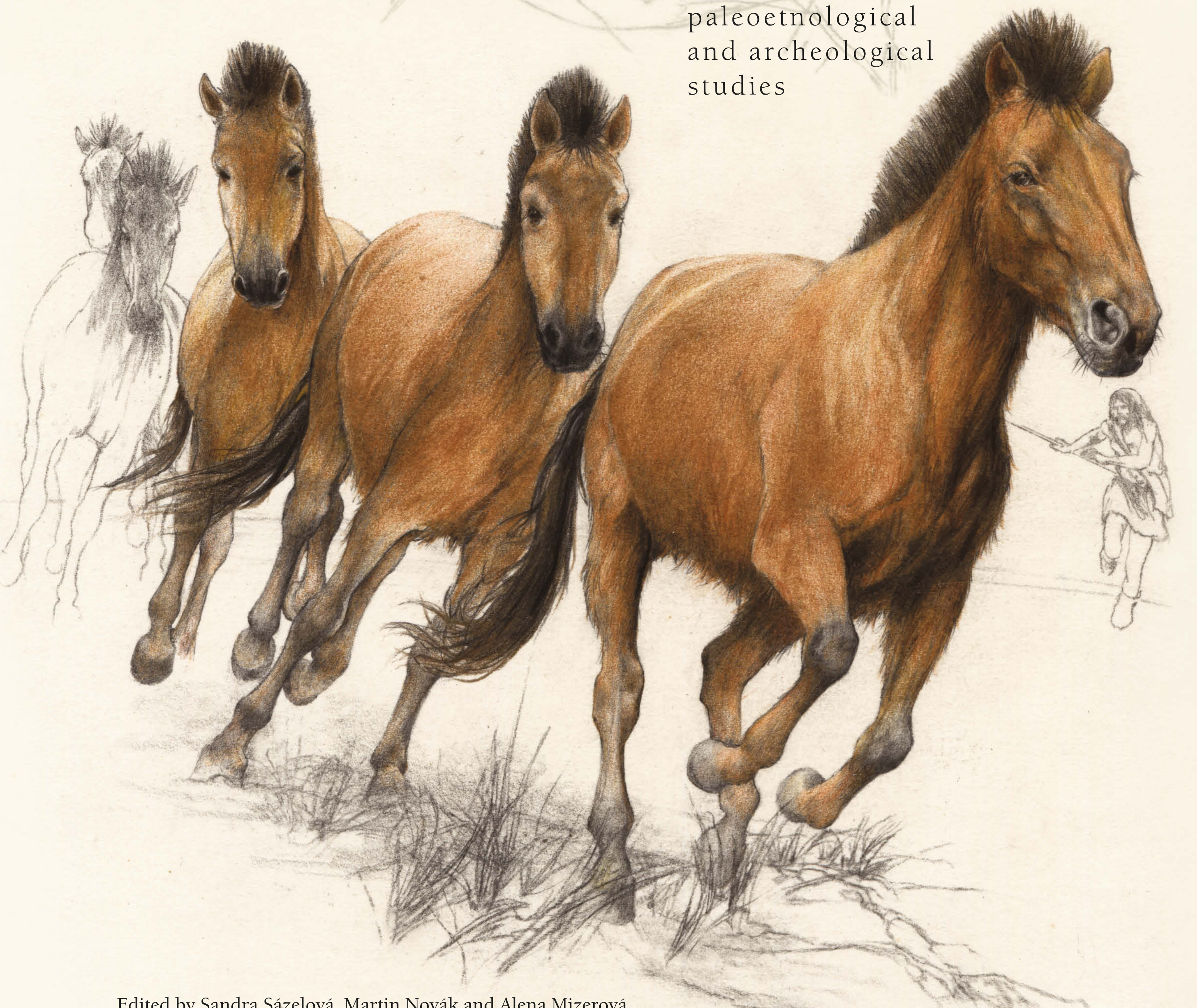
FORGOTTEN TIMES AND SPACES

New perspectives
in paleoanthropological,
paleoetnological
and archeological
studies



Edited by Sandra Sázelová, Martin Novák and Alena Mizerová

INSTITUTE OF ARCHEOLOGY OF THE CAS, BRNO & MASARYK UNIVERSITY

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archeologický ústav av čr v brně

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This monograph is dedicated to Jiří Svoboda

Reviewed by:

dr. Angela Perri (Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Leipzig)
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FOREWORD

Human lives and their evolution are spanned throughout different times and various spaces. Nevertheless, their destiny might seem inexorable, for the witnesses, their memories or tangible evidences are slowly forgotten. This book displays two main efforts – on one hand in collecting and describing the shreds of previous and yet forgotten lifestyles, and on the other in reflecting the scope of Jiří Svoboda's physical and intellectual cooperation with all our contributors, even if they were looking just for inspiration in his work.

