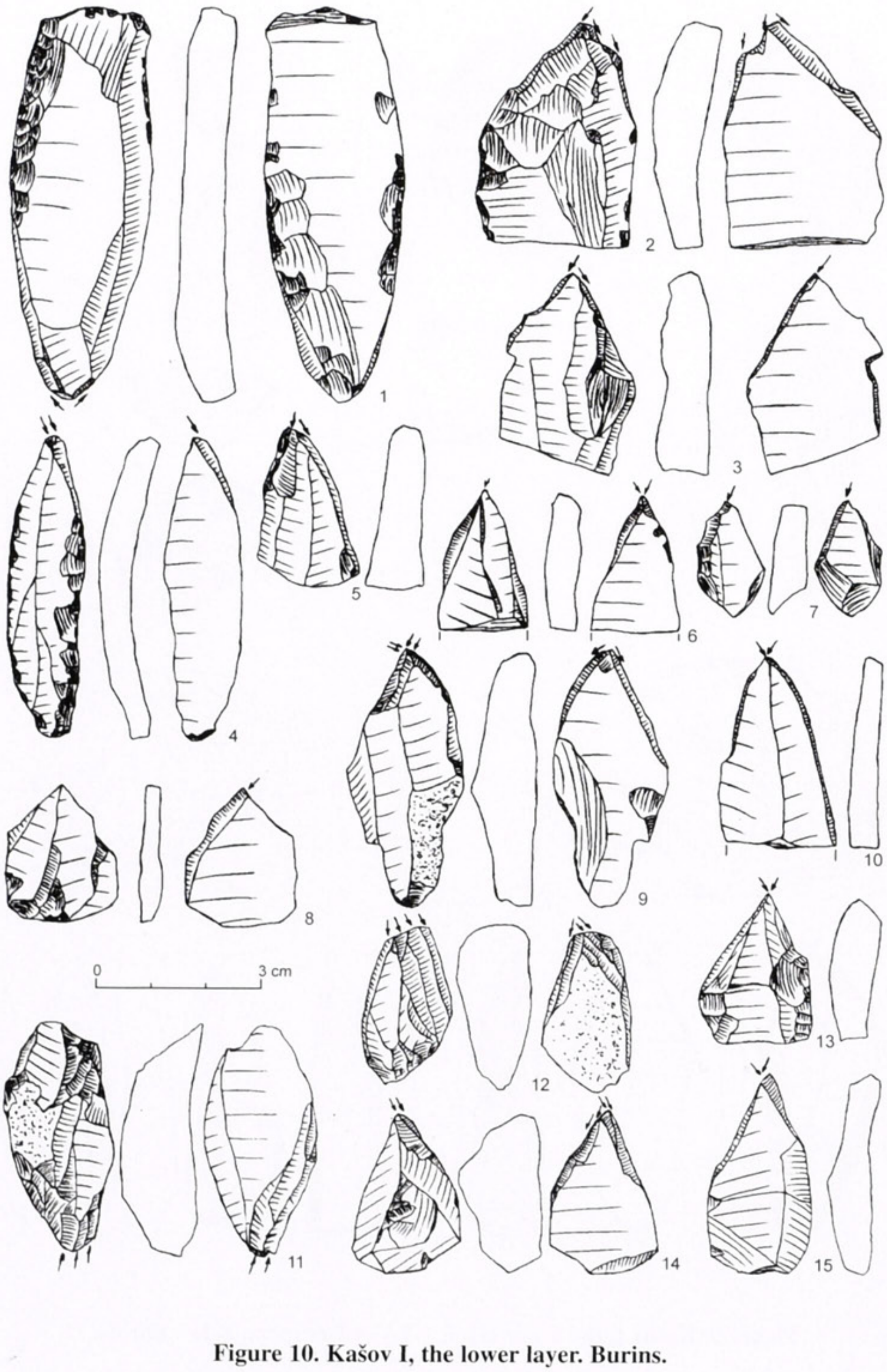

Figure 10. Kašov I, the lower layer. Burins.

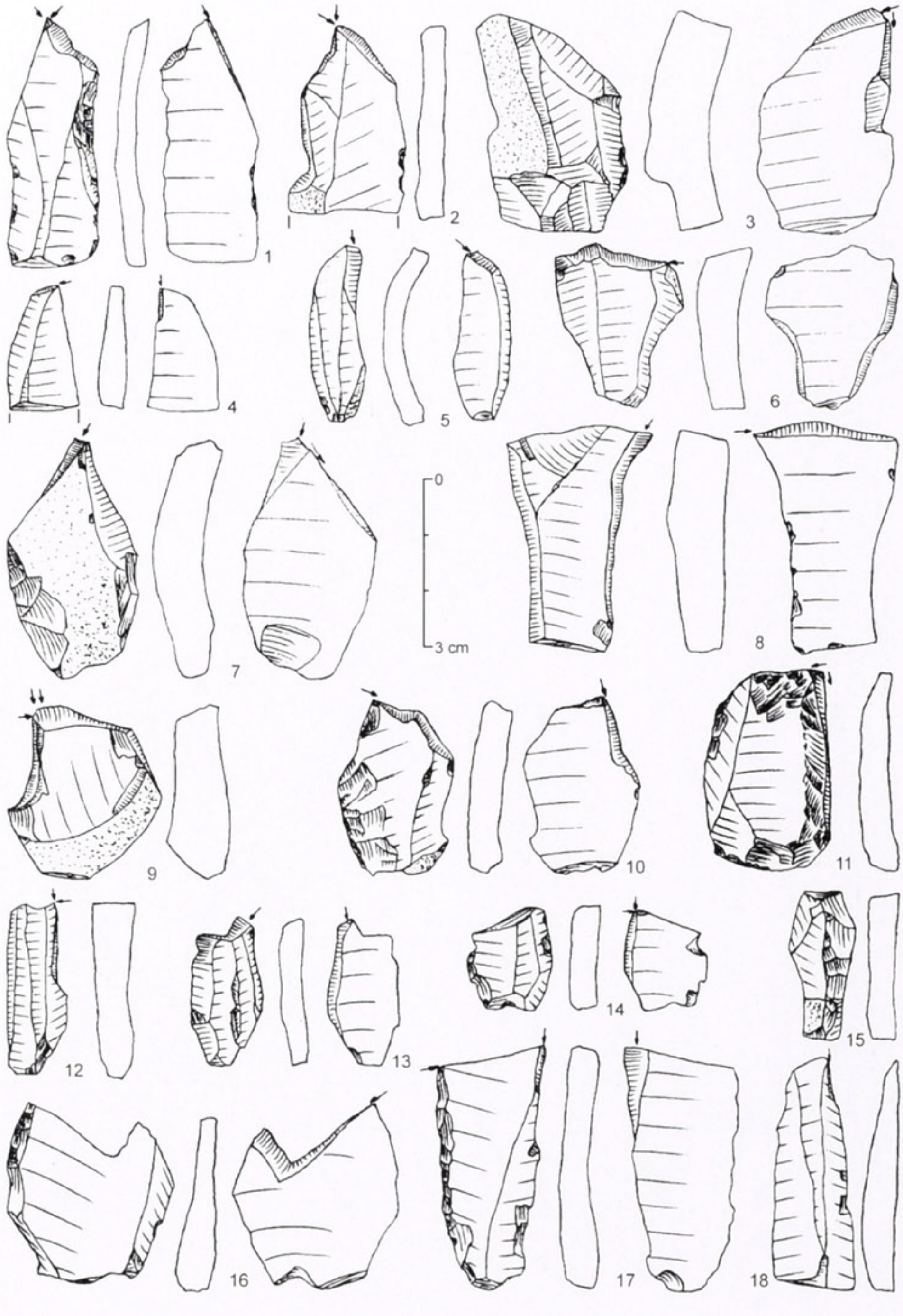

Figure 11. Kašov I, the lower layer. Burins.

Figure 12. Kašov I, the lower layer. Burins.

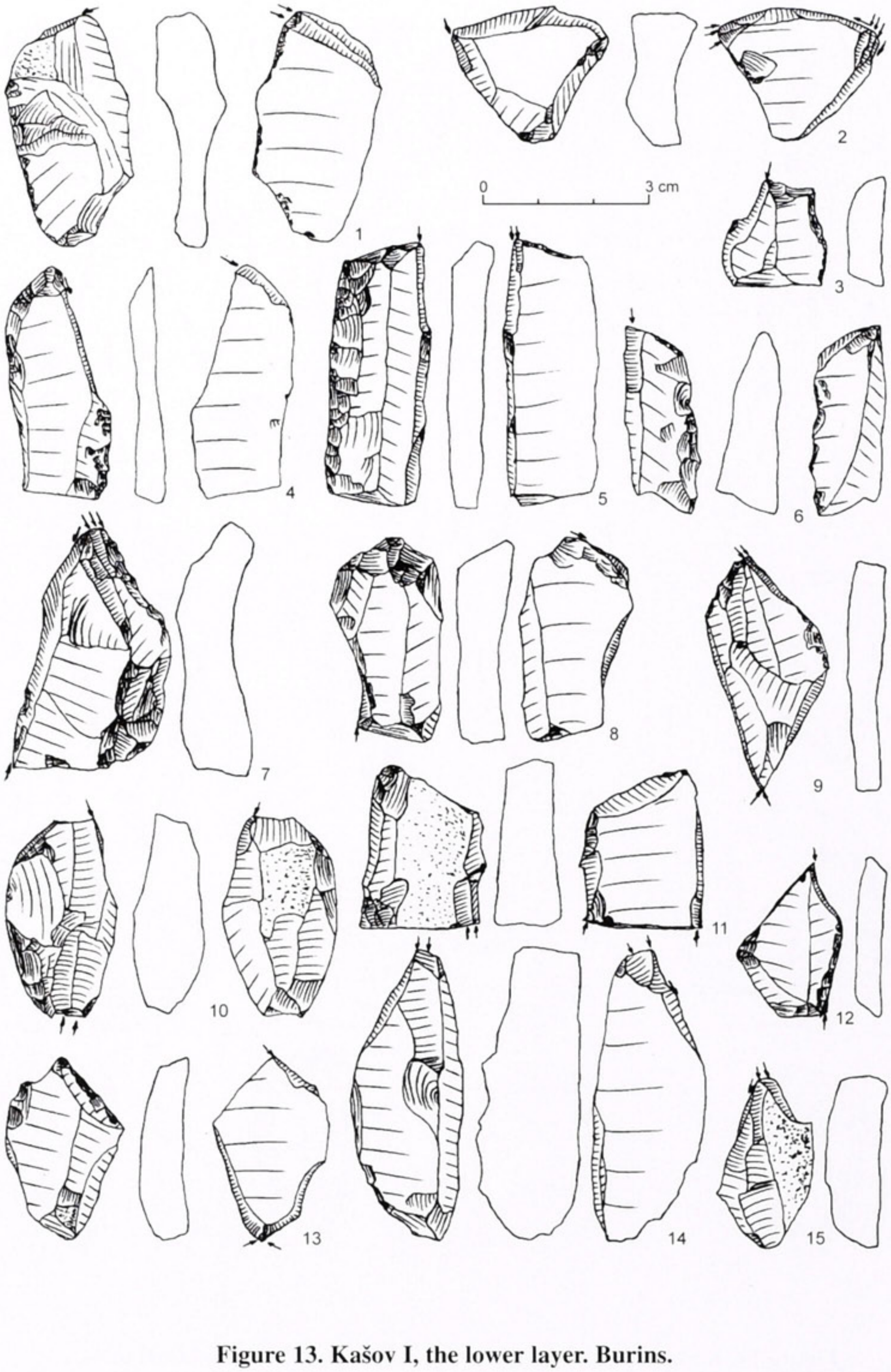

Figure 13. Kašov I, the lower layer. Burins.

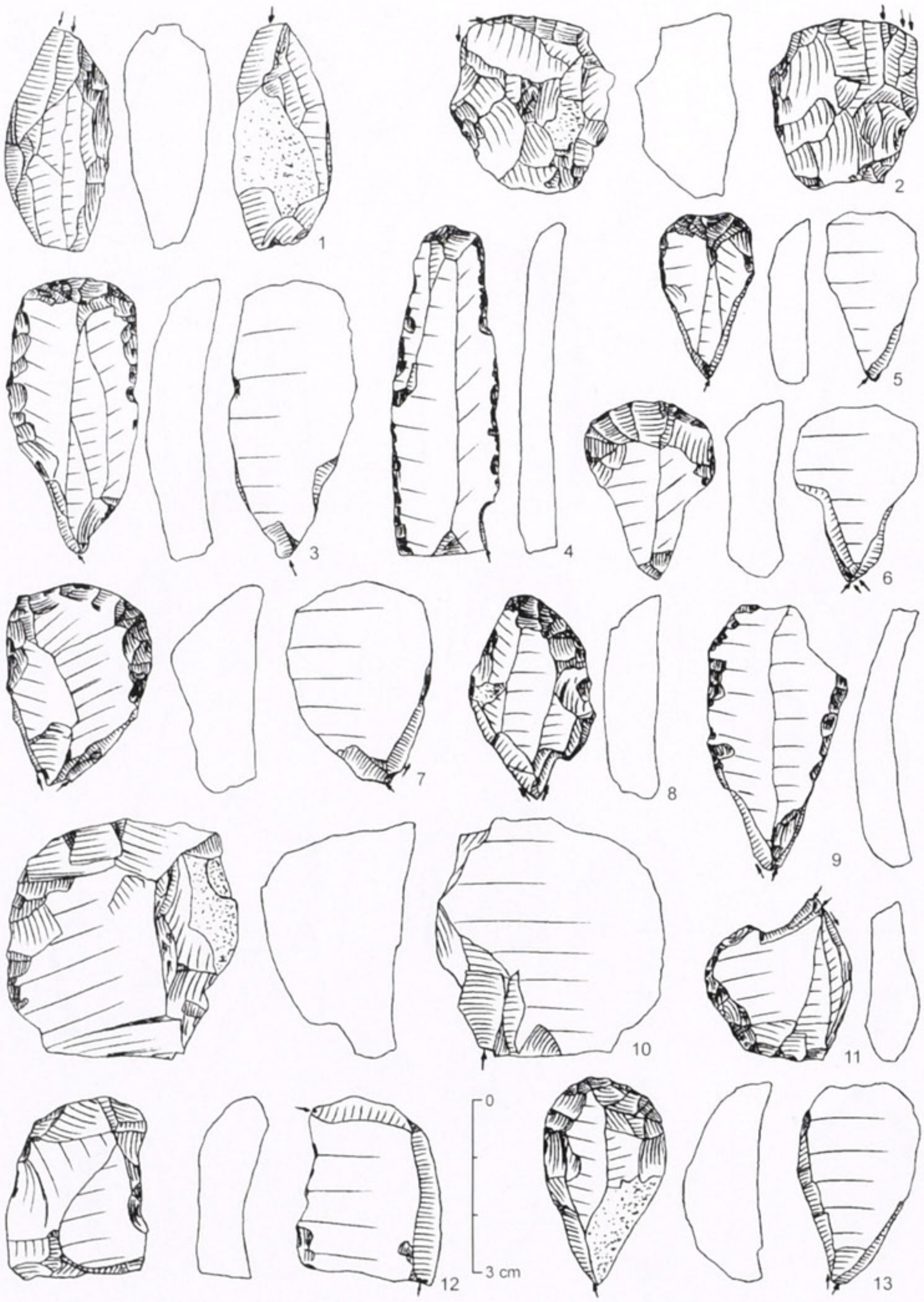

Figure 14. Kašov I, the lower layer. 1, 2 – burins; 3-13 – combined tools.

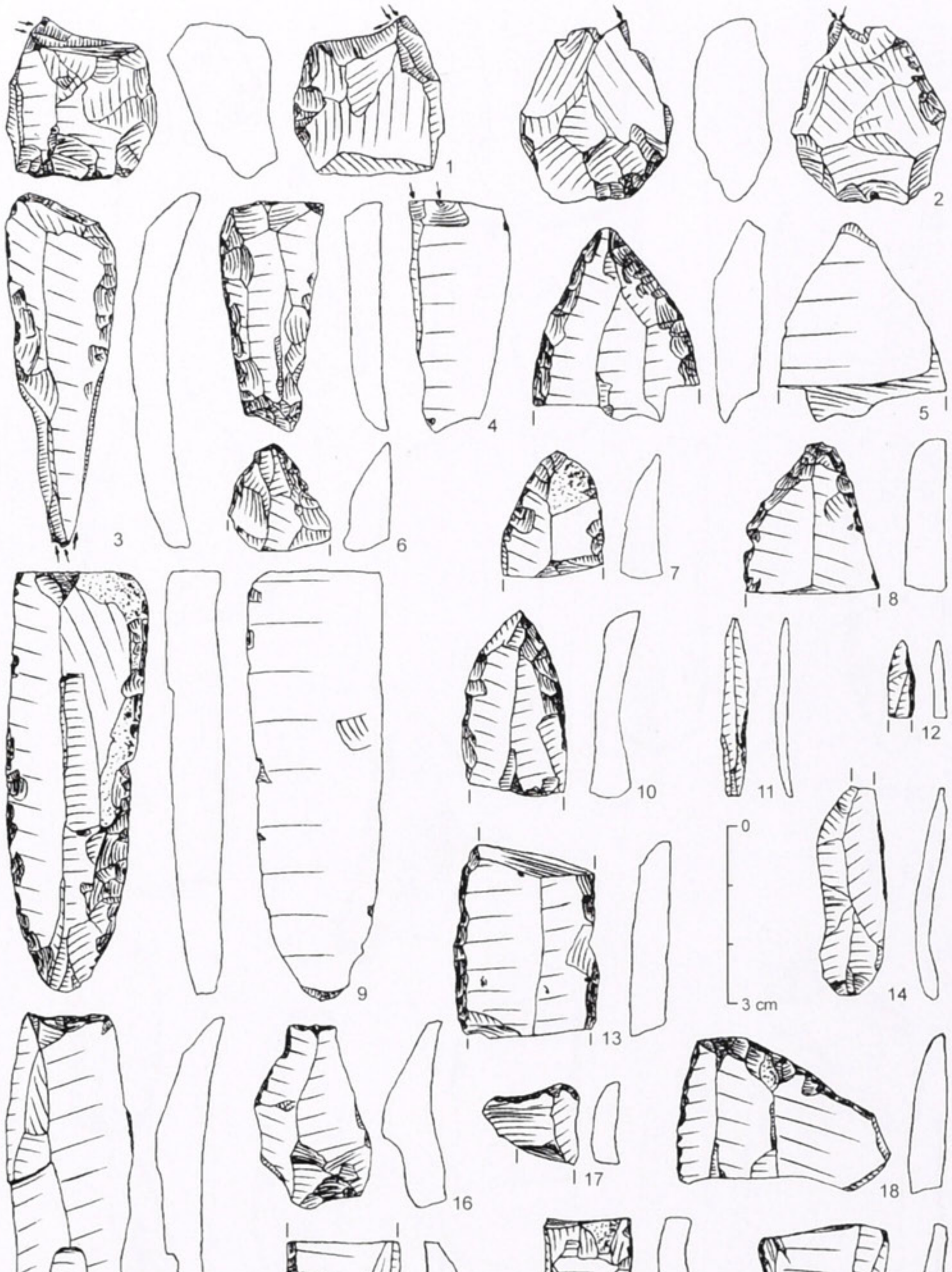

Figure 15. Kašov I, the lower layer. 1-4 – combined tools; 5-14 – backed implements; 15-21 – retouched blades.

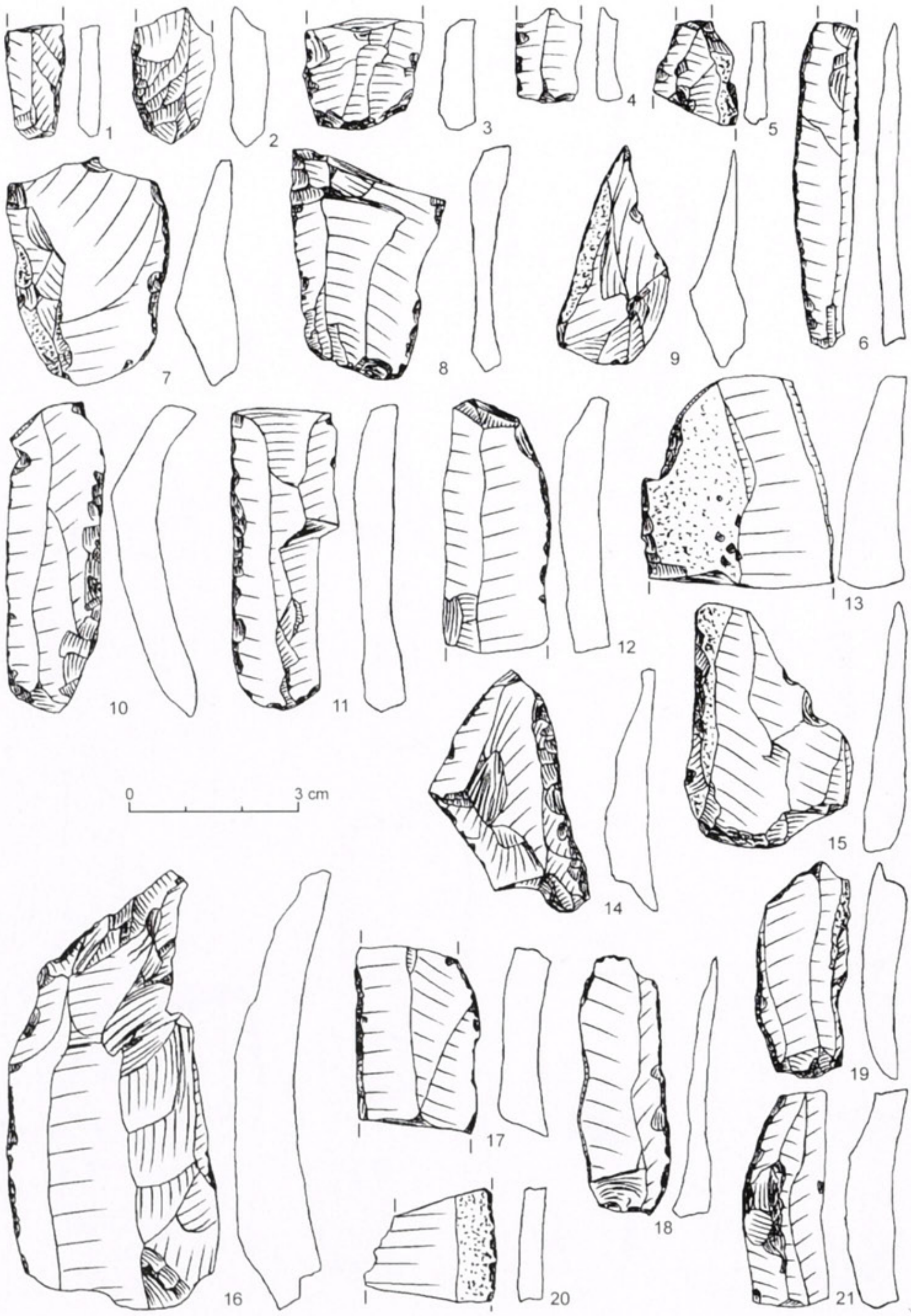

Figure 16. Kašov I, the lower layer. Retouched blades.

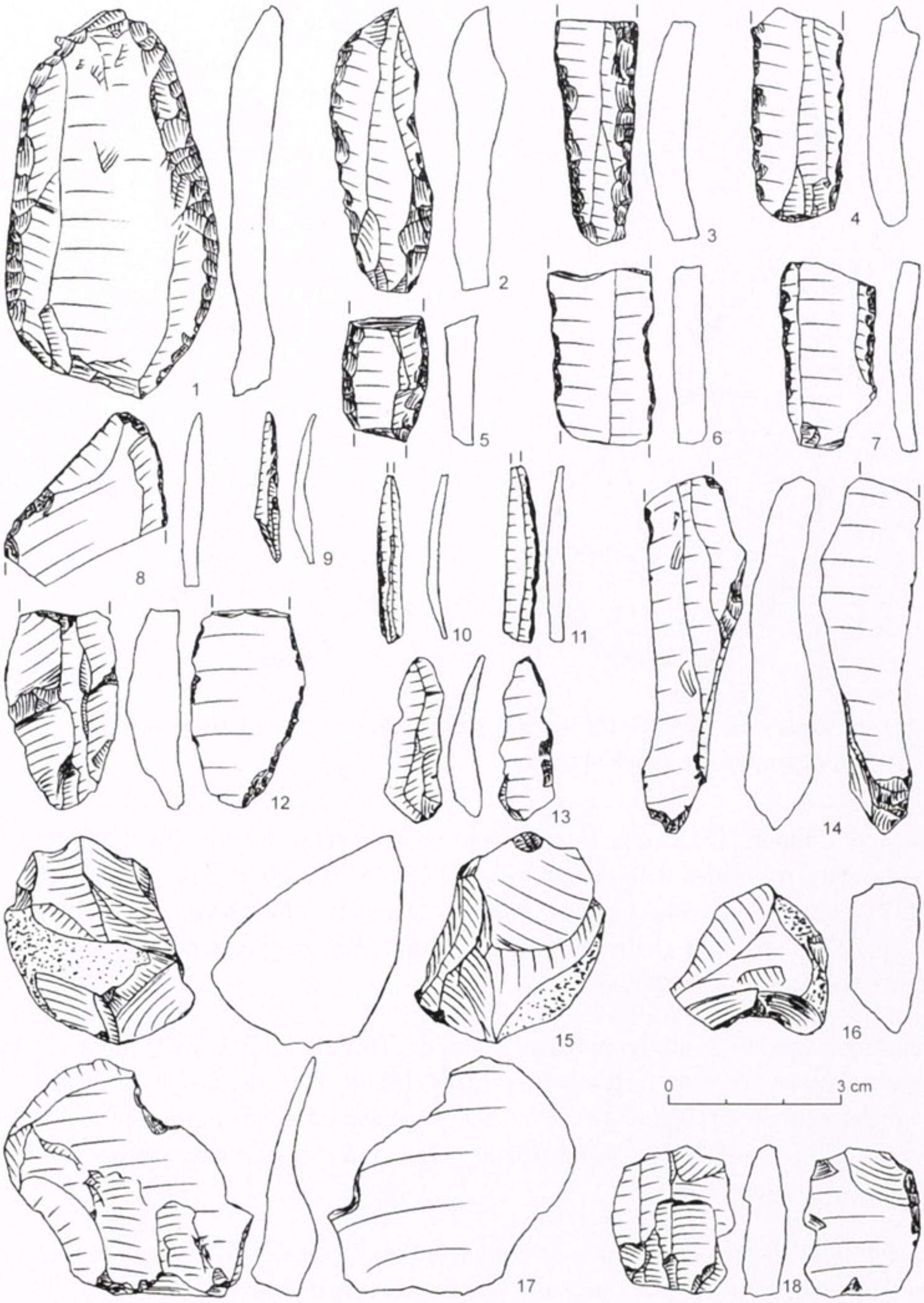

Figure 17. Kašov I, the lower layer. 1-8, 12, 13 – retouched blades; 9-11 – backed bladelets; 12, 13 – retouched bladelets; 14 – borer; 15 – rabot; 16, 17 – notches; 18 - chisel.

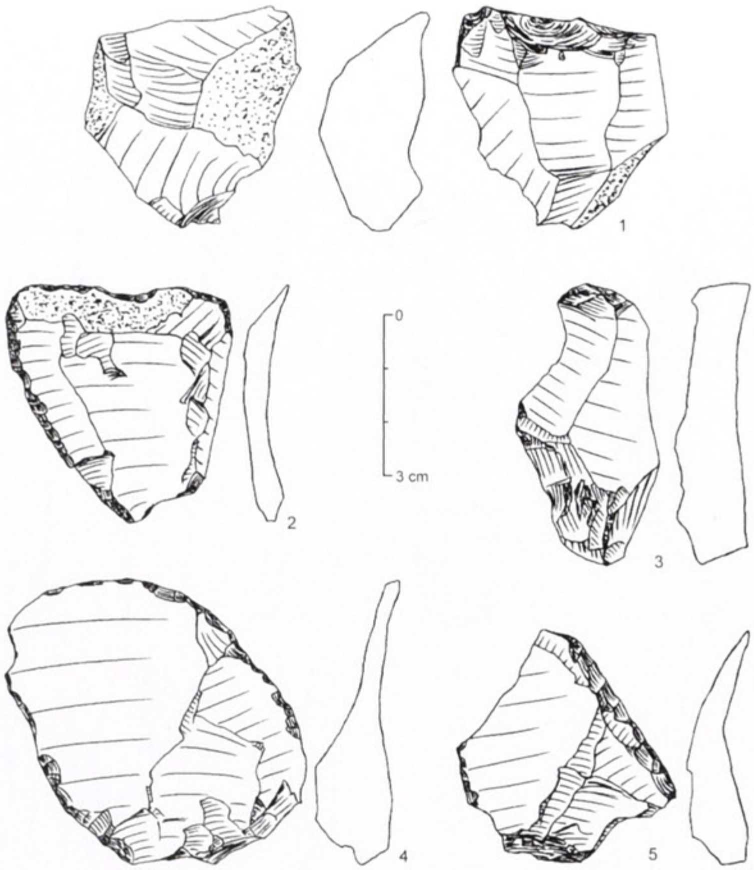

Figure 18. Kašov I, the lower layer. 1 – chisel; 2, 3 – raclettes; 4 – side scraper; 5 – retouched flake.

retouch (24 pieces; Figure 15: 19-21, 16:1-21) and bilateral retouch (9 pieces, Figure 17: 1-8). Other types are represented by blades with straight (Figure 15: 15, 16), oblique (Figure 15: 18) and concave (Figure 15: 17) retouched truncation and the group of bladelets consist of 2 pieces with inverse retouch (Figure 17: 12, 13). The flint is the dominant raw material in this group, followed by obsidian, limnoquartzite, hornstone and radiolarite.

The other retouched tools are typologically various. There are 2 notches (Figure 17: 16, 17) made on flakes of obsidian and of flint, 2 chisels (Figure 17: 18; 18: 1) made of radiolarite and obsidian, and 2 raclettes of flint and jasper (Figure 18: 2, 3). A rabot made on a hornstone core residual (Figure 17: 15), a borer made on a broken flint blade (Figure 17: 14), and a flint side scraper (Figure 18: 4) are represented by single exemplars.

The inventory of the retouched tools is completed by 2 pointed distal fragments of typologically undetermined retouched blades and 1 partially broken retouched flake (Figure 18:5).

Burin spalls - The assemblage contains 26 burin spalls, including 17 pieces of 1. series and 9 pieces of 2. series (from rejuvenation of burins). 12 primary and 5 secondary pieces are retouched laterally. The length varies between 13 and 53 mm, most frequently between 20 and 30 mm, the width is between 3 and 10 mm.

21 burin spalls are made of flint, the remaining pieces are of limnoquartzite (2 pieces), obsidian, hornstone and radiolarite (by 1 piece each).

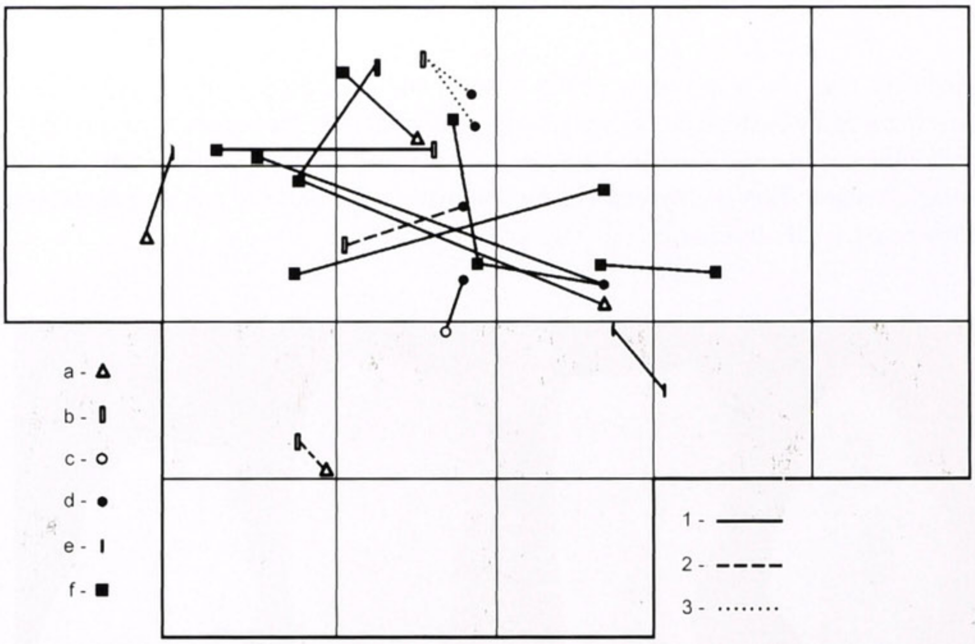

Figure 19. Kašov I, the lower layer. Spatial distribution of refitted artefacts. Key: 1 - production sequences and reutilizations; 2 – breaks; 3 – breakage by frost; a – retouched tools; b – blades; c – flakes; d – fragments and chips; e – burin spalls; f – cores.

3.3. Refittings

In the assemblage of lithic industry it was possible to refit some of the artefacts from the same complex. 12 refittings were conjoined by A. Verpoorte out of 28 artefacts of flint, hornstone, obsidian and limnoquartzite, including breaks, production sequences and reutilizations (Figure 19).

The breaks represent 3 series of fragments of broken blades, in one case the blade was cracked by frost. Production sequences represent short series, composed of mostly two, maximum of four flakes or blades, originating from various stages of core reduction. No blocks of raw material or complete cores in initial stage were refitted. Reutilization of semi-products as tools illustrate the sequence of burin and burin spall and two burin spalls of 1. and 2. series.

Spatial distribution of the refitted artefacts shows that the refittings are concentrated mostly in the western and central part of the site, where the highest density of artefacts is observed. Thus the core area of the site, in what concerns the tool production, might be located there.

4. Worked and unworked stones

In addition, in the lower layer of Kašov I were found 9 pieces of other stone artefacts which can be described as worked and unworked stones.

The worked stones are polished or grinding artefacts (Figure 20). 3 pieces are made of volcanic tuff and one is of sandstone. These raw materials are local and they could be obtained from vicinity of the site. Morphologically, they are desk-shaped and flat, with traces of polishing or grinding on the lateral edges. All these artefacts are reddish in coloration and probably were burnt in fire.

These artefacts are completed by 5 unworked stones representing various fragments of riverine pebbles of quartz sandstone and metamorphic rocks.

5. Results

The lithic industry from the lower layer of the Kašov I site can be generally described as Gravettian. Characteristic features are the high proportion of chips and small flake fragments, in the group of retouched tools the predominance of burins over endscrapers, and a relatively high proportion of retouched blades. The raw material composition is characterized by domination of extralocal northern flints from southern Poland, followed by local obsidian.

Figure 20. Kašov I, the lower layer. Polished and grinding artefacts.

Technological analysis of the lithic industry has shown a complete chain of core reduction at the site, but the tool-production activity was limited. This is demonstrated by the minimal proportion of cores and a relatively low proportion of flakes. Cores are mostly of local obsidian (12 obsidian pieces and only one flint core). Such a small representation of flint cores compared to the overall domination of flint in the whole assemblage, suggests that either there was small quantity of imported reserves on the site, or that the flint was more reduced and exhausted than the obsidian, for example because the flint as an imported raw material could be more reputable. The latter possibility is also supported by the fact that some retouched tools of flint are made on residual cores. This intensity of flint exhaustion also suggests that there was not periodical nor continuous supply of the flint to the site. On the contrary, the higher number of obsidian cores compared to the low proportion of obsidian between retouched tools suggests supplementary role of obsidian during the tool production.

Main type of blank for tool production are the blades and bladelets, and especially their medial parts. This observation is confirmed by the fact that proximal parts predominate among the unretouched blades, suggesting that the blades were broken on purpose to obtain a regular form such as the medial part of the blades. The proximal parts of the blades were discarded while the other parts were used for the tool production or they were taken away of the site.

The high proportion of chips, small flakes and flakes fragments, the higher number of blades and the presence of burin spalls suggest an increasing intensity of reduction, transformation and tool rejuvenation compared to production of new pieces from prepared cores. This is a typical feature of assemblages dominated by extralocal flints. On the contrary, these operations were less important in assemblages based on local raw materials, where the proportion of cores and preparation flakes increases (Kozłowski 2000, 173, 174).

The spatial analysis shows that the lithic distribution area represents one concentration and corresponds to one phase of occupation. There were no traces of dwelling structures, hearths or depressions, which would show surface modification of the site. No compact hearth, demonstrated by surface modification, stone structure or ash layer was discovered. However an existence of one or more hearths might be suggested by the presence of wooden charcoals, burnt stone artefacts and ash-coloured spots in the analysed area.

The ash-coloured spots can be interpreted as areas of hearths or places were fire-waste and organic material were discarded. The absence of surface depressions, stone structures surrounding hearths as well as the influence of the post-depositional processes does not allow to reconstruct precisely the way the hearths might have looked and been localized. These were probably simple open fireplaces grounded directly on the surface and probably kept just for certain short period on the occasion of using the fire. The size, duration and the number of the hearths depended on the activities performed at the site.

Two site models might be considered on the basis of the spatial structures, mainly on the relation between the finds concentration and the hearths locations. The first one assumes using several hearts, without a central one. Some of the hearths might have been used simultaneously and might have served for a certain kind of a specialized activity or, alternatively, just one hearth functioned and another one could be initiated nearby after its termination. The second model represents a site with one central hearth, used for a longer period, but not long enough to be reflected in the archaeological situation. Its waste was removed to the marginal parts of the site where the other ash-coloured places are localized. Besides this, there might have been also one satellite hearth in the northern part of the site, as evidenced by the ash-coloured places with burnt flakes and the concentrations of retouched tools and blades. This hearth could be used for some specialized activities and only during a short time.

The spatial pattern and artefact composition, especially the high proportion of retouched tools, demonstrate that the site was not of a workshop or hunting character, but that the various activities were realized simultaneously. So, it can be interpreted as a short-term base camp settled by small group of people and combining the living and working areas.

The analysis of the lithic industry, the radiocarbon dating of charcoal, and the lithostratigraphic position place the lower layer of the Kašov I site to the Late Gravettian horizon, to the period directly preceding the LGM. This chronological position is also confirmed by analogies with other Gravettian sites, chronologically dated to the same period, for example Moravany nad Váhom – Lopata II (Kozłowski ed. 1998) or Banka – Horné farské role, trench 5 (Alexandrowicz *et al.* 2000).

A similarity could be seen in the raw material structure, mainly in the proportion of extralocal flints and local materials (in case of Moravany or Banka mainly the radiolarite) and in the composition of technological and typological groups (Figure 21). In all the compared assemblages the cores are represented by a small number of pieces, and the group of chips, small flakes, and flake fragments is the most numerous category. The next common features are the predominance of burins over end-scrapers, a higher proportion of retouched blades, and a relatively stable proportion of backed implements. The importance of burins is supported by the combined tools with predominating combinations of burins. Other similarities can be seen in the spatial distribution of artefacts creating medium size concentrations (about 6 to 8 m) around the hearths.

6. Conclusions

On basis of the present knowledge, during the Late Gravettian horizon, in the period from 22 to 20 ky BP, the settlement in Central Europe decreases and the typical features of the shouldered points horizon disappear (Kozłowski 1998). During this time period, new occupation system operated between the territories north of the Carpathian arc and the inner part of the Carpathian basin, connected to migrations of the hunting groups and seasonal exploitation of a variety of territories (Kozłowski 1999, 2000).

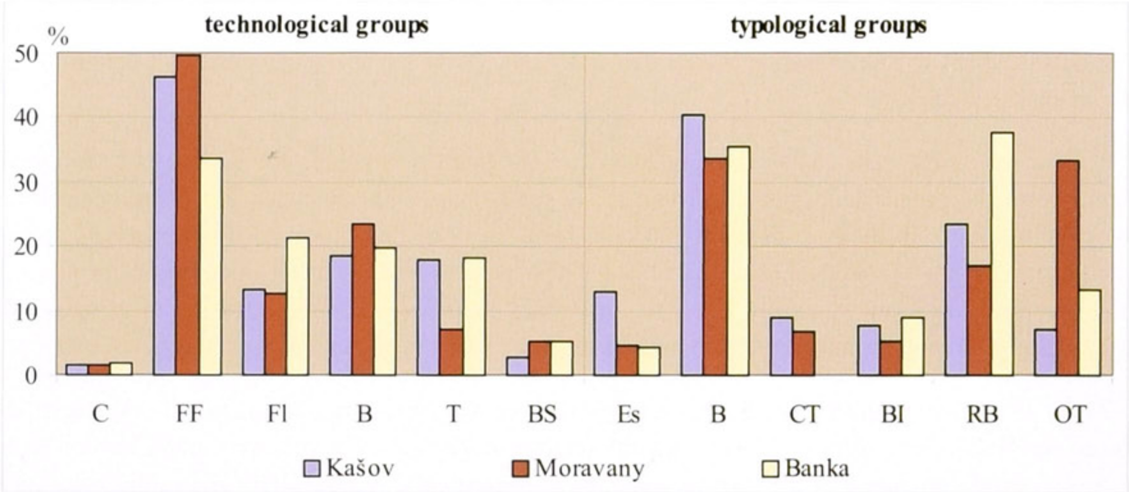

Figure 21. Kašov I, the lower layer. Comparison of technological and typological composition of the chipped industry in the selected late Gravettian assemblages (for key see Figures 6, 7).

This model may well be applied to the north-western part of the Carpathian basin, and it also clarifies the observed relationships among certain sites in the middle Váh, upper Oder and Vistula basin (for example Moravany – Lopata II, Banka – Horné farské role, Ostrava – Petřkovice, Kraków – Spadzista). The territories north of the Carpathians were exploited during the summer, the middle Váh basin in the autumn, and in the winter we expect a shift to the middle Danube region or even Trasnsdanubia (Kozłowski 1999, 2000).

In conclusion, and basing on the character of occupation in the lower layer of Kašov I, this model could be used for north-eastern part of the Carpathian basin as well. In that case, the site Kašov I, lower layer, represents a typical transitory camp of late Gravettian hunter's groups (such as Moravany – Lopata II in western Slovakia) on the way from their summer hunting grounds in southern Poland (the Upper Vistula basin) to the southern territories in the eastern part of Carpathian basin in winter. These seasonal shifts could follow the Carpathian gates through Nízke Beskydy, in the Topla, Ondava or Laborec basins, where some Paleolithic artefacts have been discovered (Bárta 1965, 1983). It could also be supported by the raw material composition of the lithic industry from Kašov I, lower layer, where hornstone, radiolarite and limnoquartzite pieces are recorded and their primary sources occur in the territory mentioned above.

During the period after 20 ky BP, the Epigravettian culture started to develop. In eastern Slovakia, especially in the area of Zemplín Hills, a rich settlement is recorded. Because the questions of stratigraphy are not completely answered, future research is needed to solve the relations between the Gravettian and the Epigravettian sites in this area and the possible continuity of cultural development.

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ADAPTATION STRATEGIES AND RAW MATERIAL SUPPLY NETWORKS OF THE EVOLVED GRAVETTIAN IN CENTRAL AND SOUTH-EASTERN EUROPE ON THE EXAMPLE OF TEMNATA CAVE (BULGARIA), WILLENDORF II (AUSTRIA) AND LA CALA (ITALY)

Ts. Tsonev

Abstract

The present study considers three of the longest Gravettian sequences in Europe: Willendorf II (Lower Austria), Temnata cave (North Bulgaria), and La Cala cave (South Italy). As a starting point an assessment of the topography of the sites is made that is followed by the environmental contrasts within each site and between sites. On this basis criteria for optimal behaviour of raw material supply strategies are proposed. Their analysis reveals a minimax formula of maximum benefit that should describe the past human behaviour. The question explored further is whether such rational formula fits the real data from the three sites. The definite answer is no. A term - 'communication corridor' is coined that describes the technological, typological and raw material supply variability of the three sites. The "irrational" from our point of view behaviour of the communities of the three Gravettian sequences can be explained by the amount of information flow channeled by actively manipulated by humans' natural environment that creates an enormous variety of archaeological record.

KEYWORDS: raw materials procurement, maximum benefit, Gravettian

1. Topography of the sites

The topography of the three sites: Temnata cave, Willendorf and La Cala cave defines rich and diverse environment. Each of the three localities has its own particularities that were attractive for early communities. Both Temnata and Willendorf are situated in narrow passes cut through mountains (Balkan range, Wachau) by big rivers (Iskar, Danube) which flow in south - north direction. In the first case, the area is rich of large flint nodules. The quality of the local flints, however, is not good and high quality flints were imported. Almost similar is the situation with Willendorf where except some marls, sandstone, quartzite gathered along the Danube terraces all the rest of the materials: hornstein and radiolarites were brought in from northern Moravia and southern Poland. Few of the radiolarites show rolled cortex and they may have come from fluvial deposits of the Danube. La Cala cave, which is at present at the sea level dominated an environment that varied from a continental steppe-prairie to more temperate, humid and forested environment (Bartolomei *et al.* 1975, Figure 6) that during the Wurm interpleniglacial ran down to then sea level estimated to be about 100 meters below the present one. On the terraces, now below the sea, small concretions of dark flint and jasper were used by Palaeolithic people.

The location of the three sites permitted the hunting communities to control mixed and diverse landscape. In the first two examples the micro-region is constituted by large canyons along big rivers with a network of short lateral canyons and valleys connected with alluvial lowlands. La Cala provided open view on a varied, partly deciduous forest or steppe environment.