We would like to thank to the Institute of Archeology of the Academy of Sciences of the Czech Republic in Brno and Masaryk University for their financial and technical support. We are grateful to Pavel Dvorský for drawings, to Roland Nespoulet & Dominique Henry-Gambier, Luc Moreau, Laurent Klaric, Walpurga Antl, Marc Händel and Alexander Pryor for their help with French, German and English corrections and translations; to Angela Perri and Philip Nighst for their reviews, to Ivan Ruller & Valér Kováč for their unique photo documents and drawings from the Libyan expedition in 1979–1981; to Margherita for portrait of J. Svoboda, and to Petra Hájková & Lea Novotná for their brave and often ungrateful help in typing and reference-proofs. The main English work was done by company Proof-reading-Service.com.

Sandra Sázelová, Martin Novák and Alena Mizerová

PART I

WHAT DO AUSTRIAN PUPILS KNOW ABOUT HUMAN EVOLUTION? A SURVEY IN SECONDARY SCHOOLS

Gerhard W. Weber and Cornelia Fitsch

Abstract
This article discusses the importance of education in human evolution for modern developed societies and makes an attempt to evaluate the current status-quo in Austria. In a pilot study 157 pupils at the end of their final school year (aged 18–20) of four Austrian federal states (Lower Austria, Upper Austria, Styria and Vienna) and all kinds of types of school were included. By means of a questionnaire background information about the general structure of the class and the education in biology was gathered. The second part of the questionnaire tried to assess the pupils' actual knowledge in human evolution. Moreover, structured interviews with school and university teachers as well as with didactic and paleoanthropology experts were conducted and analysed. In summary, human evolution is taught in most of the secondary schools in Austria, although the extent can be regarded as minor, particularly *vis-à-vis* the disciplines of cell and molecular biology, and often with only little or no relation to the current scientific literature. The use of demonstration material in class increased the knowledge significantly. Religious creation myths such as Intelligent Design and Creationism do not seem to have a big influence in our Austrian sample. There is a good chance for improvements since the survey highlights the distinct interest of pupils in biology and human evolution. Cross links from evolution to other topics might improve the understanding of this complex issue considerably.

Keywords
Human evolution, education, secondary school, questionnaire study, Austria

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Introduction

The topic "human evolution" is more or less exotic for the layman but there is hardly any educated citizen who is entirely unresponsive when it comes to the question of our own biological roots. Every now and then public media report sensational findings, for instance, when a new species or "ancestor" is discovered. These waves of attention are like tsunamis – short lasting but huge – and capture virtually all channels from high quality to tabloid press, TV and radio stations, and of course all kinds of online media. While we can be sure that the topic comes into the popular focus occasionally, the question remains what the average citizen knows about human evolution? And why should (s)he bother anyway?

Particularly the last decades have shown rapid progress in developing methods in the field and a rapid increase in the number and completeness of unearthed fossils. The picture that we can draw based on hard evidence becomes finer. In addition, molecular and genetic sciences support one or another scenario for geographical dispersal and admixture or raise doubts on traditional views such as the separateness of species. Moreover, ethologists working with extant primates or evolutionary psychologists widen our horizon on how our typical traits such as human perception and language might have evolved. Is anything of that relevant for our daily lives? Not so much if our goal is just to survive until the next day. However, to understand how groups of organisms develop over time and how humans and their societies act and interact, in the long run it seems advisable to learn from our unwritten history deep in the past. Sexual dimorphism, to mention just one obvious example, affects our daily life. Not only have sex differences in medicine (Miller 2014) became important since the 1990s but also the hurdles in overcoming gender inequalities are more likely to be understood if taking into account our biological and cultural evolution. This is not a statement out of biologism. Our genes co-determine our phenotype and are the product of a long evolution. While some traits selected in the past might have been favorably then, they could create trouble in our new lifestyle. Diabetes, impacted wisdom teeth, infarction and other problems might be better understood if we consider the conditions for which our bodies were shaped. Besides such practical considerations, knowing about our origin is mainly an intellectual endeavor, of no less and no more merit than writing opera or flying to the moon. If one appreciates those merits, one can also argue that, at least in a wealthy and educated society, people should be aware of where they come from (which might also help to understand where we might be heading in the future).