2. Environmental contrasts

As Fr. Delpech and J. L. Guadelli (1992) have pointed out, there is enough evidence to suggest the existence during the Wurm interpleniglacial (55-25000 BP) of at least two bio-geographic zones in Europe. The first one is situated to the North of the pyreneo-alpain arc and the second one - to the South. Balkans show greater similarity to the second one. The northern climatic conditions had almost no or little influence on the Italian peninsula as well as moderate repercussion on large fauna in the eastern Balkans. For example, the spread of reindeer included northern latitudes and the southern limit of that habitat never reached the territories south of the lower Danube. The same is with the Antelope saiga - well known from the north-European lowland and Aquitaine. Remains of this species were never found neither in Temnata nor in Bacho Kiro caves. The horse in Temnata differs from both sub-species of the recent Wurm in western Europe. The "Asinien" from Temnata varies from that known from western Europe but is quite similar to the Italian *Equus hydruntinus*. Differences are also found in bison and big cats.

On a micro-regional scale the topography of the sites and the diversity of the surrounding areas define the major hunting activities of the Gravettian communities. Landscapes are rich and varied. In the case of Willendorf, there is an open, cold steppe environment with arctic species like reindeer and mammoth. The Capra ibex, which is generally associated with mountainous areas with altitude above the forest zone is also present. Horses and bisons appear only at the upper part of the sequence in layers 8 and 9. Big Cervidae, which probably are associated with development of marshy zones near the Danube occur inconsistently in the Willendorf II sequence: in layers 5, 8 and 9 (Thenius 1959).

The surroundings near the Temnata cave are even more diverse. The environment is predominantly open steppe and it is submitted to a gradual climatic continentalization as it follows from bottom to top of the Gravettian sequence. The landscape is opened to the large lowland to the North. That is why Equidae and Bovinae represent the most numerous species found. The second comes the mountainous factor represented by *Capra ibex*. Many small forested valleys - habitat for *Rupicapra rupicapra* (chamois) are cut through the karst region. The marshy zones along the deep Iskar gorge were occupied by big Cervidae: elk and *Megaceros*.

The La Cala cave (near Salerno, southern Italy) is now situated almost at a sea level cut into a calcareous rock stretched out onto the sea. At La Cala cave temperate, humid and more continental, steppe conditions dominated. Species associated with mountainous and partly deciduous forest environment are present. They are red deer, chamois, *Capra ibex*, *Sus scrofa*. Sea molluscs are not found in the Layers ßI-II and Q (Palma di Cesnola 1971:264).

3. Criteria for optimal behavior of the Gravettian communities

Undoubtedly, raw material supply played an important role in the lifestyle of the Gravettian communities. Unless Middle Palaeolithic people that were much more opportunistic in their subsistent strategies, Gravettians were narrowly specialized in hunting and other activities. This increased the demands of these communities for high quality flints. For example, the 10 cultural levels defined in the Temnata Gravettian sequence show an increase of the slenderness of the blades with the increased import of high quality flints. Moreover, the increase of the imported flints fits the parameters of an optimization task. This means that the supply with high quality flints was kept at a level of maximum benefit by the Gravettian communities (Tsonev 1999). The extralocal outcrops that have been identified so far include regions lying in a distance about 250-300 km and even some less probable identifications point out much greater distances. Some of the most important extralocal outcrops located by M. Pawlikowski (1992) are: northern Greece, southern Bulgaria (the Rhodopes near the Greek border), eastern part of the pre-Balkan platform, eastern Serbia. Much less probable are possible contacts with the Hungarian mid-mountains. Although the probability for such contacts is very small we cannot exclude entirely this possibility.

From the formal analysis of the Temnata Gravettian sequence the following list of criteria for rational behavior in the raw material supply strategies of Gravettian communities is presented.

1. Quality of the raw materials
2. Availability of the raw materials
3. Distance to the high quality raw materials
4. Relation imported/local flints
5. Raw material restrictions imposed on knapping techniques
6. Dimensions of the nodules of raw materials used

All the listed above criteria have direct or indirect contribution to the benefit sought by the Gravettian communities in their raw material supply strategies. In relation to the benefit the following data matrix was examined by a two way joining clustering method (Figure 1). To simplify the task without loosing any information the scores assume the easiness of the fulfillment of these criteria. For example, at Temnata and Willendorf the local flints and rocks used are of bad quality while the imported ones are of high quality. This mixed character is scored 1. At La Cala high quality materials: jasper and flint are local; they are easily obtainable and hence scored 2. The same rule - relative easiness of fulfillment of the criterion - explains the scores of the Availability and Distance to the raw material sources. The dimensions of the raw material nodules are relatively bigger at Temnata and Willendorf - score 2 than at La Cala where the raw materials exhibit excellent knapping qualities but are of small dimensions. Hence they are scored 1. Obviously the small dimensions of the flint nodules impose restrictions on knapping techniques. At the first two sites there are no restrictions since the dimensions of the concretions used are diverse. They are scored 2 while La Cala where such restrictions on technology are observed is scored 1. In other words, it is much more easy to produce tools with various dimensions if there is a rich and diverse supply of raw materials than if one works only with a single type of raw materials. The last criterion refers to the relation imported/local raw materials. Although the ratio varies from 20% to 45-50% at Temnata and Willendorf sequences equal scores of 0.5 were arbitrarily ascribed. This rounding off of the scores does not change the reordering of the matrix. It was made only to sharpen the contrast between the sites. At La Cala imported flints are negligible quantity or they are rather absent.

	TEM	WILL	CAL
Quality	1.00	1.00	2.00
Availability	1.00	1.00	2.00
Distance	1.00	1.00	2.00
Dimensions	2.00	2.00	1.00
Restrictions	2.00	2.00	1.00
Relation	0.50	0.50	0.01

Figure 1. Reordered Data Matrix.

According to these criteria, there is a marked contrast between Temnata and Willendorf on the one side and La Cala on the other. In Temnata and Willendorf the raw materials are of mixed quality: high quality imported and low quality local flints. To this pattern can be added that most of the bladelets and tools were made of imported flints. This means that the good quality raw materials were valued and intentionally imported. The import itself could not be easy in terms of the long distances. At La Cala, Gravettian communities had at their disposition good quality raw materials in the immediate vicinity of the cave. On the other hand the small dimensions of the nodules put some restrictions on the technology and typology of the assemblages in La Cala. Such restrictions are not observed at Temnata and Willendorf.

Although these features point towards a clear cut contrast between Temnata and Wilendorf on the one side and La Cala on the other, essentially they all reveal a marked tendency of maximum exploitation of the resources (local or distant) provided it is obtained at the lowest possible cost. Formally, such a behavior can be described as a uniform process that defines the following formula: these communities sought to exploit the highest quality materials available applying the smallest possible efforts. Their direct target for exploitation should have been the closest sources of high quality materials and if there were no such sources they would go further and further to find materials that would meet their demands. And it is that uniformity of behavior that would constitute our expectations for examining the patterns of raw material supply and the way it fits the existing data.

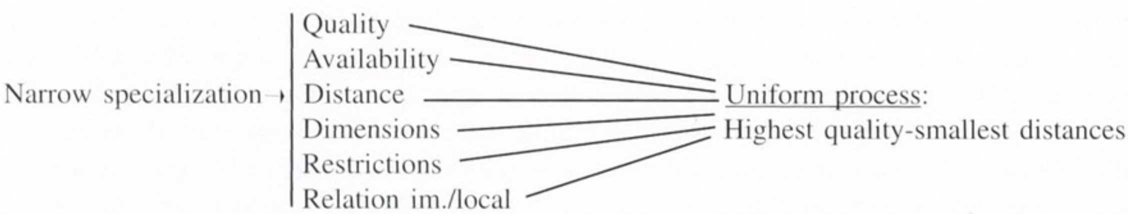

Figure 2. Minimax formula of maximum benefit.

4. Irrationality in the patterns of raw material supply of Gravettian communities

The question arises whether such simple, uniform process: "Highest quality: smallest distances" fits the real data. The answer is that a minimax mathematical optimization procedure cannot fully describe the complex behavior of the Gravettian communities. Undoubtedly, similar minimax formula played an important role as a general guidance that organized to some extent past human behavior. The most obvious example of this formula is presented at La Cala cave where the rich and available local sources dominated the local industry and even modified it. In this case raw material exchange, which, generally, is regarded as a manifestation of past human contacts cannot help us in establishing a pattern of communications of La Cala communities. There is no doubt, however, that contacts with other communities existed though they cannot be tracked down in the present archaeological record. Indirectly, we can judge about them in the significant internal dynamic of evolution of the cultural levels defined within the layer Q. Although the flint assemblages of layer Q from La Cala show some particularities in their technology and typology they all can be ascribed to the so-called complex of the "Evolved Gravettian with Noailles burins" (Palma di Cesnola 1971). Had such contacts not existed the evolution would have gone into considerable deviation from this complex.

In terms of the minimax formula the raw material supply in Temnata and Willendorf cannot be entirely explained. In both sites Gravettian communities did not use the closest high quality flint sources. For example, in Temnata flints were brought in from distant outcrops that lie about 250-300 km away. These communities could have exploited high quality flints from outcrops situated much closer: Muselievo - about 60 km in the northwest direction or, the numerous outcrops in the Cretaceous limestones along the Tarnovo-Lovec anticline - about 100 km to the east. A similar situation is observed in Willendorf and in the Moravian mega-sites: Pavlov and Dolní Věstonice. For example, in his recent investigation on some materials from Pavlov I, A. Verpoorte (1997) mentioned that in terms of distance over 90 % of the materials used come from more than100 km away. In the same time, there is almost complete absence of less distant, good quality cherts from Krumlovský les and Stránská skála. The main bulk of imported materials points to the northeast direction (White Carpatians) and even as A. Přichystal (1997) makes a note, some silicites may have come further from the North - from Krakow-Czenstochowa Jurassic.

There is also a marked dissimilarity in the distant raw material supply patterns of Temnata on the one side and Willendorf and the Moravian mega-sites on the other. In the individual cultural levels in Temnata the structure of the distant raw materials is incomparably more diverse than that observed in Willendorf and the sites in Moravia. In Temnata many distant sources were exploited but flints from each of these sources constitute no more than few percents on average of the total amount of extralocal flint varieties. The percentages of the extralocal materials in individual levels fluctuate considerably: from 1.4 % at level X to 18.7% at level Vb (Drobniewicz *et al.* 1992: 388, table XXII). The amount of mesolocal flints doubled: from about 16% to about 30%. The local flints make considerable drop of about 20 %: from about 80% to about 60%.

This varied structure of raw material supply fits to some extent to the rational, minimax formula: "minimum efforts-maximum benefit". This is so because of the greatest increase of the mesolocal flints that shows a smooth, uniform process of expansion of the raw material supply. This process may have been triggered by steadily growing demands for high quality flints of those communities based on their narrow specialization. Yet, the question why those communities maintained such long distance, effort consuming contacts remains still unexplored. There are, however, some attempts of explanation. The long distance supply of Willendorf and of the Moravian sites may have been connected with the hunting annual cycle of migration of these communities.

This hypothesis is supported by some additional facts. It is well known that large game like mammoths, reindeer, horses etc. have long distance migratory cycles. Probably for this reason particular forms of the landscape (killing sites) like long passes through mountains along rivers, or long valleys bordered by lowlands may have been valued and consistently occupied by the Gravettian people. Also to this explanation can be added the existing gradation of the different environment (from tundra to open steppe and steppe-forested habitats) of the three sites. If we accept that the open, cold steppe to tundra environment promoted long distance, annual migration this may have explained the significant presence of extralocal flints in Willendorf and Moravian sites. In this case, the past human behavior seems to fit into the rational, minimax formula: "minimum effort-maximum benefit".

In La Cala the temperate, steppe-forested environment which contained more diverse repertoire of game not connected with annual migration like wild boar, chamois, Capra ibex did not promote long distance communications. Even sea shells and other marine objects were not found in Layer Q though the sea must have been much closer compared to the distances mentioned above: from Danube to White Carpatians or Temnata - Rhodopes in Bulgaria. Undoubtedly, this is also due to the presence of rich and high quality outcrops of flints and jasper in the near vicinity of the cave.

On this background the long distance supply of high quality flints in Temnata cave seems to be quite unreasonable. It cannot be justified by the fact that these materials are of high quality. There are enough high quality, less distant flint outcrops which, according to the archaeological record, were increasingly exploited by the Gravettian people. Also, it should be stressed the fact that the share of the mesolocal flints shows a steady increase while the extralocal ones increased too but it is connected with considerable fluctuations. This unstable, long distance supply from sources like Orphei (Ivanova 1987, 1994) in the Rhodope mountains to the South which lies over 300 km away cannot be explained by simply including them into the migratory hunting lifestyle of the Gravettian people. The difficult even now tracks through high mountains or along the Balkan range cannot constitute a migratory route for large game.

This phenomenon may be called a "communication corridor". All we know is that there existed human contacts over long distances and these contacts cannot be explained in terms of a rational behavior of maximum benefit. At least such assessment cannot be done from our point of view. For the presence of high quality flints from the Rhodopes in some of the Gravettian levels in Temnata cave may seem to be reasonable according to our expectations. But how can we explain in terms of maximum benefit the presence of low quality, unique in its characteristics type of flint whose origin has been proved to be in the Senonian limestones of the Iskar gorge (Pawlikowski 1992: 252) into Gravettian materials of the Orphei site in the Middle Rhodopes (Ivanova personal communication)?

A straightforward answer cannot be given now. It certainly does not include only behavior that refers to particular human relations like family or tribal connections. It may include broader cultural forms - style of tool manufacturing and expressive artistic behaviour.

5. Communication, environment and particularities of evolution of the Willendorf II, Temnata and La Cala Gravettian sequences

There is a marked dependence of the typological diversity and evolution of the three Gravettian sequences on communication networks. For example, La Cala where long distance connections are not registered shows the least typological diversification. According to Arturo P. di Cesnola (1971) this Gravettian sequence still remains within the characteristics of the evolved Gravettian of Noailles burins known from Central and Northern Italy (Mochi Shelter, middle and upper parts of layer D; Laterina; Palidoro, levels 8-6). On the other hand, this industry gives enough evidence to suggest the existence of a "Southern " Gravettian facies. It is important to note that in layers ß I-II and Q the evolution of the Gravettian does not show considerable changes. There is a lack of introduction of new types of tools. Its internal dynamic is marked by the decrease in the upper part of the sequence of the proportion of burins and increase of non-specific forms as retouched blades, scrapers and denticulated tools. This in turn justifies the notion proposed by Arturo P. di Cesnola (1971) of gradual impoverishment of this Gravettian sequence during its evolution.

The two other sequences Temnata cave and Willendorf II show quite different way of evolution. For example, almost at every cultural level in the Temnata cave new types of tools occur. Its typological structure displays a clear pattern of seriation and fits the Petrie's form (Tsonev 1997). These diagnostic, sensitive to chronological change tool types were gradually being introduced. At level IXb, there is only one typical Gravettian tool - a backed blade. In the next level IXa microretouched and backed bladelets appear. At the next VIII level microgravettes occur for the first time. In level VIIa for the first time a single backed bladelet occurs. This tool type reaches its maximum representation in level VI and then decreases. A relatively numerous series (6 ex.) of micropoints with double blunted backs appears in levels VI-VII. The seriation ends with a trapeze which occurs in levels IV-V.

The typology of Willendorf II Gravettian sequence shows greater diversity. It starts with the typical Gravettian layer 5 featured by relatively numerous series of microgravettes, micropoints, retouched bladelets and a trapeze. Contrary to this, the next lying above layers 6 and 7, which are quite similar to one another display greatest dissimilarity to layer 5 according to their typological structures (Tsonev 1998). Instead of backed forms made on bladelets, there is a good proportion of heavily retouched and pointed blades that remind the Aurigniacian style of retouch (Tsonev 1996). The typology and lithic style of layers 8 and 9 of Willendorf II determine the former and situate the latter within the horizon of shouldered points in Central and Eastern Europe (Kozlowski 1996). Layer 8 may be ascribed to the Gravettian with some Jerzmanowician elements (Pavlov, Předmostí, Kostienki 8-I) (Svoboda 1996). Shouldered points of the Kostienki type are widely spread throughout Central and Eastern Europe (Willendorf II, layer 9, Petřkovice, Předmostí, Milovice, the sites in Western Slovakia, Kostienki I-1). These types along with pointed blades are unknown for the Gravettian in the Eastern Balkans.

From a comparison of the typological structures and lithic styles of the three sequences two conclusions can be drawn. The first one is that the oldest Gravettian layers despite the geographical distances between them tend to display similar typological and stylistic features.The second one is that with the process of their evolution the Gravettian traditions differentiate. The Middle Danube Gravettian evolves into the so-called shouldered points horizon. The East Balkan Gravettian shows much more uniform evolution. The later Gravettian levels do not differ from the lower ones. Their final evolution is marked by gradual introduction of particularly formed tanged points (pointes a face plan) and small double backed points of a Sauveterre type. The La Cala sequence does not show evolution in terms of introduction of new types and preserves its particularities throughout the entire depth of layer Q.

6. Communication corridors and lithic typology and style

Unless our present expectations, the existence of long distance contacts between different communities does not mean that they would automatically exhibit identical typological structures and style of tool and art manufacturing. Undoubtedly, there is considerable similarity in typology, structure and style of lithic assemblages of the Gravettian sequences presented. This similarity, however, is better presented at their lower parts where an obvious "microlithisation" marks the beginning of the Gravettian complex.

But the communication or information flow between these communities had twofold influence on the evolution of the Gravettian sequences considered. The first one is that it promoted the spread of similar artefacts over long distances, i.e., the horizon of shouldered points in Central and Eastern Europe. This area coincides to some extent with the region of maximum distribution of the famous female figurines - Venuses. The open environment that varied from tundra to continental steppe as well as the annual migration of large game and the quality of the raw materials promoted the tendency of development of closer relationship of the Gravettian communities. These contacts stimulated the innovation capacity and social identity of these communities. It is not merely the chance that forwarded the appearance of textile, ceramics and large settlement structures in Moravia and the Middle Danube region. The intense information flow is manifested also by the spread of the Venuses.

Obviously the manifestation of the information flow and innovation capacity of the Gravettian communities is much less in the Eastern Balkans and Southern Italy. While in the steppe forest environment in the Eastern Balkans the evolution of the Gravettian people is marked by a greater typological diversity and introduction of new types of tools the evolution of La Cala sequence remains strictly uniform and even impoverished. The development of the Gravettian communities in such a less intensive information environment explains the second feature of the impact of the long distance communication corridors on the evolution of the Gravettian culture. While in Central and Eastern Europe shouldered points of the Kostienki type are widely spread this is not the case with the East Balkan Gravettian. The presence of flint varieties from the Rhodopes and Northern Greece in Temnata Gravettian implies contacts of both populations. But this is not manifested in the flint assemblages. The shouldered points from Orphei (Ivanova 1987, 1994) and the Kastritsa cave (Drobniewicz *et al.* 1992: 413) do not occur in the Gravettian levels of Temnata and Bacho Kiro caves. This fact along with the lithic style and some technical traits give enough evidence to suggest differentiation of the Balkan Gravettian into Southern and Northern facies.

The general conclusion that can be drawn from the above presented materials is that the information flow undoubtedly played the major role in the evolution of the Gravettian. Its intensity stimulated the innovation capacity and social identification of these early communities.

7. Acknowledgments

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EAST AND SOUTH OF THE ALPS: THE MUP FUNERARY AND ARTISTIC RECORD OF ITALY AND MORAVIA COMPARED

M. Mussi

Abstract

Two major concentration of MUP burials and items of art have been discovered in Central and Western Europe, respectively in Moravia and in Italy. Intriguing similarities occur, both in funerary practices and in artistic production. Multiple burials, with grave goods including personal ornaments, are known in the both areas, while some of the "venus" figurines of Italy and Moravia display a complex set of attributes very similar to each other. Other aspects, however, are different: the Italian burials are often more rich than the Moravian ones, while in the artistic record there is no evidence of clay figurines and related rituals which characterise the Moravian sites. A distinct range of animal species was exploited in the two regions, and also the chronology is to a certain extent different: the Gravettian is found earlier in Moravia, but lasts longer in Italy. The peninsula was closely linked to southern France, and there was apparently no direct contact between Moravia and eastern Italy through the Danube valley and Croatia. However, a limited influx into Italy, via France, of human groups displaying cultural traits also found in Central Europe, can be hypothesised after 27-26 ky BP.

KEYWORDS: Palaeolithic burials, Venus figurines, Italian Upper Palaeolithic, Gravettian

1. Introduction (Figure 1)

Italy, a Mediterranean country stretching between 37° and 47° lat. North, and Moravia, a central European region extending from 49° to 50° lat. North, are hardly comparable from a geographical viewpoint – even more so taking into account a landscape of rocky mountains, coastal cliffs and short, often torrential rivers over most of Italy, and the ample valleys and gentle hills of Moravia. The two countries, however, both yielded a record or Gravettian burials and Gravettian venuses, which is by far the largest of Western and Central Europe respectively [1]. I will discuss below the chronology, animal resources, art and funerary rituals, with a strong emphasis on Italy, as a first step to better understand the similarities underpinning the Mid Upper Palaeolithic record[2].

2. The Italian record

2.1. Chronology

Not including the directly dated burials, radiocarbon dates are available from less than 10 sites, mostly from the caves (Table 1)[3]. Some of them only yielded scanty remains, while others are complex multi-layered sites. The dates spread rather smoothly between 20 and 26 ka BP (uncalibrated) (Figure 2).

Footnote 1. For the sake of simplicity, I consider here the Rhine/Adriatic divide as the boundary between Western and Central Europe.

Footnote 2. The Mid Upper Palaeolithic, or MUP, as defined in Roebroeks *et al.* (2000) is dated between 30 and 20 ky BP.

Footnote 3. The C14 dates provided Bisson *et al.* (1996) for the long lost sequence of Barma Grande are not included for reasons discussed by Bolduc *et al.* (1996) and by Mussi (2001b); see also Formicola *et al.* (in press).

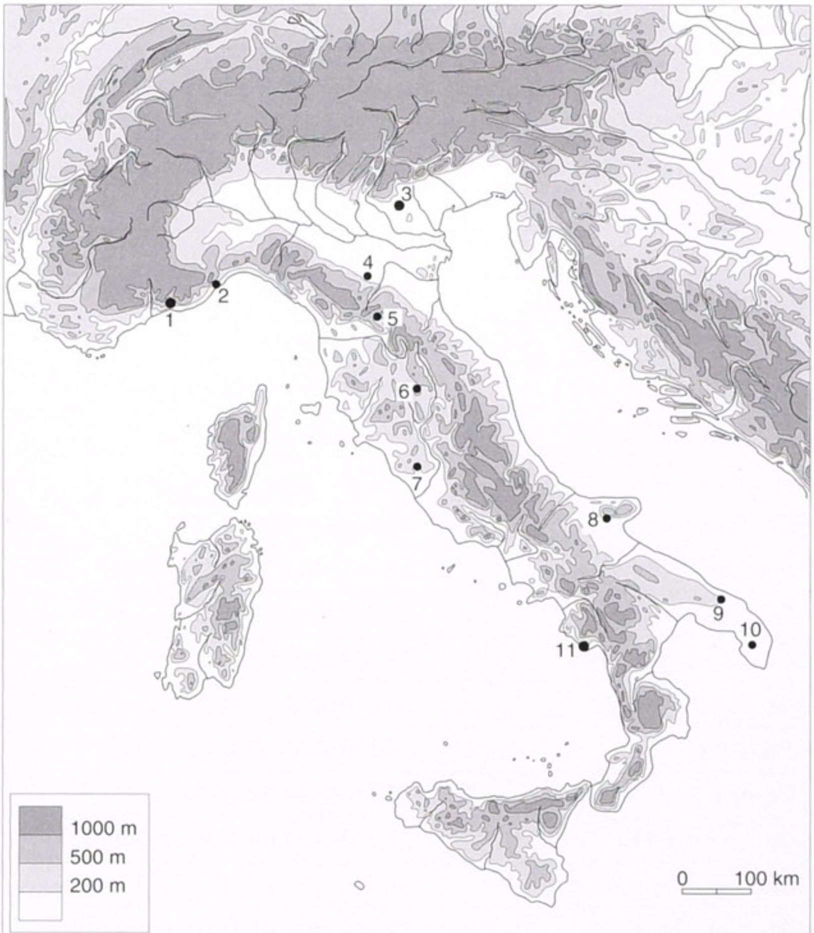

Figure 1. Location of MUP sites mentioned in the text: 1: Grimaldi or Balzi Rossi sites (Gr. dei Fanciulli, Gr. del Caviglione, Barma Grande, Baousso da Torre, Gr. del Principe); 2: Gr. delle Arene Candide; 3: Gr. del Broion, Gr. di Paina; 4: Savignano; 5: Bilancino; 6: Trasimeno; 7: La Marmotta; 8: Gr. Paglicci; 9: Gr. di S. Maria di Agnano; 10: Gr. delle Veneri; 11: Gr. La Cala, Gr. La Calanca Cala delle Ossa.

Earlier dates are more problematic: they are known from two sites, Gr. la Cala and Gr. Paglicci, but at both they occur in reversed stratigraphic order (Table 1). At Gr. La Cala, furthermore, the dates which have central values of 27-28 ky BP were produced in the early days of C14 dating, and display excessively large standard deviations. In the last few years, dates of 26-27 ky BP were published for the lowermost Gravettian levels of this site (Boscato *et al.* 1997). Accordingly, I rather dismiss the dates 27,530 ± 2360 BP (F-22), 28,230 ± 2460 BP (F-23) and 27,400 ± 1720 BP (F-24) of Gr. La Cala.

The lack of any reliable date earlier than 27 ky BP also casts doubts on determinations in excess of 28 ky BP produced respectively for lev. 22F4 and for lev. 23A of Gr. Paglicci (Palma di Cesnola 1993). In the lowermost part of the same stratigraphic sequence (lev. 23B), a date of 26,300 ± 400 BP is in much better agreement with the other Italian dates.

The next firmly dated sites and levels lie in the range of 25.5 to 25 ky BP, as it can be seen in Table 1. The evidence from directly dated burials is in agreement with the overall Gravettian record. As discussed in more detail below, the Italian burials all date between approximately 25 and 23.5 ky BP (Table 5, Figure 3).

Gr. Azzurra lev. 7 (Gr. di Paina)	20,200±240 BP (UtC-2697)
Gr. Paglicci lev. 18b2	20,200±305 BP (F-44)
Gr. Paglicci lev. 18b3	20,160±310 BP (F-45)
Gr. Arene Candide lev. P9	20,470±320 BP (R-2541)
Gr. Paglicci lev. 19a	20,730±290 BP (F-46)
Gr. Paglicci lev. 20b	21,260±340 BP (F-47)
Gr. Paglicci lev. 20ca	22,220±360 BP (F-48)
Gr. Paglicci lev. 20cb	22,110±330 BP (F-49)
Gr. Paglicci lev. 20de	22,630±390 BP (F-50)
Gr. Paglicci lev. 21a	23,040±380 BP (F-51)
Gr. Arene Candide lev. P12	23,450±220 BP (Beta-53983)
Gr. Paglicci lev. 21b	23,470±370 BP (F-52)
Fosso di Pagliano	23,500±400 BP (ROM-144)
Gr. Paglicci lev. 21c	23,750±390 BP (F-54)
Gr. di Cala delle Ossa	23,780±350 BP (Rome)
Gr. Paglicci lev. 21c	24,210±410 BP (F-53)
Bilancino	24,220±100 BP (Beta-93272)
Gr. di S. Maria di Agnano	24,410±320 BP (Gif-92471)
Gr. del Broion lev. D	24,700±400 BP (UtC-2694)
Gr. Paglicci lev. 21d	24,720±420 BP (F- 55)
Gr. Paglicci lev. 22b	24,800±300 BP (Utrecht)
Bilancino	24,990±110 BP (Beta-93271)
Gr. del Broion lev. E	25,250±280 BP (UtC-2693)
Bilancino	25,410±158 BP (Beta-106549)
Gr. Arene Candide lev. P13	25,620±200 BP (Beta-53982)
Gr. Arene Candide lev. P13	25,620±220 BP (Beta-56692)
Gr. La Cala lev. QII	*27,530±2360 BP (F-22)*
Gr. La Cala lev. QIV	*28,230±2460 BP (F-23)*
Gr. La Cala lev. QV	*27,400±1720 BP (F-24)*
Gr. La Cala lev. GB1	26,380±260 BP
Gr. La Cala lev. GB3	26,880±320 BP
Gr. Paglicci lev. 22F4	*28,300±400 BP (Utrecht)*
Gr. Paglicci lev. 23A	*28,100±400 BP (Utrecht)*
Gr. Paglicci lev. 23B	26,300±400 BP (Utrecht)

Table 1. The uncalibrated dates at Italian MUP sites, arranged by increasing central value, and following the stratigraphic order, if any. Directly dated burials are not included (see Table 5). Laboratory number provided when available. Rejected dates are in italics (see text). For references: Mussi 2000; Mussi 2001a.

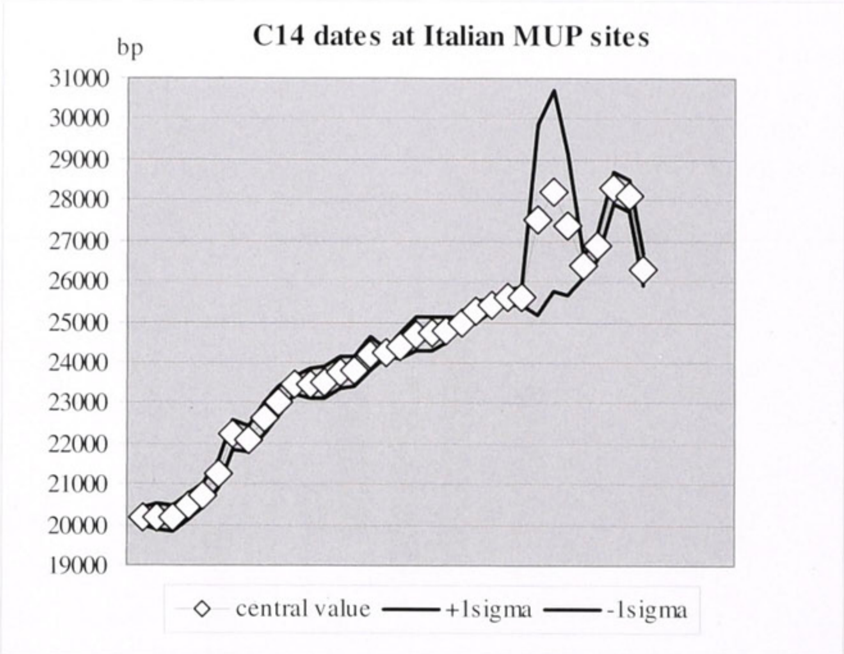

Figure 2. The distribution of C14 dates at Italian MUP sites, based on Table 1.

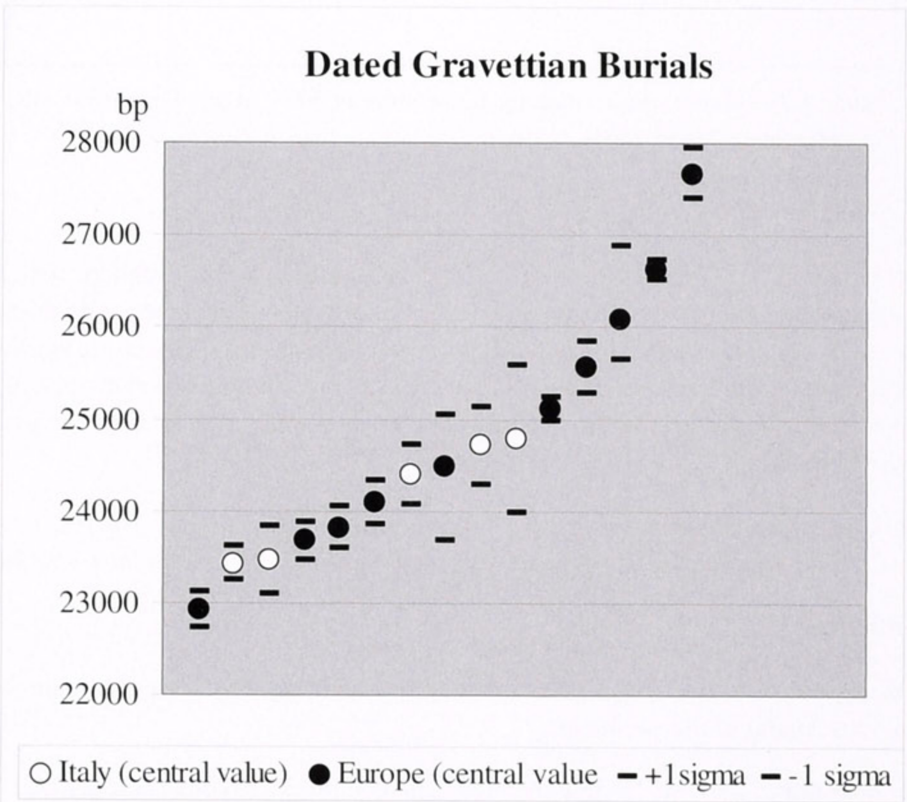

Figure 3. The dated Gravettian burials, based on Table 5. White circles: Italian burials; black circles: other European burials. Whenever more than one date is available, the central value is the mean of central values; the standard deviation is the maximum one, obtained summing/subtracting 1s to the maximum/minimum age respectively.

Summing up, there is no firm evidence of a Gravettian peopling of Italy before 27 ky BP. The earliest acceptable date is 26,880 ± 320 BP, from Gr. La Cala lev. GB3. The data presented by Boscato *et al.* (1997), however, do not allow to decide wheather this is a date *post quem* for the Gravettian sequence of La Cala, or if it is the actual age of the earliest MUP evidence at this site. After 25.5 ky BP, however, there is little doubt that the peninsula was successfully colonised by MUP human groups, as amply evidenced by the archaeological record.

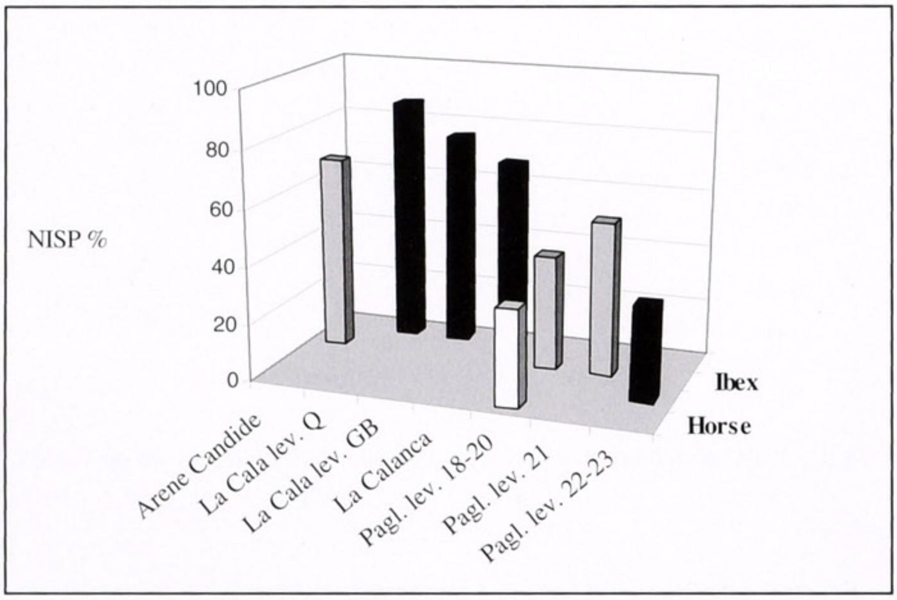

Figure 4. Herbivore species making 1/3 or more of NISP at any Gravettian site. For references: Mussi 2001a.

2.2. Animal resources

The general environment was characterised by herbivore species in varying numbers, with a north-south gradient following adaptation to more open and arid environments in the south. The documented ones include *Capreolus capreolus*, *Alces alces*, *Megaloceros giganteus*, *Rupicapra rupicapra*, *Equus hydruntinus*, *Sus scrofa*[4]. Only a handful of species, however, are not only found at most of the sites, but are also represented in substantial numbers. Those are *Cervus elaphus*, *Capra ibex*, *Equus caballus*, and *Bos primigenius* (Figure 4).

The carnivores were *Canis lupus*, *Vulpes vulpes*, *Meles meles*, *Martes martes*, *Ursus spelaeus*, *Ursus arctos*, *Crocuta crocuta*, *Felis sylvestris*, *Lynx lynx*, *Panthera (Leo) spelaea*, *Panthera pardus*.

2.3. Burial practices

Burials were discovered in two widely severed areas of the Italian peninsula: western Liguria in the north-west, and southern Apulia in the south-east.

Altogether 16 burials are so far documented, all of them in caves (Table 2). All the Ligurian inhumations were found before the end of the Second World War – Arene Candide 1, the latest, in 1942, the other ones actually before First World War. The Apulian inhumations, vice versa, were all discovered in the last decades of the 20[th] century, allowing for a better and more detailed record.

Footnote 4. *Mammuthus primigenius* has been found so far only at Gr. delle Arene Candide, in lev. P7, dated to 19,400 ±230 BP (R-2533). Accordingly, it post-dates the Gravettian occupation (Cassoli and Tagliacozzo 1994).

As some are double and one is triple, alltogether the remains of 21 individuals are preserved. All of them are adolescents or adults, except for the unborn baby with its mother at S. Maria di Agnano[5] (Table 3). Some are difficult to sex, but there is little doubt that males outnumber females. An extended or semi-flexed position is the rule, or nearly so. The orientation varies, but it was noted that it generally follows the axis of the cave (Mussi 1986a). Burial pits, the use of ochre, and sometimes a partial coverage of stones or stone slabs are well documented.

Burial goods are constantly found. The exception would be Baousso da Torre 3: E. Rivière, who unearthed it in 1873, and who was working rather carefully by the standards of the time, was positive about the fact that there was neither ochre nor any associated implement (Rivière 1887). However, he also underlined the very poor preservation, which makes one suspect that there are taphonomic processes involved[6]. Generally speaking, burial goods are more abundant in Liguria than in Apulia. They include elaborate ornaments, made with perforated canines of deer and marine shells, large flint implements, and bone tools. In some of the Ligurian burials (namely in the Triple Burial - Barma Grande 2,3 and 4 - and with Arene Candide 1), some ivory ornaments were also found, which is just exceptional in Italy (Giacobini and Malerba 1995) (Appendix 1). Most of the pendants are found clustered on the head, suggesting a decorated cap or bonnet, and a few more occur on the chest, and close to the knees.

Notwithstanding some differences between Liguria and Apulia, there is little doubt that, overall, very similar burial customs were followed in the two areas (Mussi 1986a, Mussi *et al.* 1989).

	Single Burials	Double burials	Triple Burials
Liguria			
Gr. dei Fanciulli	1	1	
Gr. Caviglione	1		
Barma Grande	3		1
Gr. B. da Torre	3		
Gr. Arene Candide	1		
Apulia			
Gr. Paglicci	2		
Gr. S.Maria Agnano	1	1	
Gr. delle Veneri		1	
Total	**12**	**3**	**1**

Table 2. Inventory of the Gravettian burials in Italy. Note: At S. Maria di Agnano there is a mother with her unborn child, that is counted as a "double" burial only as a best approximation. For references: Mussi 2000; Mussi 2001a.

2.4. Art

Some positive hands and three red horses were painted in the innermost part of Gr. Paglicci in Apulia. Boscato and Palma di Cesnola (2000) excavated the passage leading to this inner chamber, and found that it had been almost totally filled by deposit with Early Epigravettian industries, dated to c. 20-19 ky

Footnote 5. The formal name of this burial is Ostuni 1.

Footnote 6. This skeleton has since been lost.

Specimen	Sex	Age	Pos.	Orient.	Burial Pit	Ochre	Grave goods
Gr. dei Fanciulli 4	M	adult	E	N-S	x	x	Ornaments
Gr. dei Fanciulli 5	F	old	F	N-S	x	?	Ornaments
Gr. dei Fanciulli 6	F?	13-15	F	N-S	x	x	Ornaments
Gr. del Caviglione	M	adult	SF	S-N	?	x	Ornaments, a bone tool, two blades
Barma Grande 1	M	adult	E	N-S	?	x	Ornaments, three blades
Barma Grande 2	M	33-35	E	E-W	x	x	Ornaments, a blade
Barma Grande 3	F?	12-13	E	E-W	x	x	Ornaments, a blade
Barma Grande 4	F?	14-15	E	E-W	x	x	Ornaments, a blade
Barma Grande 5	M	adult	E	N-S		No	Ornaments
Barma Grande 6	M	adult	F	N-S			Ornaments
Baousso da Torre 1	M	adult	E	NW-SE		x	Ornaments, a blade
Baousso da Torre 2	M	25-30	E	NW-SE		x	Ornaments
Baousso da Torre 3	?	c.15	E	NW-SE		No	
Arene Candide 1	M	14-15	E	S-N	x	x	Ornaments, four bone tool, a blade
Paglicci 2	M	13-14	E	SW-NE		x	Ornaments, a bone tool, flint tools
Paglicci 25	F	18-20	E	N-S	x	x	Ornaments, lithic tools , a *Pecten* shell
Ostuni 1	F	c.20	SF	S-N	x		Ornaments
Ostuni 1bis	?	fetus					
Ostuni 2	?	adult ?	SF	S-N			
Veneri 1	M	<30-35	SF	S-N	x	x	An ochred pebble
Veneri 2	F	<30-35	SF	S-N	x	x	Ornaments

Table 3. Main features of the Italian Gravettian burials, arranged following the geographic distribution of sites from North to South. Age: in years, when known. Position: E, extended; F, highly flexed; SF, semi-flexed. Orientation: from head to feet. Grave goods: see also Appendix 1. Further notes: Baousso da Torre reportedly was extended on the abdomen; the double burial with Veneri 1 and 2 was half destroyed by a Neolithic pit. For references: Mussi 1995; Mussi *et al*. 1989.

BP. Accordingly, it is possible to believe that the paintings were made during the previous, i.e. Gravettian, occupation of the cave.

Most of the artistic evidence, however, is represented by small statuettes commonly called "venuses" (Table 4). They were found all over the peninsula, both in caves and in open air sites, but, unfortunately, none in a firm stratigraphic context[7].

This concerns the recently discovered specimen from La Marmotta in central Italy: it was retrieved during underwater excavations at the base of a Neolithic sequence (Fugazzola 2000-2001[8]). In my opinion, however, technological analysis, stylistic comparisons, and contextual evidence point to an attribution to the Gravettian figurines as listed in Table 4.

	Soft Stone	Ivory, Bone and Antler
Barma Grande (Balzi Rossi)	1	1
Gr. del Principe (Balzi Rossi)	11	2
Savignano	1	
Trasimeno	1	
La Marmotta	1	
Gr. delle Veneri		2
Total	**15**	**5**

Table 4. Inventory of the venus figurines.

Soft stone (steatite, serpentine, chlorite), as well as ivory[9], antler and bone were used. Not surprisingly, figurines in organic material were only preserved in the caves[10]. The statuettes from Savignano, Trasimeno and La Marmotta, discovered in the open air sites, are made in serpentine and steatite. The figurines vary in size from 221mm in length, and 585gr in weight (Savignano and Mussi 1996), to 27,5 mm in length, and 1,9gr in weight (the "Bicephalous" from the Balzi Rossi and Mussi *et al.* 2000).

Stylistically, they are also quite different from each other, even if at Gr. delle Veneri and at the Balzi Rossi, where more than one item has been discovered, some are similar enough and can be grouped together. The figurine of La Marmotta is also strikingly similar to the "Yellow Venus" of the Balzi Rossi.

The general characteristics have been discussed elsewhere, and these link the Italian figurines to Western and Central Europe, as well as to Eastern Europe and even to Siberia (Mussi *et al.* 2000).

3. Italy and Moravia compared

3.1. Chronology

A different chronological development can be seen in Figure 5. Before 27 ky BP, while the Early Pavlovian develops in Moravia, Italy is just devoid of any dated sites. Between 27 and 25 ky BP, the both regions

Footnote 7. Most of them, i.e. 15 specimen from two of the Balzi Rossi caves, were discovered in the late 19th century by a French amateur of the time, Louis Alexandre Jullien (Mussi *et al.* 1996).

Footnote 8. Fugazzola (2000-2001), who discusses the hypothetical cultural context, concludes that, in her opinion, it is rather Neolithic than Palaeolithic.

Footnote 9. As mentioned above, carved ivory is exceedingly rare in the Italian Palaeolithic.

Footnote 10. Loess deposition is scarce or non-existent in Italy during OIS 2, and at Gravettian and Epigravettian open-air sites organic preservation is extremely poor.

are represented in the graph, while between 25 and 20 ky BP the evidence is much stronger in Italy than in Moravia.

The same pattern can be seen in the appearence of dated burials (Table 5 and Figure 3): the Italian record is definitely later than the Moravian one.

3.2. Animal resources

The animal remains identified at the Moravian mega-sites of Dolní Věstonice I and II, and Pavlov, include mostly bones of mammoth, reindeer, horse, wolf, hare and fox (Nývltová-Fišáková 2000). Deer, woolly rhinoceros, bear, lion, wolverine, and wildcat are much rarer. Taphonomic processes, and possibly seasonality, might be different in the open-sites of Moravia, compared to the cave sites of Italy. However, there is little doubt that the Italian assemblages which are dominated by red deer, ibex, horse and aurochs,

Burial	**C14 Date** (direct dating in bold)	**Reference**
Sungir 1	**22,930 ± 200** (Oxa-9036)	Pettitt and Bader 2000
Arene Candide 1	**23,440 ± 190** (OxA-10700)	Pettitt *et al.* 2003
Paglicci 25	23,470 ±370	Mezzena and Palma di Cesnola 1989-1990
Brno 2	**23,680 ± 200** (OxA-8293)	Pettitt and Trinkaus 2000
Sungir 2	**23,830 ± 220** (Oxa-9037)	Pettitt and Bader 2000
Sungir 3	**24,100 ± 240** (Oxa-9038)	Pettitt and Bader 2000
Ostuni 1	**24,410 ± 320** (Gif-9247)	Vacca and Coppola 1995
Lagar Velho	23,920 ± 220 (OxA-8422) 24,520 ± 240 (OxA-8423) 24,660 ± 260 (OxA-8421) 24,860 ± 200 (GrA-13310)	Pettitt *et al.* 2002
Paglicci 2	24,720 ± 420 (F-55)	Mezzena and Palma di Cesnola 1972
Barma Grande 6	**24,800 ± 800** (Oxa-10093)	Formicola *et al.* in press
Cussac locus 1	**25,120 ±120** (Beta-156643)	Aujoulat *et al.* 2002
DV 16	25,570 ± 280 (GrN-15276)	Svoboda 1994
Paviland 1	**25,840 ± 280** (OxA-8025) **26,350 ± 550** (OxaA-1815)	Aldhouse-Green and Pettitt 1998
Předmostí	26,320 ± 240 26,870 ± 250	Svoboda 1994
DV Triple (DV 13, 14 and 15)	26,640 ± 110 (GrN-14831)	Svoboda 1994
Cro-Magnon	27,680 ± 270 (Beta-157439)	Henry-Gambier 2002

Table 5. The dated Gravettian burials. Laboratory number provided whenever available.

are hardly comparable to the Moravian ones. A distinctly colder cachet characterizes the latter fauna - even more so considering that, by and large, the Gravettian peopling of Italy is later and, if anything, closer to the LGM.

3.3. Burial practices

The remains of tenths of individuals have been found at Moravian sites, but only a fraction are partial or whole skeletons displaying some degree of anatomical connection (Jelinek 1991). Much uncertainty derives from the single major discovery, i.e. the notoriously lost "mass grave" of Předmostí [11]. It has been suggested that a number of natural and/or cultural processes were responsible for bone scattering, and that, at Dolní Věstonice at least, proper burials may well have originally occurred in higher numbers (Trinkaus *et al.* 2000). Suitable comparisons with the Italian inhumations can be established only with 8 specimens, i.e. those from Dolní Věstonice (DV 3, the Triple burial DV 13-15, DV 16); with Brno 2; and possibly with two rather disturbed burials: DV 4 and Pavlov 1.

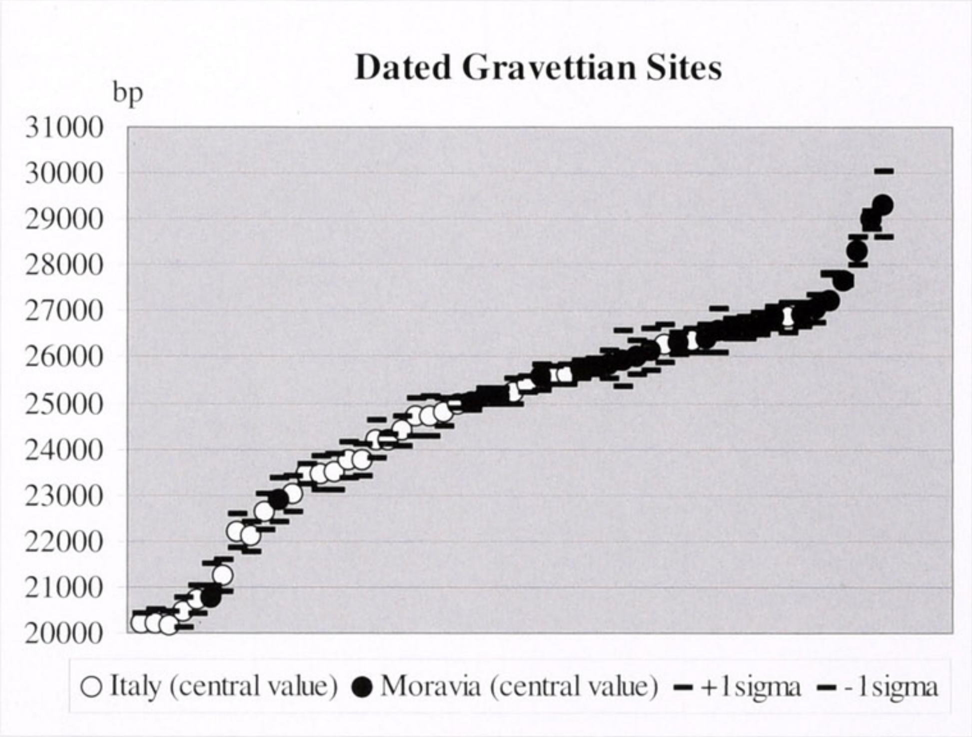

Figure 5. Radiocarbon dates for the Gravettian of Italy and Moravia, based on Table 1 (Italy) and on Svoboda 1994 and Verpoorte 2001 (Moravia). Not included: dates with a standard deviation in excess of 1000 years, and dates rejected after discussion (see text).

Ten unperforated polar fox canines were in the right had of DV 3 (Jelinek 1991), and DV 16 was accompanied by four perforated teeth (Svoboda 1987). In the Triple burial DV 13-15, a small number of perforated fox and wolf canines, and a few ivory beads, were found on the upper part of the skulls (Klíma 1987). No extant burial goods were discovered with Pavlov 1, while the child burial DV 4 had 42 perforated fox canines around the skull (Jelinek 1991). The Brno 2 burial was considerably more rich, even more so taking into account that it was discovered in the late 19th century and that all the associated objects were not properly collected and curated (Oliva 2000): there were at least 600 fossil *Dentalium* shells; two large rings of marl slate; a minimum of 13 roundels of bone, ivory, stone, haematite, ground mammoth molar; and a big ivory figurine, definitely a male one.

Footnote 11. Doubts on the very existence of such a well-defined structure have been cast after a re-edition of the original notes taken by K. J. Maška in 1894 (Oliva 2000-2001).

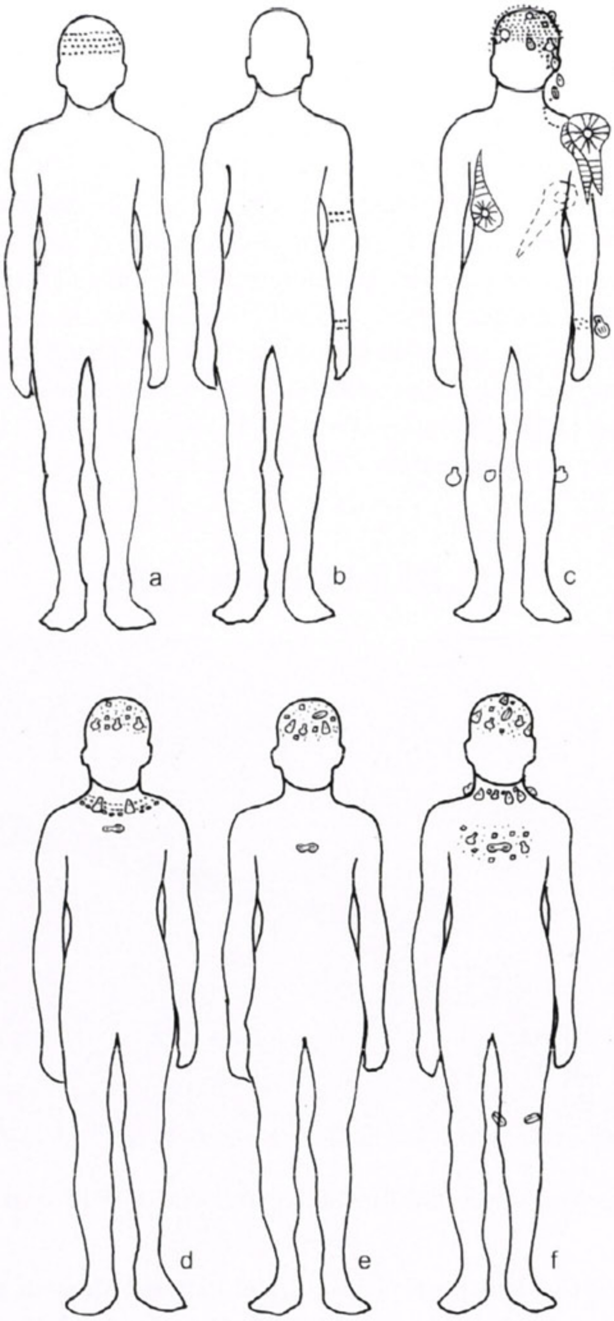

Figure 6. A scheme of ornaments and bone tools found in selected Gravettian burials (see Appendix 1). Lithic tools are not included. a): Gr. dei Fanciulli 6 (*Gr. des Enfants* 6); b): Gr. dei Fanciulli 5 (*Gr. des Enfants* 5): c) Arene Candide 1; d) Barma Grande 4; e) Barma Grande 3; f) Barma Grande 2.

In Italy as in Moravia, ornaments tend to cluster around the head, but the burial goods are usually more numerous and elaborate in Italy. This is exemplified, for instance, by the Triple burial of Barma Grande (Figure 6, Appendix 1). The richest burial is, by far, Arene Candide 1, while the simplest ones (not including Baousso da Torre 3, as discussed above) are from Gr. dei Fanciulli (Gr. des Enfants in the French literature).

As mentioned, the Italian burials are all in caves, while the Moravian ones are in the open air. Another difference is in the position of corpses: in Moravia they were apparently deposited either rather tightly flexed, or extended, while in Italy an extended or slightly flexed deposition is nearly constant. The exception is the double burial of Gr. dei Fanciulli (Gr. des Enfants in the French literature)[12] (Table 3).

3.4. Art

After Verpoorte (2001), there are 29 anthropomorphs in the Moravian record[13], and I add the specimen from Předmostí illustrated in Figure 9. This compares well with the 20 Italian figurines, even if the raw material is quite different: mostly ceramics, some ivory items, only two stone statuettes in Moravia (where an engraving is also recorded); mostly stone, some ivory and bone specimens, and no ceramics in Italy (Table 4). The preservation is also quite different: most specimens are fragmented in Moravia, while complete or nearly-complete ones are frequent in Italy. I will focus below on aspects of figurine rendering which allow direct comparisons between the two areas. Accordingly, I will discuss: 1) a single trait; 2) a whole shape; 3) a specific iconographic example.

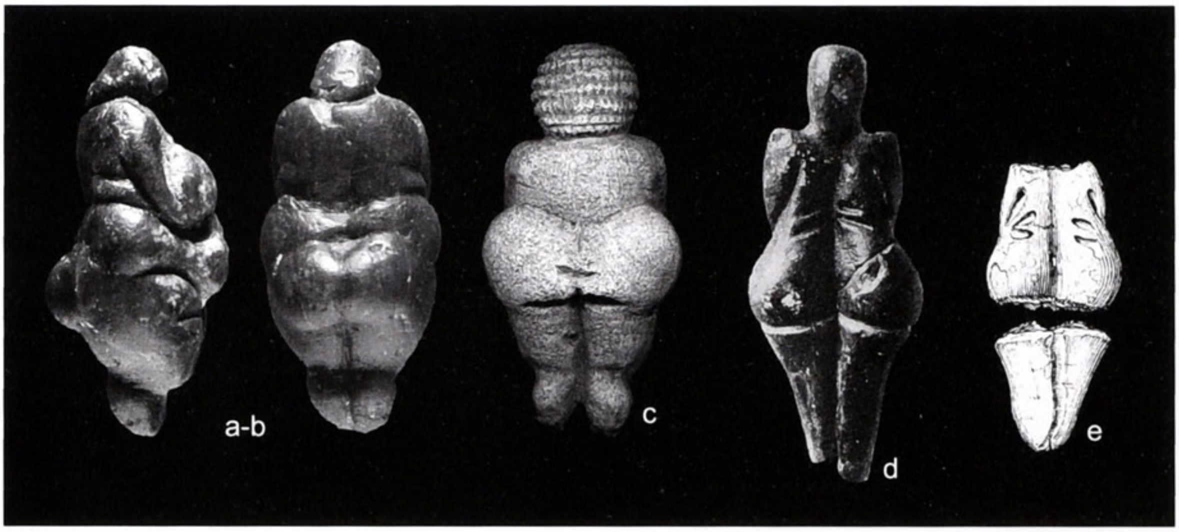

Figure 7. Figurines with two folds on each side of the spine, at different scales: a-b) La Marmotta, Italy; c) Willendorf 1, Austria; d) Venus I (the Black Venus), Dolní Věstonice, Czech Republic; e) Venus VI, Dolní Věstonice, Czech Republic.

The dorsal area of the figurines is scarcely illustrated in most of the publications. Some ceramic specimens from Dolní Věstonice are an exception, because it has long been recognised that they display an unusual, herring-like pattern, produced by two folds incised on each side of the spine (Figure 7). The two bilateral folds can be seen on the back of the Black Venus, as well as on fragments Venus VI and Venus VII. They are also represented on Willendorf 1, even if less dramatically, but were not documented outside central Europe before the recent discovery of the statuette from La Marmotta in Italy, which clearly displays a double fold on each side of the back..

One of the figurines from the Balzi Rossi is a non-human face made by incisions and drilled holes on a small disk-shaped stone support (Mussi *et al.* 2000) (Figure 8a). No similar representation is known from western Europe, while comparisons can be made with decorated items from the central Russian Plain. The only figurine to match it closely, however, was discovered in the Czech Republic, namely

Footnote 12. Interestingly, this is possibly also the earliest Italian burial, after the extant stratigraphic evidence (Mussi 1986b, Mussi 2001a).

Footnote 13. It should be noted that I dismiss the highly fragmented numbers 17, 20 and 23 of Verpoorte's inventory; vice versa, I consider anthropomorphs the followings specimens, rejected by Verpoorte: the fork-shaped Venus XIII of Dolní Věstonice which, after my own examination of the original, has a vulva-like slot between the legs; the rod-cum-breasts Venus XIV of Dolní Věstonice; and the engraved venus of Předmostí. The Venus of Petřkovice, which belongs to the Willendorfian-Kostenkian, is also counted here.

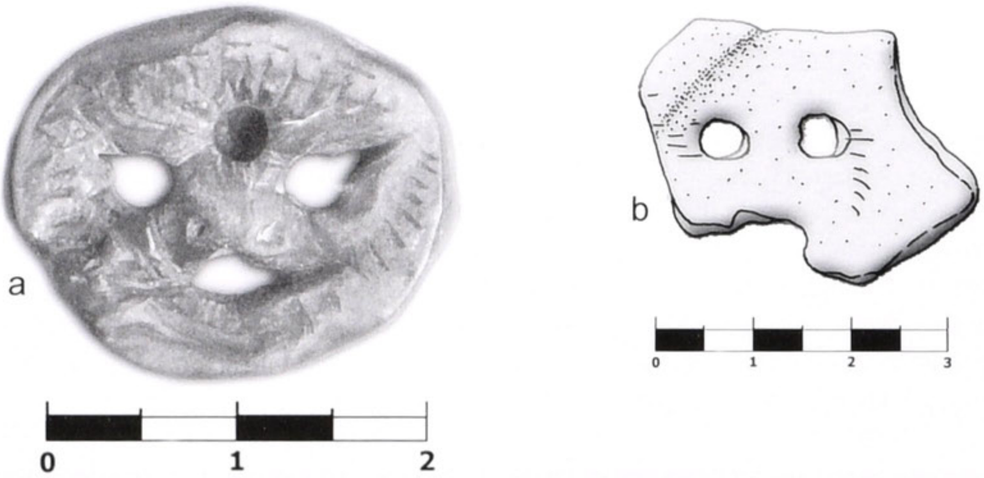

Figure 8. Stone masks: a) Balzi Rossi, Italy (Copyright Pierre Bolduc, Montreal); b) Předmostí, Czech Republic.

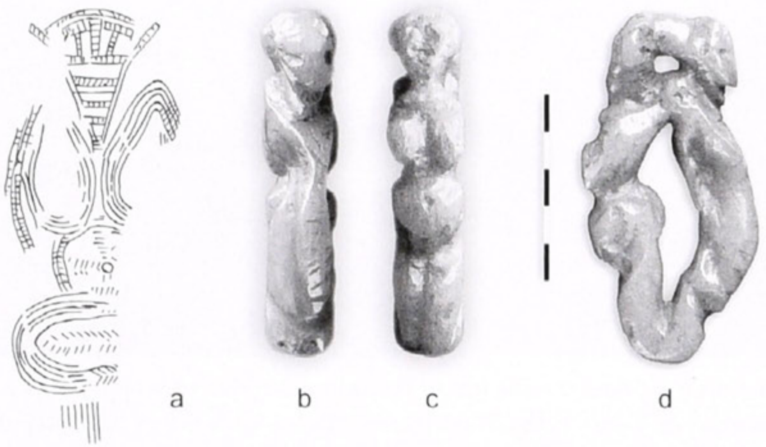

Figure 9. Human/non-human female beings, at different scales: a) the Předmostí Venus; b-c-d) Beauty and the Beast, from the Balzi Rossi, two frontal and one side view (Copyright Pierre Bolduc, Montreal).

at Předmostí[14] (Figure 8b). The Italian and the Moravian specimens are both very similar in shape and size, and were also made using the same drilling technique.

To end with, a very similar iconography is displayed by two most extraordinary art objects, found respectively at Gr. del Principe at the Balzi Rossi, and at Předmostí (Figure 9). In this case the technique and the support are quite different from each other: at the Italian site there is a steatite figurine, carved in the round, which is nicknamed "Beauty and the Best", while the Předmostí Venus is engraved on a mammoth tusk. The Italian representation, furthermore, is a double one: a woman, clearly recognisable as such, is symmetrically opposed to a non-human being, with a triangular face, little horns, little arms, and a serpent-like body. The Moravian engraving, vice versa, is a compound of the same two creatures: the triangular face with little horns on each side is on the top of an odd, but still recognisable, female body, and two little arms are added. At close scrutiny, more details match each other: the face of the "Beauty" has been accurately destroyed by a number of strokes, while the face of the Předmostí Venus is covered by a tight geometric pattern; both heads end, in the upper part, with an arc-shaped element;

Footnote 14. This nearly complete schist mask, of 36 x 25 x 6mm, was discovered by K. J. Maška, and is now kept at the Moravské Muzeum in Brno (inv. 12216).

both figures have large oval breasts, on the top of a perfectly circular belly, with the navel exactly in the middle; and while herring-like patterns and other geometric "decorations" can be seen on the lower part of the Předmostí Venus, the lowermost body of the "Beast" is covered by 19 transverse incisions, deep or superficial, some of which are oblique.

4. Concluding remarks

Examples have been discussed in some details, suggesting that the MUP records of Italy and Moravia display some close similarities, especially the numerous burials and figurines. Differences have also been underlined, both in the natural resources and environment, and in the chronology. Italy was definitely settled later, as far as the MUP is concerned, but then the human peopling was not disrupted, as in Central Europe, by the onset of the LGM (Mussi 2001a, Svoboda *et al.* 1996).

There is no evidence of any direct geographical link. The shortest way from Moravia to Italy would be following the Danube to the south and then through the present Croatia into the peninsula. Long distance movements from Moravia, as evidenced by raw material procurement, were rather directed to the north and east (Svoboda *et al.* 1996); while Italy is linked to southern France by a string or archaeological sites (non-existent on the Adriatic side), and by flint import as well (Mussi 2001a, Negrino and Starnini in press). The very fact that the Arene Candide 1 burial includes several *bâtons perforés* can also be seen in this perspective: the *bâtons perforés* are an exotic item in the Italian record, not discovered outside Liguria. They apparently originated somewhere in western Europe, and starting with the Aurignacian they are documented in southern France (Escalon de Fonton and Bazile 1976). In Central Europe they are much later, and predominantly found after the Epigravettian (Svoboda *et al.* 1996).

Summing up, the Gravettian is relatively late in Italy, and the MUP peopling of the peninsula happens via the "western gate" only, that is through Liguria. This can be understood taking into account the complex scenario of Europe around 30 ky BP, and most notably the persistence of areas with Neanderthal occupations: the evidence from Vindjia in Croatia points to Neanderthals well and alive around 29-28 ky BP (Smith *et al.* 1999), that is while the Early Pavlovian and anatomically modern humans are reported in Moravia. It is not known when the latest Neanderthals became extinct in this region, at the "eastern gate" of Italy. In the southern Iberian peninsula, some kind of avoidance between the two human species was suggested, leading to a delayed Gravettian peopling (D'Errico *et al.* 1998). I assume that, in the case of Italy, the scenario was somehow similar, with MUP groups eventually entering Liguria via France after 27 ky BP, and successfully adapting to a Mediterranean environment. There is little doubt, however, that at least some of these new people was characterised by an ideological background, and by cultural models, with a distinctive Moravian blend.

5. Acknowledgements

I wish to thank Jiří Svoboda and all the organisers of the congress "The Gravettian along the Danube" for inviting me to Mikulov. I am grateful to Pierre Bolduc (Montreal) for allowing me to publish pictures of his collection, and to Jacques Cinq-Mars for the graphic treatment of the images. Martin Oliva, of the Moravské Museum, allowed me in 1995 to study the collections from Předmostí and Dolní Věstonice in his care, and helped in countless ways. Lucio Narisi, and Filiberto Scarpelli, both at the Laboratorio di Paletnologia del Dipartimento di Scienze dell'Antichità, Università di Roma "La Sapienza ", elaborated respectively Figure1 and Figures 6-9.

6. Appendix 1. Burial goods from selected Italian MUP burials[15]

Gr. dei Fanciulli 5 (or *Gr. des Enfants* 5)

- 2 strings of perforated *Cyclope neritea* above the left elbow;
- 2 strings of perforated *Cyclope neritea* around the left wrist;
- 2 small serpentine pebbles close to the forehead.

Gr. dei Fanciulli 6 (or *Gr. des Enfants* 6)

- 4 strings of perforated *Cyclope neritea* around the head.

Barma Grande 2

- perforated and engraved canines of red deer, salmonid vertebras, some perforated *Cyclope neritea*, on the head, and some ivory pendants on the forehead;
- 14 incised and engraved canines of red deer, some salmonid vertebras and small ivory pendants around the neck;
- salmonid vertebras, small ivory pendants and a 8-shaped ivory pendant on the chest;
- a large retouched flint blade (229 x 48 x 11 mm) in the left hand;
- a large perforated *Natica hebraea* on each side of the left knee.

Barma Grande 3

- perforated red deer canines, salmonid vertebras, perforated *Cyclope neritea*, a perforated *Purpura* sp. shell, a small ivory pendant, on the head;
- a 8-shaped ivory pendant on the chest;
- a large flint blade (261 x 48 x 17mm) in the left hand.

Barma Grande 4

- salmonid vertebras and perforated *Cyclope neritea* covering the head, with some small ivory pendants on the forehead;
- a complex necklace, still in place in the clayey sediment, which was made by two strings of salmonid vertebras and one of perforated *Cyclope neritea*, alternating with very large red deer canines;
- a decorated 8-shaped ivory pendant close to the neck,
- a flint blade (168 x 50 x 14 mm), retouched into an endscraper, below the head.

Arene Candide 1

- a cap or bonnet, decorated with packed ornaments, as follows: hundreds of perforated *Cyclope neritea*, some small sea-urchin shells, perforated shells of *Cyprea* sp., perforated red deer canines, a small ivory pendant. On the left, down to the chest, the cap or bonnet was continued by a strip of a kind, similarly decorated with red deer canines and marine shells;
- many *Cyclope neritea* and a large ivory pendant close to the left wrist;
- a dozen of *Cyclope neritea*, in a lump of ochre, close to the left hand;
- two engraved *bâtons à trous*, made of elk antler, on the left side of the chest;
- an engraved *bâton à trous*, made of elk antler, between the right arm and the chest;
- an undecorated *bâtons à trous*, made of elk antler, larger than the previous ones, on the left side, below the skeleton;
- a large flint blade (250 x 40mm) in the right hand ;
- an oval bone flake, and a large ivory pendant, just below the right knee;
- a large ivory pendant close to the left knee.

Footnote 15. Prof. Alberto Malatesta kindly updated the taxonomic determination of marine shells.

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TEXTILES AND UPPER PALEOLITHIC LIVES. A FOCUS ON THE PERISHABLE AND THE INVISIBLE

O. Soffer and J.M. Adovasio

Abstract

Reconstructions of Upper Paleolithic life have always been based on inventories made of durable materials. This perspective is at odds with the ethnographic data which show that most of the implements used by hunter-gatherers are made of plant based materials. Archaeologists have documented the same as true for prehistoric groups, even in arctic environments. Since plant-based technologies are associated with the work of women, our lithocentric focus heavily biases our reconstructions of Paleolithic life, making them unreliable.

Recent discoveries show the existence of textiles, baskets, and nets during the Upper Paleolithic. They also show that late Pleistocene inventories contain tools used to make these items. These plant based inventories suggest that extant subsistence practices included communal net hunting - a harvesting technique that involved participation by entire corresidential units, including the women, the children, and the elderly. Iconographic evidence associates many of the textile technologies with women and strongly suggests that their production skills in these domains were highly valued. In addition, evidence for plant use hint that Upper Paleolithic.

The evidence for textiles not only diversifies our understanding of Upper Paleolithic life, but also challenges us to both employ methods to recover these materials and to utilize analytical methods to recognize and study them. In sum, we argue that since life in the Ice Age was not lived by stone alone, time has come for us to translate this understanding into archaeological research.

KEYWORDS: Ice Age lives, Upper Paleolithic, plant use, textiles, women's work

1. Introduction

The Paleolithic material record has been used extensively to reconstruct life in late Pleistocene Europe. During the first century of Paleolithic research prehistorians focused on implements made of stone augmented by those in antler, ivory, and bone (Grayson 1983, Sackett 2000). The advent of ecological concerns in the middle of the last century resulted in faunal remains receiving archeological attention as well (Trigger 1989). This shift in research interest from the tools to the tool-makers also brought with it ecological concerns and led to multidisciplinary attention to recovering pertinent information about past environments. While palynologists and analysts of macro-botanical remains worked to refine their research methodologies so as to offer more reliable reconstructions of past environments, their archaeological colleagues continued, by and large, to focus on the lithics and to ignore the fact that the plant kingdom was likely far more than just a proscenium for animal life during the Paleolithic.

Such privileging of the durables - most specifically of stone - in Paleolithic archaeology, including in research on the Gravettian, is at odds with the global ethnographic record which documents that it is the more perishable plant based technologies that form the bulk of hunter-gatherer material culture -

even in arctic and sub-arctic environments (e.g., Damas 1984, Helm 1981). The same fact has been confirmed by archaeologists working with remains from sites with ideal preservation (e.g. in permafrost, dry caves, wet sites), who have documented that artifacts made of plant remains - the cordage, the nets, the baskets, cloth, footwear, etc. - outnumber those made of stone by a factor of 20:1 (e.g. Clark 1968, Croes 1997, Taylor 1966).

This glaring discrepancy between the ethnographic reality, the archaeological record from sites with ideal preservation, and Paleolithic material remains we work with, warns us that we are envisioning Paleolithic life in highly biased ways, ones based on considerably less than 10% of what was made and used then. The wealth and diversity of plant-based implements which likely existed in the Upper Paleolithic, and our failure to recover such items, clearly strongly biases our understanding of late Pleistocene lives. This bias stems from the fact that plant based inventories are cross-culturally associated with the work of women and, by extension, with the labor of children and of older individuals (e.g., Mason 1910, Murdock 1937, Murdock and Provost 1973, Watanabe 1968).

In short, by looking only at stone tools we focus on male technologies - especially those used by prime aged males who hunted - and ignore tools and implements used by the rest of the people, those making up the majority during any time period, including the Gravettian (Adovasio *et al.*1998, 1999; Conkey 1991, Kehoe 1991, Owen 1996, Soffer *et al.* 2000a, 2000b, 2001).

In this chapter we reverse the pattern and focus on indirect as well as some direct evidence for plant based technologies in the Upper Paleolithic and consider some implications that they carry for the daily life of the Gravettian groups along the Danube and its tributaries.

2. Paleolithic perishables

Clearly we are not the first to point out the seminal importance that plants and plant-based inventories likely had in the Pleistocene. There were some French prehistorians, such as Cheynier (1967), Lacorre (1960), and Chauvet (cited in Bahn 2001), who postulated that plant-based technologies such as weaving and basket making were likely important in the Upper Paleolithic. Because their data were highly conjectural and because they themselves were considered "amateurs", their findings were either ignored or dismissed outright (Bahn 1985, 2001, both wits references).

2.1. Indirect Evidence

Today our conjectural or indirect evidence that plants were used to make perishable items in the Upper Paleolithic comes from textile impressions, from bone, ivory, and antler tools used to weave, make baskets, and loop nets, and from the iconography of the "Venus" figurines.

Impressed Textiles - Collaborative research with Czech, German, and Russian colleagues on textile impressions have shown that textile and cordage technologies existed in Europe by at least ca. 28,000 BP (Adovasio *et al.* 1998, 1999; Soffer *et al.* 2001 - both with references) (Figure 1). We define textiles as a category of plant-based products that includes two distinct yet related sets of structures: basketry and textiles on the one hand and cordage and cordage byproducts on the other. Since in terms of process and product the two are related, we define them at an equivalent classificatory level (Adovasio *et al.* 2001 with references).

Initially we identified these technologies on impressed fragments of fired clay recovered from the sites of Dolní Věstonice I, II, and Pavlov I in Moravia. These sites are assigned to the Pavlov culture, a local variant of the Gravettian technocomplex, and date to 28,000 - 23,000 BP. Subsequent studies have documented that additional impressions are present at two sites in Russia: Kostenkí I-2, dating to ~21,000 BP, and Zaraisk - from a layer dating to ca. 19,000 BP (Soffer *et al.* 2000c with references). Both are assigned to the poorly understood Willendorf-Pavlov-Kostenki-Avdeevo cultural entity. Einwögerer's (2000) recent studies of archaeological remains from Krems/Wachtberg have shown that impressed fragment of fired clay were also recovered from this Gravettian age site. While some of the published impressions appear to represent finger or palm prints, others may be impressions of textiles - something requiring further study.

Textile technologies were present at other time periods and in other cultural contexts as well. We have identified impressions of cordage in other media - specifically on a worked basal fragment of antler from Gönnersdorf - a Magdalenian site in Germany dating to ca. 15,000 BP - that bears impressions of cordage on its flattened side (Soffer *et al.* 2000c, for a discussion of its likely genesis see Soffer *et al.* 2001).

Figure 1. European sites with textile impressions: (1, 2) Dolní Věstonice I and II, Pavlov I; (3) Kostenki I; (4) Zaraisk; (5) Gönnersdorf; (6) Badegoule; (7) Lascaux.

Finally, it is instructive to recall that it was Abbé Glory (1959) who first documented Upper Paleolithic cordage when he discovered a fragment of rope in one of the adjacent galleries at Lascaux. Although the original rope fragment he found has not survived, our recent examination of both its positive and negative casts confirms the use of a six-ply rope at least 15,000 years ago (Soffer et al. 2000c with references). This fragment was not an isolated phenomenon in France. Cheynier (1967), for example, published, albeit in an anecdotal fashion, a textile impression from the Solutrean level at Badegoule, dating between ca. 21,000 - 18,000 BP (Soffer *et al.* 2000c with references).

Such indirect evidence for these perishable technologies is not unique to Upper Paleolithic Europe but found beyond it as well. For example, ceramic fragments from the first true pottery, dating to ca. 13,500 BP, recovered from the Russian Far East, bear textile impressions (Derevianko 1997, Zhushchikhovskaya 1996). Remains of analogous plant-based technologies also exist in the New World, where perishable fiber artifacts have been recovered from Pleistocene-age sites in both North (Adovasio *et al.* 1998, 1999 with references) and South America (Adovasio 1997 with references). Similar impressions are also well documented from prehistoric sites dating to the Neolithic period. In fact, just such an impression can be seen on a side of a large ceramic vessel recovered from the Neolithic site of Luleč (Illingworth *et al.*2003).

The sum of these data indicate that the near absence of these technologies from our synthetic publications about Upper Paleolithic lifeways and text books on prehistory do not reflect their absence from the archaeological record - just our research biases and past failure to both recover and recognize these items and their significance.

Technological Diversity - The impressions from the Upper Paleolithic sites in Europe show that a wide range of perishable items was made by a wide array of additive methods (Adovasio *et al.* 1998, 1999) (Table 1). This inventory included cordage, knotted netting, plaited wicker-style basketry, as well as a wide variety of non-heddle, and loom-woven textiles. A number of these items show intentional structural decoration as well as conjoining of two pieces of fabric by a whipping stitch to produce a seam (Adovasio *et al.* 1998, 1999).

All of these impressions, which range in age from ca. 28,000 BP to ca.13,000 BP, represent well-made items. The typological heterogeneity coupled with the general regularity and narrow gauge of the warp and weft elements used indicate a high level of standardization and prior development, both for these specimens and the fiber industry at large.

Several impressions of knotted cordage are also present and represent weaver's knots or one of its variants such as a fishnet knot (Adovasio *et al.* 1999 fig. XX). Ethnographically and archaeologically known knotted cordage often represent fragments of netting and we assume that the Moravian and Zaraisk specimens we have identified do likewise.

What they made - We have noted elsewhere that the studied impressions are highly fragmentary and, thus, little more than miniature "negatives" of the original products. Because of this, it is not possible to specify the original form or size of any of the items (Adovasio *et al.* 1998, 1999; Soffer *et al.* 2000 a,b,c). We do know that both woven textiles and plaited baskets are present. It is likely that the plaited items represent baskets or mats. Similarly, the relatively wide range of textile gauges and weaves suggest mats, perhaps wall hangings, blankets, and bags, as well as a wide array of apparel. The narrow gauge of some of these pieces suggests fine woven clothing, while the presence of whipping stitch seams indicate the sewing of more complex pieces such as clothing and bags.

The Plant Medium - Our research has shown that the textiles, basketry, and cordage specimens were clearly made of plant rather than animal fibers. Pollen analyses from the Moravian sites indicate the presence of a number of plant taxa which may have been used, including fibrous bark of both alder (*Alnus* sp.) and yew (*Taxus* sp.), as well as milkweed (*Asclepias* sp.) and nettle (*Urtica* sp). All of these have well-documented ethnographic and prehistoric used as perishable production media (Barber 1991). Nettle, for one, has a long history of use as a weaving fiber in Europe (Barber 1994, Hald 1941). Similar species are reported from the Russian sites as well (Amirkhanov 2000). Thus, although at present we are uncertain what specific fibers were woven because we do not know what specific plants were used because we have no original specimens on hand, many species were available for such use.

The availability of these plants serves as a warning to us that we must stop envisioning Upper Paleolithic Eurasia as a frozen landscape devoid of plant life and to remember that while this period had 40,000 Januaries it also had 40,000 months of July and August when suitable and useful plants were clearly on hand.

Type	Pavlov I	Dolní Věstonice I	Dolní Věstonice II	Gönners-dorf	Kostenkí I	Zaraisk
Textiles: Twining						
Open Simple, Z-Twist Weft	2	-	-	-	-	-
Close Simple, Z-Twist Weft	2	1	-	-	-	-
Open Simple, S-Twist Weft	3	3	-	-	-	-
Close Diagonal, Z-Twist Weft	1	-	-	-	-	-
Open Diagonal, Z-Twist Weft	4	-	-	-	-	-
Close Diagonal, S-Twist Weft	2	-	-	-	-	-
Open Diagonal, S-Twist Weft	3	1	-	-	-	-
Close Simple, S-Twist Weft	-	1	-	-	-	-
Close Simple, Z and S-Twist Wefts	-	1	-	-	-	-
Open and Close Simple, Z and S-Twist Wefts	-	1	-	-	-	-
Close Simple, Unknown-Twist Weft	2	-	-	-	-	-
Open Unknown, Z-Twist Weft	2	-	-	-	-	-
Unknown Simple, S-Twist Weft	1	-	-	-	-	-
Unknown	7	1	1	-	-	-
Textiles: Plain Weave						
1/1 Balance Plain Weawe	-	5	-	-	-	-
Basketry: Plaiting						
2/2 Twill	-	4	-	-	-	-
Unknown	-	6	-	-	-	-
Cordage						
Single, One-Ply, Z Spun	1	-	-	-	-	-
Multiple, Two-Ply, S Spun, Z Twist	2	1	-	-	-	-
Multiple, Two-Ply, S Spun (?), Z Twist	-	1	-	-	-	-
Multiple, Two-Ply, Z Spun, S Twist	4	-	-	-	-	-
Multiple, Two-Ply, Z Spun (?), S Twist	-	3	-	-	-	-
Compound, Two-Ply, Z Spun, S Twist	1	-	-	-	-	-
Braided, Three-Strand	1	1	-	-	-	-
Z Twist	3	-	-	-	1	-
S Twist	8	6	-	1	-	-
Unknown	-	1	-	-	1	-
Miscellaneous: Knotted Netting						
Weaver's Knotted	4	-	-	-	-	1

Table 1.

The Weaving Tools - The second indirect source of evidence for the widespread production of plant based inventories in the Upper Paleolithic comes from the specialized tools used by the makers of these inventories. Although this research is still in progress, it shows that evidence for textile production appears at the same time as do the tools associated with sewing, weaving, and net making (Soffer *et al.* 2001 with references). For example, eyed needles become widespread across Eurasia at the same time that we see evidence for textile production. As we have noted, although the larger needles, such as the one from Předmostí (Klíma 1990: Fig. 28) may have been used to make nets, their much smaller ivory equivalents point to sewing and possibly to embroidery - something previously hypothesized by Cheynier (1967). We have also pointed out that the forms of some of the bone, ivory, and antler artifacts commonly associated with hunting, with the processing of the kill, or identified as "ritual" objects, suggests that the pieces in question were more likely associated with textile production (Soffer *et al.* 2001 with references). Some of these include the "spear head" from Předmostí (Klíma 1990: Fig. 33) and its equivalent from Abri Blanchard (White and Breitborde 1992: Fig. 7), the enigmatic "rondelles" from Sungir' (Bader 1998: Fig. 114) and elsewhere, or the engraved "pendant" from Kniegrotte (Feustel 1974: Fig. XXVII). We have also noted that at least two scholars, Heite (1998) and Lacorre (1960) have relied on ethnographic analogies to suggest that some of the perforated "*batons de commandement"* may have been used to spin cordage (Figure 2).

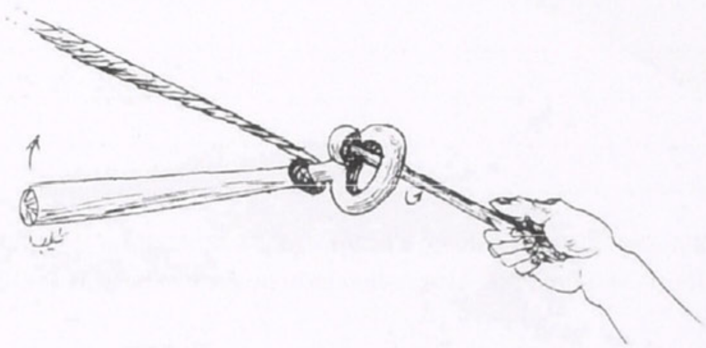

Figure 2 Wood utensil used presently in Portugal to twisting cordage (after Lacorre 1960: Fig. 19).

Furthermore, our studies of the pertinent ethnographic collections, curated at a number of museums, have permitted us to identify the diagnostic use wear patterns which result from the use of wood and bone tools to weave textiles, plait baskets, and loop nets (Figure 3). This evidence permits us to identify a number of net spacers or gauges used to make nets as well as weaving sticks or battens in the inventories of such sites as Dolní Věstonice I, Pavlov I, Předmostí, and Avdeevo (Figures 4, 5). As we have noted elsewhere, similar objects are quite frequent in the organic inventories from other European Upper Paleolithic sites as well (Soffer *et al.* 2001).

In sum, our indirect evidence for plant based perishable technology includes not only the impressions of the pieces made but also the tools used to make them.

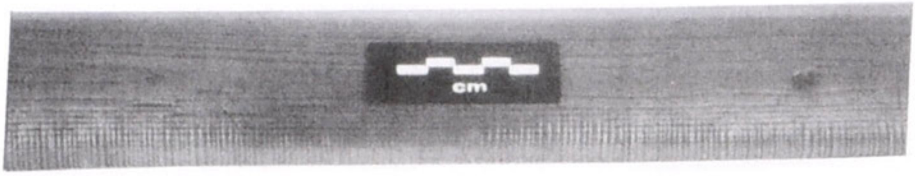

Figure 3. Close up of diagnostic wear on the working edge of a Navaho batten, ethnographic collection at the Illinois State Museum (photo O. Soffer).

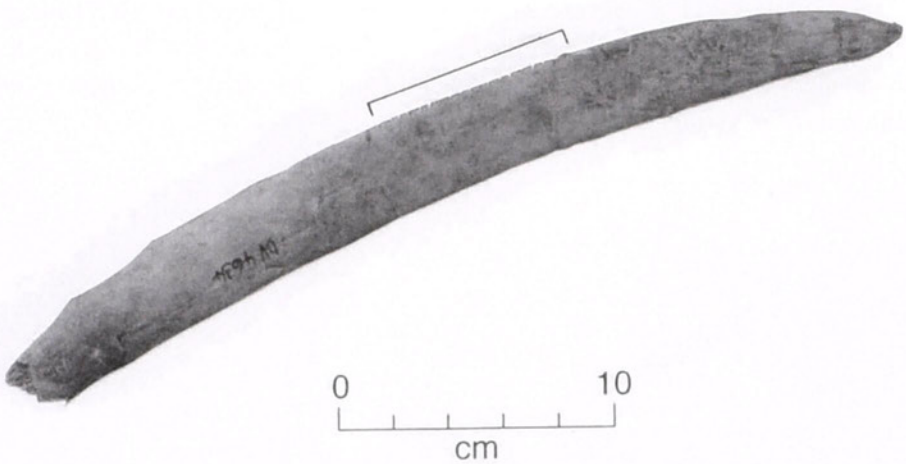

Figure 4. Batten made of mammoth rib, Upper Paleolithic site of Dolní Věstonice I, number DV 4634. Diagnostic wear in the rea between the lines (photo O. Soffer).

The Clothes on the "Venus" - Our third source of indirect information comes from iconography - from the clothes shown on the "Venus" figurines. We have discussed this evidence at length elsewhere and just summarize it here (Soffer *et al.* 2000a, 2000b, 2000c; Soffer *et al.* 2001). Specifically, our studies of the female images dating between some 28 - 21,000 PB - have shown that a number of these figurines are shown wearing woven clothing made of plant fibers. This "Venus wear" includes headwear, belts, and bandeaux, and its detailing is so precise as to show the fine details of the production sequence used to make the clothing (Figure 5)

We have also noted that these "dressed Venuses" have been found across Europe, and that all the clad figurines show that their makers devoted as much attention to the detailing of the clothing as they did to the delineation of the figurines' primary and secondary sexual characteristics. Consequently, we have interpreted these data to imply that: 1) the weaving and basket making skills were socially important enough to be made permanent in ivory and stone, and 2) these depictions highlighted the social importance of these perishable technologies, and 3) that the shown fine details of perishable production suggest that the makers of the figurines were either the same individuals who made the perishable items or that the makers were instructed by those who did.

2.2. Recovering and Recovered Direct Evidence

While we have abundant evidence for pollen and macrofossil botanical remains at Paleolithic sites, our information about how plants and plant products were used is abysmally poor prior to the early Holocene. Although preservation biases clearly do work against our chances to recover these more perishable items, it is also true that the recovery techniques routinely used in Paleolithic excavations almost guarantee not finding them. Specifically, we note that although Paleolithic archaeologists routinely wet or dry screen their sediments, few, if any, routinely use flotation. Since remains of plants and plant products are far more friable than other organics, and since they are often best preserved in a charred state - dry or wet screening, no matter how fine the mesh, is simply too aggressive a procedure which destroys the burned remains. The optimal way to recover them - something practiced routinely by most contract archaeology concerns as well as by specialists working in later time periods - is through flotation. This need not involve complex equipment or machinery or even electricity - a tub of water, a spoon, and an embroidery hoop strung with hosiery will do. Using such simple methods we recovered a charred cordage fragment from a hearth at Mezhirich, dating to some 15,000 years ago (Adovasio *et al.* 1992). Additional charred fragments of cordage were observed at Kosoutsy as well (Adovasio *et al.* 1992).

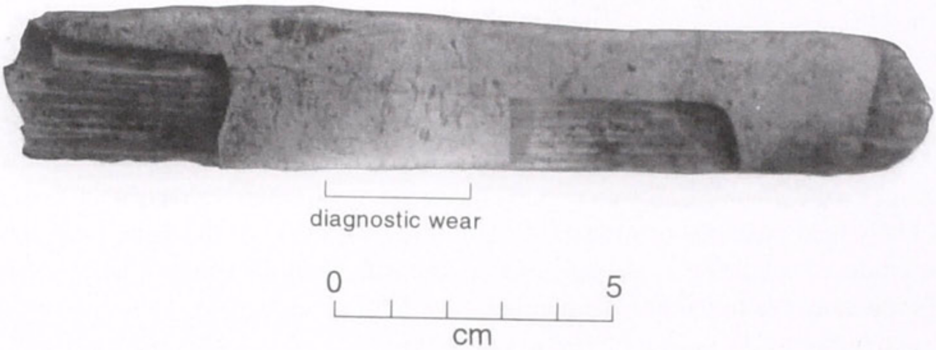

Figure 5. Batten made of mammoth rib, Upper Paleolithic site of Avdeevo, Russia, number 475/53xx (photo O. Soffer).

Similar findings of plants and their products are documented from other parts of Upper Paleolithic Europe also. Flotation of a hearth at Dolní Věstonice II, dating to some 26,000 BP, permitted Mason and her colleagues to recover remains of what they identified as fleshy tap root (*Compositae*) likely used as soft weaning foods (Mason *et al.* 1994). We have already noted that Abbé Glory recovered an actual fragment of a plant based 6-ply rope at Lascaux. Our cursory examination of Cheynier's collections recovered from the Solutrean level at Badegoule, where he reported an impression of a textile, revealed actual burned fragments of highly friable textile fabric adhering to pieces of flint (Soffer *et al.* 2000c). Cordage as well as an abundance of other plant products have been documented at Ohalo II in Israel, and dated to some 19,300 (Nadel *et al.* 1994). Moving even further back in time, Prince (2000) has recently reported finding 2 plant fibers which may represent cordage remnants on a Middle Paleolithic stone tool fragment from La Grotte du Portel, which hints at an even greater antiquity for perishable technologies. This should not surprise us, given the evidence from Shöningen (Thime and Maier 1995) which clearly informs us that wood was used to fashion a variety of implements from simple fire hardened sticks to spears and possible hafts as far back as 400,000 years ago.

3. The perishable technologies and their implications for paleolithic life

Our documentation that diverse and sophisticated plant based perishable technologies were widely produced across Eurasia revise our current reconstructions of Upper Paleolithic life in a number of significant ways. These, as we have discussed in detail in a number of our recent publications, include the following observations (Adovasio *et al.* 1999, Soffer *et al.* 2001 - both with references).

First, the evidence for Upper Paleolithic nets clearly impact our reconstructions of subsistence practices because net making implies that net hunting was likely a part and parcel of the late Pleistocene food quest. Furthermore, as we have argued elsewhere, this way of hunting probably involved concerted involvement of entire communities. Thus the Upper Paleolithic nets reveal one of the ways that the women, the children, and elderly contributed to the food quest. This, in turn, provides us with our first glimpses of what the heretofore unseen majority of Upper Paleolithic people may have been doing on a regular basis and allows us to envision Ice Age life beyond just the actions of prime-aged males. It also suggests that this way of hunting may signal added demands on the labor of these constituencies.

Second, the existence of perishable technologies across Upper Paleolithic Europe, combined with the iconographic evidence associating these technologies with women, permit us to begin thinking about gender, agency, labor, and the value placed on that labor. Specifically, as we discussed in detail elsewhere (Soffer *et al.* 2000a, 2000b, 2000c, 2001), there are strong reasons for associating weaving and basket making with some Upper Paleolithic women. This affords us another glimpse at women's work in the deep past.

Moreover, the fact that perishable weaving and plaiting skills were apparently important enough some 25,000 years ago to be immortalized in such durable media as stone, ivory, and bone, has led us to argue that such iconographic transformations suggest that the women who wove the textiles and made the baskets likely held positions of marked status in their societies. At the same time, the fineness of some of the produced textiles may be signaling an intensification of women's labor - something also suggested by the evidence for communal hunting.

4. Some conclusions and a fervent plea

In sum, we conclude the following about late Pleistocene lifeways:

1. A very wide range of plant based textiles were made in Eurasia by at least 27,000 BP. To date, this is the earliest evidence for textiles, baskets, and nets in the world. These perishable technologies shed light on women's involvement in subsistence practices, on women's work, and illuminate the likely importance assigned to the productive skills of women.

2. These insights show that the focus on perishable technologies permits us to diversity the kinds of people we envision in the Paleolithic. Thus, a consideration of plant use not only brings us face to face with the women and the children of the past, but also permits us to get beyond a focus on male hunting - our perennial obsession for the last 150 years.

3. Diversifying our ideas about Upper Paleolithic hunting to include communal endeavors, brings us to issues of windfall surpluses of game that such hunting produces. Such surpluses are congruent with our interpretations of some Central European Upper Paleolithic sites as aggregation base camps where large number of people came together seasonally.

Figure 6. Front and back views of the "dressed" figurine from Kostenki I (photo O. Soffer).

4. Plant based remains also give us rare glimpses of children in the past. The recovery of baby foods lets us consider how such foods may have been prepared, as well as how cooking was done in general. This culinary perspective, in turn, shows us that in Central Europe foods may have been stewed in boiling pits while roasting may have been favored in Eastern Europe (Soffer 2000).

Simply put, it is clear that looking beyond Gravettian points and Kostenki knives and diversifying our past actors opens up a new multifaceted past for our consideration.

We close with some suggestions which emerge directly from our conclusions. We underscore that:

1. Much of the perishable evidence we have discussed could not have been obtained without special recovery techniques such as flotation - something which must become a part of our recovery techniques.

2. Most of the evidence could not have been recognized without training in analytical methods traditionally either consigned to later time periods - e.g. what prehistoric textiles look like archaeological contexts - or not emphasized in Paleolithic research because of unwarranted assumptions about the likelihood of recovering plant remains. This urges us not only to keep an open mind about what the archaeological record may contain, but also to be ready to recognize the unexpected.

The archaeological record of the past contains far more than we are trained to recognize at any one moment in time. This is our failing and one which should frame all of our research. The data on hand clearly tell us not only that life in the past was not lived by stone alone, but challenges us to question received wisdoms about what was or was not present in the past, as well as to hone our skills to learn more about the past than the wisdom received from our predecessors.

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AFTERWORDS: THE PAVLOVIAN AS A PART OF THE GRAVETTIAN MOSAIC

J. A. Svoboda

Abstract

The mosaic of Gravettian occupations over the European scene was not a static one, but displays a dynamic pattern of changes. Moravia, where the settlement density and complexity culminates during the earlier Gravettian (the Pavlovian) and decreases afterwords (the Willendorf-Kostenkian), provides a reverse picture to that of some other European regions. In Italy, an influx of population is observed during the Gravettian, possibly from the west. Parallel and later movements occured between the central and eastern parts of our continent, from Moravia to the Carpathian Basin and further to the eastern plains of Europe. In the later case, the impuls would probably be provided by environmental changes that have occured in Central Europe before and around the Last Glacial Maximum, and the archaeological reflection would be the eastern expansion of the Kostenkian type of the Gravettian.

KEYWORDS: chronology, settlement pattern, population shifts, Gravettian, Central Europe

While reporting on the results of the European Science Foundation conference held at Pavlov in 1995 under the title *Copying with deteriorating climate*, Mussi and Roebroeks (1996) compared the Gravettian complex of Eurasia to *The Big Mosaic*. At the first sight, this mosaic seems monotonous if compared to the Middle-to-Upper Paleolithic transitional mosaic, for example, when Europe has been covered by a network of typologically distinct cultural units at various stages of technological transition, and possibly produced by anatomically different human types. Elements of the Gravettian mosaic seem to have been technologically and culturally uniform over larger regions: France and southern Germany, Italy, the Danubian region, and Eastern Europe. However, the same time-period evidently saw the persistence of the last Neandertals in Croatia and probably in southern Spain, evidence of the later Aurignacian at the beginning of this period, and formation of new, hitherto poorly understood entities labeled provisionally as „Epigravettian" and/or „Epiaurignacian" at the end.

The Pavlovian represents an important component located just in the geographic center of the Gravettian mosaic. When this term has been coined in southern Moravia (Klíma 1959, Delporte 1959), its territorial and chronological boundaries were not yet precisely defined. The geographic limits of the Pavlovian remained flexible over the past 40 years, and it has been defined alternatively as Moravian, Central European, or Central and East European entity. And, because the Paleolithic technocomplexes are traditionally being observed and evaluated from the western perspective, the term Pavlovian would also be used for any type of the Gravettian different from the western one: the Eastern Gravettian (Valoch 1969) or the Willendorf-Pavlov-Kostenki-Avdejevo unity (Soffer 1993).

In a closer look, it seems that the Pavlovian is linked to a specific physical and cultural geography. The Danube region plays an intermediary role within the Gravettian mosaic, as a west-to-east oriented connection between the western edges of Europe and the vast steppes of Eurasia. As soon as the Eastern Europe has been established as another cultural center, a kind of counterweight to the Western Europe during the Early and Mid Upper Paleolithics, the Danube river valley started to function as an intermediate.

However, not even the Danubian Gravettian displays patterns of uniformity. The Upper Danube (south Germany) shows typological and behavioral relationships to France, whereas the Carpathian Basin and Balcans belong to another Gravettian sub-province.

The Pavlovian occupies a central location on the Middle Danube. Besides the archaeological typology, several behavioral patterns are important for its definition:
- formation of the large open-air settlements in lower altitudes, and along the rivers (*the Gravettian landscape*),
- intensive exploitation of mammoths, supplemented by a variety of small animals,
- long-distance transport of lithic raw materials along the Moravian corridor,
- aspects of ritual and style.

1. Differences in space and time

Not only differences, but also similiraties are visible in certain artifacts on continental and even overcontinental - Eurasian scale. These "analogies of shape" are most markedly demonstrated in art objects such as the female figurines (Gamble 1982, Svoboda 1995, figs. 22-23, Mussi, Cinq-Mars, Bolduc 2000). If this general view is precised by means of chronology, than the closest similarities will be recorded during the younger Gravettian: the shouldered points as the diagnostic lithic artifacts, and the female figurines as the most remarkable symbolic artifact, uniting areas of more than 1,500 km in distance. Examples are the "globular venuses" of Willendorf - Gagarino, or more protracted ones of Moravany – Kostenki, displaying standard shapes and positions. Surprisingly, analogies in form are also remarked between Předmostí and Avdeevo (the mammoth figures, simple "weights/females" carved of mammoth phalanges, and decorations, Gvozdover 1995), and this may support the hypothesis of a multilayer character of the Gravettian at Předmostí (Svoboda 2001b). Generally, it seems that the mosaic, as observed during the earlier Gravettian, becomes more and more uniform during the later Gravettian development, at least in Central and Eastern Europe.

Soffer (1993, 45) rightly recognized a change in the increased mobility between the Gravettian occupants of the Pavlovské Hills area of some 26 ky ago and their descendants in Eastern Central Europe of some 23 ky ago[1]. Not only the shift of core residential areas and the more or less related changes of adaptive nature are recorded, but also the emergence of new artifact types. The complex of changes (Table 1) seems so important that it is difficult to talk about a Willendorf-Pavlov-Avdeevo-Kostenki archaeological entity (Soffer 1993), but, rather, we separate the Pavlovian as representative of the earlier stage, and the Kostenkian (or, Willendorf-Kostenkian) of the later Gravettian stage (Kozlowski and Sobczyk 1987, Svoboda 1994, etc.).

In the Middle Daunbian region, the multilayer Upper Paleolithic sequence of Willendorf II has been taken as a key section to demonstrate the patterns of loess geochronology (Haesaerts *et al.* 1996) and typological change through time (Otte 1991). Later comparisons expanded these observations to the spatially large, but stratigraphically rather homogenous settlements of the Moravian corridor (Svoboda 1994), and to broader regions of Central and Eastern Europe (Otte and Noiret this volume), with special emphasis on the loess deposits of the Dniestr and Prut valleys (Haesaerts *et al.* this volume).

Regional aspects of change are also reflected in the individual contributions of this volume. Whereas the traditional Upper Paleolithic settlement areas, as are the caves of South Germany, show rather the patterns of consistent settlement and subsistence between 30-20 ky BP (Münzel this volume), Italy may have witnessed an influx of population after 27-26 ky BP (Mussi this volume). After 25 ky, a horizon of newly dated sites is recorded in Bohemia (Lubná, Jenerálka), West Slovakia (the Moravany-Banka area,

Footnote 1. All C14 datings are conventional. See Jöris and Weninger, this volume, for calibration.

	Settlement	Mammoth bone deposits	Art	Burials
Willendorf-Kostenkian	The Gravettian landscape Larger distances between sites Emphasis on the „gates" Occupation of new regions	Present	Individual figures: Willendorf II, Petřkovice, Moravany, Brno 2	Brno 2: ochre, richly equipped with objects
Pavlovian	The Gravettian landscape Sites more clustered Concentrated in the DV-Pavlov area	Present Accumulated in the DV-Pavlov area	Complex art: Ivory, ceramics, zoomorph, anthropomorph, symbolic	Předmostí DV-Pavlov Ochre; otherwise poorly equipped

Table 1. Comparison of the Pavlovian and Willendorf-Kostenkian stages in the Middle Danube region: selected patterns of behavior.

Verpoorte 2002), East Slovakia (Kaminská, Tomášková, and Novák, this volume) and in the plains north of the Carpathes (Spadzista, Kozlowski and Sobczyk 1987, Wojtal, this volume). These observations support the model of an increasing human mobility and territorial expansion during the Gravettian period.

2. After 1995: Additions to the Pavlovian, Willedorf-Kostenkian, and Epigravettian developmental scheme

In the sense defined above, the Pavlovian is restricted to the Lower Austrian-Moravian-South Polish corridor in space, and to the earlier Gravettian stage in time (Svoboda 1994). Since the publication of the last mentioned paper, the number of C14 conventional datings increased considerably, especially from the classical Dolní Věstonice-Pavlov area from the Middle Morava river basin. A comparison of the datings between 30-20 ky shows that the majority of Gravettian dates from Moravia are clustered within the 27-25 ky interval. Thus, we expect a dynamic demographic and settlement history in Lower Austria and Moravia, as reflected in the proposed three-stages framework of the Gravettian, starting with the Early Pavlovian (30-27 ky), culminating in the Evolved Pavlovian (27-25 ky), and followed by the Willendorf-Kostenkian, Kostenkian, or the Shouldered-point horizon (25-20 ky). On a broader Central European scene, recent studies by Otte and Noiret (this volume) and Haesaerts *et al.* (this volume) precise this scheme into even finer chronological sequences. At the same time, however, the idea of Gravettian chronology in Moravia as well as work donne at the individual sites were subject of criticism by M. Oliva (e.g. 1996 and further discussions).

Stratigraphically, the Early Pavlovian stage is still best documented in the occupation layers 5-6 of the Willendorf sequence (Otte 1991), whereas in south Moravia comparable C14 dates (between 30 27 ky) are only related to small Gravettian assemblages or just charcoal deposit without artifacts, located especially in the lower parts of the Dolní Věstonice I and II site complexes. However, the large site complex of Dolní Věstonice II and IIa (Figure 3, Svoboda 2001a, with contributions by D. West, M. Nývltová-Fišáková, P. Škrdla, and A. Šajnerová) provides potentials for separating the early and evolved Pavlovian occupations spatially. Our recent studies distinguished an earlier horizon composed of several settlement units, all with C14 dates around 27 ky. The lithic industries are burin-dominated, characterized by a spectrum of simple microliths such as backed microblades, microgravettes, and

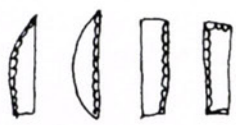
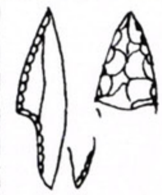
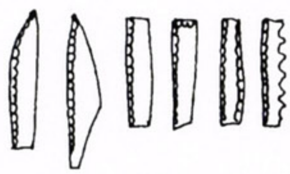
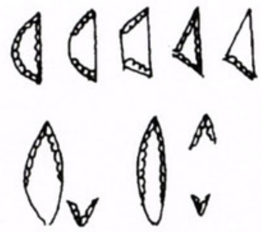
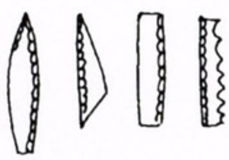
	Backed microliths	Non-backed microliths	Typical points
Willendorf-Kostenkian: Petřkovice I, 24-21 ky BP			
Evolved Pavlovian: Pavlov I, 27-25 ky BP			
Early Pavlovian: Dolní Věstonice II, around 27 ky BP			

Table 2. Comparison of the Pavlovian and Willendorf-Kostenkian stages in Moravia and Silesia: selected aspects of typology, with emphasis on the microliths.

microdenticulates (Table 2). Comparable C14 dates are from Krems-Wachtberg in Austria (Fladerer 2001 this volume, Einwögerer this volume).

The majority of Moravian Gravettian occupations belong to the Evolved Pavlovian stage (27-25 ky), characterized by an emphasis on microlithic production, but, at the same time, by a variability of typological „styles". Ongoing analysis of the site of Pavlov I (volume 3 in preparation) demonstrates the decisive role of geometric (non-backed) microliths such as triangles, trapezes, and crescents, at least in certain parts of this particular site. Another "style" of this period accentuates rather the elaborate lateral retouches on larger blades and flakes, together with a lower representation of these microliths. Originally, as we were limited to samples from the southeastern and northwestern concentrations of Pavlov I, a certain dichotomy has been recorded between the two parts of the site and the styles. As our analysis proceeds, however, and especially after analysing the central parts of the southeastern area (1954-1956), it becomes clear that there is a more gradual pattern of variability over the settlement, and that the variability also correlates with artifact density in its individual parts.

In addition, recent prospection and excavations by P. Škrdla (this volume) in the Uherské Hradiště area on the Middle Morava river revealed new industries with comparable C14 dates, especially from the site of Jarošov II. Even if this site is contemporary to Pavlov I on the basis of datings, the relative proportion of microliths is higher at Jarošov but their morphological variability is lower.

It is generally accepted that the Moravian sites (contrary to Willendorf II) do not have stratigraphic superpositions, but certain cases occur occasionaly, and these were actually studied in more detail (Svoboda

2001a,b). Namely, two C14 dated-superpositions at Dolní Věstonice I (lower part) and Dolní Věstonice IIa (excavations 1999), supplemented by the microstratigraphies recorded previously by Klíma at Pavlov I, show that in certain parts of the large Pavlovian settlements loess and anthropogenic deposits accumulated even within the Pavlovian period. Another Gravettian superposition was recently recorded by W. Antl-Wieser (this volume) at Grub/Kranawetberg on the Lower Morava river (Austria).

Culturally related occupations from caves were hitherto little known in this area. In 2002, our joint excavations with L. Kaminská and J.K. Kozlowski in the Dzeravá skala Cave, at the eastern (Slovakian) margin of the Lower Morava river valley, yielded horizons of episodic Gravettian occupations with C14 dates situated at the end of the Pavlovian.

During the Willendorf-Kostenkian stage (after 25 ky) the backed microliths clearly decrease in number, while the non-backed geometric microliths, typical of the Pavlovian, almost disappear. Besides the most typical shouldered points, we record the re-appearence of another typical projectile, the bifacial leafpoint, and an increase in number of the truncated backed blades (rectangular blades). These formal changes in size and morphology of potentional projectiles, be it just small components of composed weapons (the Pavlovian microliths) or single and larger spear-points (the shouldered points and leaf points), suggest that certain changes in hunting technology and strategy occured at this time (cf. Cattelain 1997, Kozlowski and Montet-White 2001).

In Austria, the Willendorf sequence is terminated by an important occupation stage in layer 9 (Otte 1991), while in south Moravia the large site-clusters in the Dolní Věstonice-Pavlov area were gradually abandoned at the same time. A recent revision of Předmostí at the southern end of the Moravian Gate was realised, basing on the authentic records from the late 19th century by K.J. Maška and M. Kříž (site Ia) and on our excavation at sites Ib and II in 1992 (Svoboda 2001b, with contributions by M. Nývltová-Fišáková and E. Drozdová). It shows that the location Ia of this site originally provided a stratigraphy of two or three layers, where the lower and middle one would be mammoth dominated (and clearly Pavlovian in age and nature), while the upper one was reindeer-dominated and included some leaf-ponts. This record, together with a typical shouldered point of unknown stratigraphic provenience from the same site, suggests that the upper layer at Předmostí Ia could have been a Willendorf-Kostenkian one. In Moravia, this would be unique example of a more complex Gravettian stratigraphy. Within this sequence, the burial area of Předmostí was described by the both authentic excavators as belonging to the middle (or, eventually, lower) layer, i.e., to the Pavlovian. Unfortunately, such a complex stratigraphy is no more visible in the still preserved sections of this site (locations Ib and II).

The best documented site of the later Gravettian in the Moravian-Silesian territory is actually Petřkovice at the northern (Silesian) edge of the Moravian Gate, providing both the shouldered points and the bifacial leaf points with relevant C14 datings (Jarošová *et al.* 1996), and, further to the NE, Spadzista (Wojtal this volume). Generally, the site distribution pattern within the corridor suggests an increasing role of the Wachau and Moravian Gates, and gradual abandonment of the Pavlov Hills area. This emphasis on the most strategic passages is in accord with the presumed expansion of the shouldered points as recorded from the Middle Danube valley to the Central Russian plain.

Finally, a presence of another type of industries is recorded during the later Gravettian, as at Alberndorf and Langmannersdorf (Austria), showing a kind of mixture of Gravettian and Aurignacoid tool-types. As a most recent addition to this question, we mention here a new date of 23 540 ± 180 BP (GrA-19498) obtained from context of a similar assemblage at the settlement unit A, in the lower part of the Dolní Věstonice II site.

The question of the developments around and after the Last Glacial Maximum needs to be resolved in the future on basis of a broader comparative analysis (eg. Kozlowski 1996, Otte and Noiret this

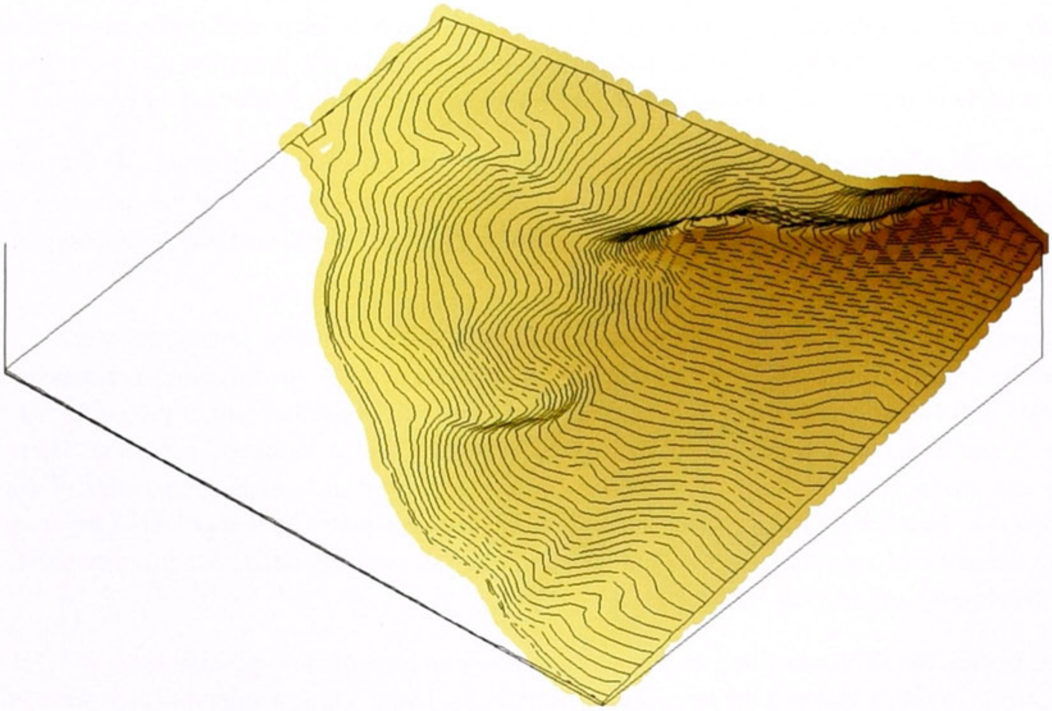


Figure 1. Geomorphology of the Dolní Věstonice-Pavlov area, the „classical" core of the Pavlovian settlement.

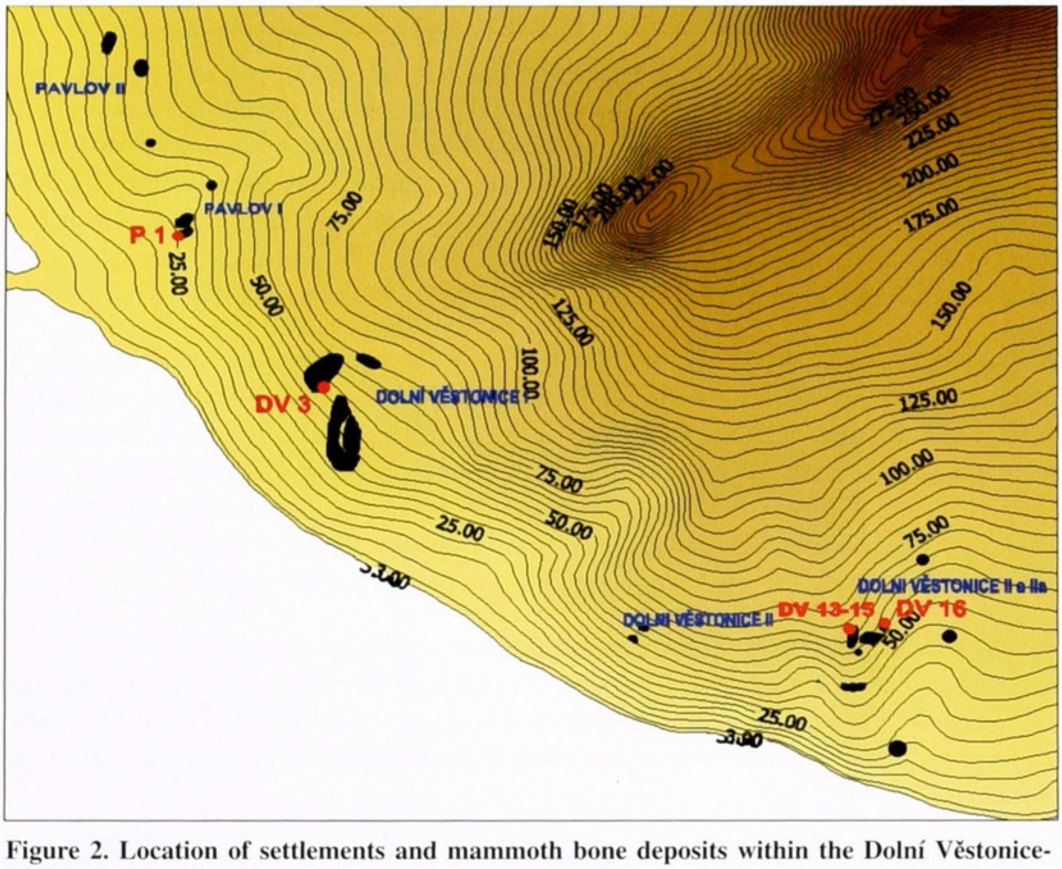


Figure 2. Location of settlements and mammoth bone deposits within the Dolní Věstonice-Pavlov area.

volume). The largest site of Lower Austria, Grubgraben, shows a considerable within-site variability in typology (cf. the reports by A. Montet White 1991, and Brandtner, 1996), while the only dated site in Moravia, Stránská skála IV, is a specialized horse-hunting location providing only a non-diagnostic lithic assemblage. The term „Epigravettian", in the sense we use it, only places these industries *after* the Gravettian without suggesting any kind of genetical connection (- and this would be even more problematic in case of the Aurignacian/Epiaurignacian). Generally, we observe so important changes in settlement and hunting strategies as well as in typology that it is difficult to follow any Gravettian and/ or Aurignacian continuity. A solution would be to coin a new name valid for eastern Central Europe basing on a good local site, and parallel to the Badegoulian as used in the western part of the continent.

3. Comparison to western Europe

One of the aims of the meeting in Mikulov in 2002 was to encouradge comparative studies along the Danube river and beyond, to the West (Germany, France... cf. Otte 1981, Kozlowski 1990, Roebroeks *et al.*, eds., 2000) and the East (Carpathian Basin, cf. Dobosi, ed. 2000; Dniest valley…). Compared to the Pavlovian, occupation strategies are more variable in these regions, combining caves, rockshelters and open-air sites; the hunting centered on the „classical" herd animals such as horse and reindeer, and a number of sites were directly supplemented by local lithic raw materials. The Gravettian settlement pattern in south Germany and France also shows a higher stability between 30 - 20 ky BP compared to the other parts of Europe.

Some of the French assemblages, if located close to lithic outcrops, include more complete operational sequences, with cores of more initial stages, and a larger-size *débitage*. The most sensitive element of typological difference, however, are the backed points and the microliths.

The Early Pavlovian of Moravia may be chronologically and typologically comparable with the Périgordian IV of France, with flechettes, La Gravette points and certain geometric or parageometric microliths, as represented at layer V of Abri Pataud (Delporte 1991, Rigaud 1984).

A typological differenciation occurs on the level of the Evolved Pavlovian of Moravia, or Périgordian V and VI of SW France. Compared to Moravia, there is a lack of geometric microliths in France: triangles are rare and broader in shape (Le Flageolet VII-VI), crescents are rarely retouched completely (Le Flageolet V, Corbiac), and trapezes were not recorded in the materials I saw. Microdenticulates were recorded in individual cases only (La Ferrassie, Le Flageolet V).

On the other hand, "western" types such as Font-Robert points (in their typical shape) and Noailles burins were not recorded from Moravia. In addition, the French Gravettian provides a wealth of larger La Gravette points and their derivates (Kozlowski and Lenoir 1988). In the modern exavations, using floating, the La Gravette points and microgravettes occure in a kind of balance, whereas in south Moravia the microlithic forms strikingly dominate over the normal-sized backed implements. Corbiac, as an example, provided a representative and morphologically variable assemblage of large-sized and middle-sized La Gravette points and microgravettes. Some exhibit ventral retouch at the base and some smaller points, formally, are comparable to the Moravian crescents. In contrast to Moravia, it seems as if some uncomplete La Gravette points pass by their form into double truncations, and when the truncation shapes are concave, the non-retouched lateral part between them advances into a gibbosity. In other cases, a concave truncation at the base may formally recall the shouldered points of Eastern Europe.

4. Levels of the Gravettian landscape

The specific character of the Gravettian landscape within the Moravian corridor was accentuated in several recent publications (Svoboda, Ložek and Vlček 1996, Oliva 1998, Škrdla and Lukáš 1999, Svoboda 2003). Actually, two levels of settlement patterning are investigated: first, the regional geography, showing that the sites are located almost axially, from the southwest to the norheast, along the main rivers of Lower Austria, Moravia and Silesia (Danube, Morava, Dyje, Bečva and Odra) and generally in lower altitudes compared to the Aurignacian or Magdalenian sites (200-300 m a.s.l.). On a microregional scale, the sites are either on slopes controlling the river valleys (Willendorf, Jarošov, Boršice), or at junctions of a main valley with short, steeply sloping side gullies (Dolní Věstonice I-II), at the end of a longer side-valley (Milovice), or on hill promotories (Petřkovice, Spadzista). In another paper (Svoboda 2003), I tried to discuss the site hierarchy within a microregion and definition of the large hunter´s settlements in terms of size and complexity.

Generally it may be argued that these site location patterns are related to the exploitation of large mammals following the river valleys, such as the mammoths at the first place.

5. Insights into the man-and-mammoth relationships

The richess observed in the Pavlovian material culture should result from an efficient resource exploitation system, but reconstructing this system more precisely on the basis of archeological record evokes certain contradictions. Various authors underline either specialized mammoth hunting or mammoth scavenging, reindeer hunting, net-hunting of smaller game (including fur animals), or plant gathering. Since the archaeological record in general suggests relative sedentism or, at least, tethered nomadism (Klíma 1963b, Soffer 1989, Verpoorte 2000, 2001, etc.), we should expect a variable, flexible, and less risky resource exploitation system capable of supplies during the whole year.

The mammoth as an important source of meat and fat certainly plaied one of the major roles within this system. The most remarkable archaeological evidence is provided by the typical mammoth bone deposit (*kjökkenmöddings,* after K. Absolon) as a typical characteristics of the Gravettian landscape. The major question is recognizing their human or natural origin.

Typical mammoth bone deposits are distributed along the Moravian corridor (Dolní Věstonice I-II, Milovice, Jarošov, Předmostí, and several smaller occurences, Svoboda 2001c) as well as in its southern and northern vicinities (as far as Spadzista in Poland, Wojtal this volume), and dated to the 30 - 20 ky BP period, or the Gravettian. This limited spatio-temporal occurence may be one of the indirect arguments for the human origin of these deposits.

In Moravia, the best-known cases are related in space and time to the large Pavlovian settlements at Dolní Věstonice I and II. Some of the other bone deposits provided first data which are slightly younger than the nearby settlements. At Milovice, the main settlement center (south - G) has Pavlovian dates of 25,2 - 25,6 ky BP, whereas the large mammoth bone deposits (north - B) provided a date of 24,5 ky BP (Oliva 1988, 1989). A similar relationship of an earlier settlement and a later mammoth bone deposit is observed at Jarošov (27-25 ky for the settlement, 23 ky for the bone dump; Škrdla this volume), and, of course, the situation remains unclear at a site as complex as Předmostí. The archaeozoological database, including the bone-type representation, their spatial relationships, and age-at-death, does not solve the question of the natural or human origin unequivocally (Klíma 1969, West 2001, Svoboda, Wojtal and Péan in press). However, the repeated location of the mammoth bone deposits in wet or even watered side-gullies at the foot of the Pavlov Hills, and below or beside the related settlements, suggests an interpretation of a natural trap: if an individual would be separated from the herd and advanced

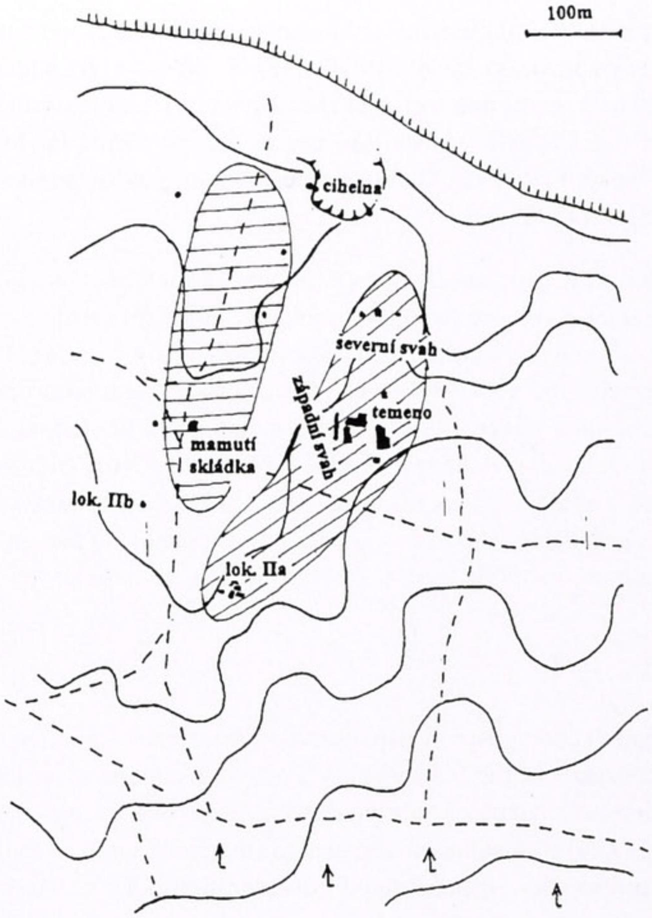


Figure 3. Detail of the Dolní Věstonice II site. Diagonally hatched is the settled area, horizontally hatched is the adjacent gully, with active brook in center and with finds of mammoth bones along the sides.

in a steeply cut and blind valley, with slippy underground, the kill does not seem to be as difficult. At Předmostí, relationship of the mammoth bone deposits to the local mineral water sources should also be taken into account.

North of the Moravian corridor, the local geography of the mammoth bone deposits slightly differs. The site of Spadzista in Cracovie provides a good case of a site complex and a mammoth bone deposits dated to the Willendorf-Kostenkian period (Kozlowski and Sobczyk 1987, Wojtal this volume). Onother northern site, Petřkovice, is deposited in sedimentary conditions unfavourable for organic preservation but it nevertheless supplied tens of mammoth molars (e.g., Folprecht 2003) as the best preserved type of faunal remains. Both sites lie on hill promotories controlling the upper courses of the large plain rivers: Visla and Odra. At Spadzista, Wojtal (this volume) suggests that the animals evidently died at this site, even if it is impossible to decide wheather the death was caused by natural or by human factors.

Indirect arguments such as the geographic relationships of the riverive networks, strategic places, natural "traps", and Gravettian settlements suggest that a conscious human strategy should be searched behind the formation of the mammoth bone deposits. In addition, the high level of technology, culture and rituals as recorded in the Gravettian evidence from the Moravian corridor, suggests at least that the hunter´s society was well equiped (by means of technology) and well prepared (in terms of psychology) to perform hunting of even the largest mammals of that time.

6. Smaller and fur-bearing animals

There is a considerable variability in the Pavlovian faunal composition, even inside a single settlement. In the Dolní Věstonice-Pavlov area, R. Musil (1994, 1997 in preparation) underlined the dominance of smaller animals such as hares, foxes and wolfs, but he also recorded the variability among the hitherto analysed areas of a single site, Pavlov I, as well as among the individual Pavlovian sites of the area. Compared to the „classic" Upper Paleolithic faunal composition, the Pavlovian shows decrease in number of reindeer and a striking lack of horses.

Dominance of the small animals is observed especially at Dolní Věstonice II (Svoboda 2001a, West 2001). The idea that the smaller carnivores were preferentially killed for furs at this site is also supported by use-wear analysis by A. Šajnerová, who recorded an evidence of fur working. In addition, the site has a rich bone industry, especially the awls. Adovasio, Soffer, and others, who observed knots imprints in the clay lumps from these sites, suggest that smaller animals were hunted into nets (Adovasio *et al.* 1997). Brühl (this conference), basing on the leaf-shaped „spatulae" of ivory from Pavlov I and supported by a number of ethnological analogies, suggests that the ivory artifacts could have served as spear projectiles, blunt enough not to damage the furs. Taking into account also the small lithic projectiles, it appears that a variety of hunting methods were used concurrently at these sites.

7. Lithic transport

Aspects of the lithic raw material composition also received considerable attention during the past period. Given the weight and the distance of the transport, the Pavlovian economic system would be a labour-expensive one. The absolute dominance of "nordic flint" is observed, even if it is sometimes difficult (especially in the patinated state) to distinguish the glacial flint from some of the south Polish silicites. At the Dolní Věstonice-Pavlov sites, space-limited concentrations of materials are detected such as the Krakow-Czestochowa silicites in the lower 1956 area of Pavlov I, the radiolarite (red and green) in the northwestern (1957) part of the same site, and other similar occurrences in Dolní Věstonice. At the other Moravian sites, an increased amount of radiolarite was recorded at Milovice I and at several places in Předmostí I, but, surprisingly, not at the sites that lie closest to the radiolarite outcrops in the White Carpathians (as at Jarošov).

Even if the flint and radiolarite industries are supplemented by artifacts of local cherts, as well as by coarse rocks and local materials for the heavy-duty industries, the pattern of long-distance lithic transport along the Moravian corridor is determinating for understanding the Pavlovian.

8. Technologies

Several recent studies center on Gravettian technologies, be it in stone (Škrdla 1997), bone and antler (Brühl this conference, Zelinková 2003), or perishables (Soffer 2000). Concerning human capacities for fine and precise technologies, especially the site of Pavlov I is well known for the miniatures, as reflected in geometric microliths and ivory carvings (at this site, their number was certainly increased by systematic floating of the sediment by B. Klíma during his excavation). Concerning the innovative technological processes, it appears that principles of certain new technologies such as polishing stone (Škrdla 1997), production of ceramics (Vandiver *et al.* 1989), textiles and cordage (Soffer and Adovasio this volume) were already known and practiced at the Pavlovian sites.

Specifically, the discovery of textile/basketery imprints at Pavlov I and Dolní Věstonice I,II attracted attention and opened discussions concerning several points: the presence weaving as early as the Upper Paleolithic, the variability of these technologies, and their social implications (Adovasio *et al.* 1997, Soffer *et al.* 2000, Soffer and Adovasio this volume). Because this discovery evoked a critique by some Czech archaeologists, further fotodocumentation and description of the imprints is running in the moment (volume 3 of Pavlov in preparation), as well as a functional analysis of the possibly related bone industry. Whereas Adovasio et al. recorded several types of textile constructions and cordage on casts (i.e., positives of the structures), additional fotodocumentation of the original pieces (i.e., negatives) display regular rectangular patterns, usually within the intervals of 1,5 - 2 mm, corresponding to textile structures in the plain weave (Kovačič *et al.* 2000). It is improbable however that this textile would have substituted animal furs as the dominating material for clothing. Rather we suppose, as does Soffer *et al.* (2000), a variety of supplementary and/or symbolic functions.

In conclusion, and compared to the Neolithic when polished stone has been used for axes, ceramics for containers, and textile for clothing, in the Pavlovian these techniques were used differently, and perhaps less „practically".

9. Variability in symbolic behavior

Symbolism, rituals, and art objects as a part of a system reflecting past human psychology, are of importance for understanding various aspects of society and economy. Several formal differences, as observed across Eurasia, should be emphasized in this context:

In western Europe, recent discoveries of new cave sites, new possibilities of AMS C14 dating of black paintings, and stylistic reconsideration of the paintings in sites already known, enabled to define a Gravettian group of parietal art: Cosquer (28-26 ky BP), Gargas (26,8 ky BP), Cougnac (25-19 ky BP), Pech Merle (24,6 ky BP), and Cussac (25 ky BP, Clottes 2000, Djindjan 2000, tab. 2, Ajoulat *et al.* 2001). Stylistically, these paintings are characterized by an expanded volume of the body compared to shorter and stylized extremities and heads (recorded both in animal and female representations), by numerous hand imprints, and by formally standardized geometric signs and symbols. Evidently, no relationship between this style and the mobile art of the Pavlovian is recorded.

Certain over-continental parallels are observed rather in the Gravettian figurine assemblages (Brassempouy, Grimaldi) and in the small decorative objects, perforated „pearls" and animal teeth (abri Labattut, abri Pataud).

In search for an art assemblage that would be comparable to the fired-clay figurines from South Moravia, there is a kind of similarity (rather "functional" than technological) in the small soft-stone sculptures of the west, namely the chronologically later (Magdalenian) sandstone assemblage from Isturitz (collections MAN). Besides the larger, flat sculptures (bisons), unparalleled in Central Europe, there is a number of smaller fragments of animal bodies and heads of bears and horses. By their form and possibly their function, they recall the fired-clay plastic assemblages from Dolní Věstonice-Pavlov, or the soft-stone (marl) sculpted assemblages from Kostenki.

In central Europe, and especially in the Moravian corridor, evidence of the mobile art demonstrates a remarkable change between the Pavlovian and the Willendorf-Kostenkian horizons. Whereas the Pavlovian is characterized by complexity of raw materials and techniques (ivory and bone carving and burnt clay figurines) and topics (animals, females and even males, as well as stylized signs of zoomorph, anthropomorph and sexual significance), the later Gravettian sites of Central Europe only provided three female figurines, two of which are carved of stone (thus *the horizon of lonely venuses* of Willendorf, Petřkovice, and Moravany). The newly obtained date of the Brno 2 burial, equipped with a single male statue in ivory, would also suggest a later Gravettian age (23.680 ± 200 BP., OxA 8293; Pettitt and Trinkaus 2000).

Contrary to the richess of the Pavlovian art in Moravia, the burials, even if numerous, were poorly equipped with objects (Předmostí, Dolní Věstonice-Pavlov; Trinkaus and Svoboda, eds. in preparation). The richess seems to have appeared later, with the Brno 2 burial, and it may be correlated with the number of rich burials from Russia and Italy, also, rather, dating to the later Gravettian and Epigravettian (Mussi this volume).

Eastern Europe provides a reverse picture to Central Europe. The formation of large hunter´s settlements with complex art (carvings in ivory, bone and stone, depicting animals, females, and symbols) did not occure before the later Gravettian (Kostenki-Avdeevo) stage. Plastics of burnt clay appear only exceptionally at these sites. The rich assemblages of clay figurines from Central Europe seem to have been functionally substituted by the carvings in soft stones (and their fragments), depicting a similarly broad spectrum of subjects and signs.

10. Population shifts

It is evident that the mosaic of Gravettian occupations over the European scene was not a static one, but it displays a dynamic pattern of changes. Moravia, where the settlement density and complexity culminates during the earlier Gravettian (Pavlovian) and decreases afterwords (Willendorf-Kostenkian), provides a reverse picture to that of eastern Central Europe, Eastern Europe, and Italy. Mussi (this volume) records an influx of population to Italy during the Gravettian, possibly from the west. Parallel and later movements occured between the central and eastern parts of our continent, from Moravia to the Carpathian Basin and further to the eastern plains of Europe. In the later case, the impuls would probably be provided by environmental changes that have occured in Central Europe before and around the Last Glacial Maximum, and the archaeological reflection would be the expansion of the Willendorf-Kostenkian, or, simply, Kostenkian type of the Gravettian.

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