While in general the wealth of evidence for evolution, and human evolution in particular, leaves no question mark about its existence, for some people the safe harbor of religious beliefs is still stronger. Two religious creation myths, Intelligent Design and Creationism, have gained more and more influence in the USA over the last decades (http://ncse.com/creationism/general/what-is-intelligent-design-creationism) which had has an impact on biological education at US-American high schools, e.g., in Kansas (http://ncse.com/news/2005/11/antievolution-standards-adopted-kansas-

00626; http://ncse.com/news/2007/02/evolution-returns-to-kansas-001070), and led to calls for "anti-evolution bills". This situation is unfortunately not limited to the United States, there is a real danger that this movement might cross to Europe and other countries (Gross 2002; Cornish-Bowden and Cárdenas 2007; Curry 2009; Borczyk 2010). So we can find an additional motivation why we should be careful with educating our young people in evolution, in Central Europe and also in Austria, where the head of the largest religious group (Roman Catholics) supports Intelligent Design (Schönborn 2005).

According to the European statistics office Eurostat, Austria in 2013 was the second richest country in the European Union measured as the Gross Domestic Product (GDP) per capita (http://epp.eurostat.ec.europa.eu/tgm/mapToolClosed.do?tab=map&init=1&plugin=1&language=en&pcode=tec00114&toolbox=types). So there is no reason to believe that educational standards in Austria should be far behind other countries, though there are some discussions going on with regard to other educational management issues (https://www.bifie.at/node/90). In a small pilot study to which we refer here (Fitsch 2011), we tried to investigate how much graduates, who are just about to leave the Austrian secondary schools (called "Gymnasium"), know about human evolution. Their knowledge should have reached a "peak" when they were interviewed because our respondents had just passed the school leaving examination (called "Matura") a few weeks or even days before filling out our questionnaire. The last reform of the syllabus for biology lessons in those secondary schools (BGBl II Nr. 277/2004, p. 53) resulted in a strong degradation of the topic human evolution *vis-à-vis* the disciplines of cell and molecular biology. Human evolution is no longer mentioned explicitly, which practically means it can be, but is not necessarily, taught. With regard to the developments mentioned above, there should be a vital interest of developed societies to promote general education in higher schools as well as the education of the general public with regard to its own biological origins, and, of course, to consider the related training at universities.

Material and methods

We included 157 pupils at the end of their final school year (aged 18–20) of four Austrian federal states (Lower Austria, Upper Austria, Styria and Vienna) and all kinds of types of "gymnasium" which have various specialities, e.g., humanities, natural sciences, technology, economics, sport, etc.

All of them were asked to fill in the same questionnaire. One part of the questions dealt with the general structure of the class and the education in biology:

- Which school was attended?
- How many years of education in biology were passed?
- Was the topic of human evolution treated?
- How many lessons were handling human evolution?
- Was demonstration material used for teaching human evolution?

– If yes, which ones?
– Do you remember the author and title of the school book used?
– Do you think that real models (casts) could support the understanding of human evolution?
– Do you have other ideas to improve the education in human evolution?
– How would you describe the biology lessons in general?
– Are you personally interested in human evolution?

The second part of the questionnaire tried to assess the pupil's actual knowledge in human evolution (see below). Moreover, structured interviews with university teachers who are responsible for the education of future biology teachers at the University of Vienna (among them the head of the Didactic centre for biology and the chairman of the Study group in biology), ten international experts in paleoanthropology [namely Sarah Elton (Hull York Medical School), Dean Falk (Florida State U), Donald Johanson (U Chicago), Andrew Kramer (U Tennessee), Gerd Müller (U Vienna), Jeffrey Schwartz (U Pittsburgh), Horst Seidler (U Vienna), Tanya Smith (Harvard U & MPI Leipzig), Fred Smith (U Illinois State), Ian Tattersall (AMNH New York City)], eight biology teachers in Austrian secondary schools, and one prominent German expert in didactics (namely Prof. Ulrich Kattmann, Carl von Ossietzky University Oldenburg) were included. The international experts in paleoanthropology were asked to describe the situation in their countries, their experience with first-year students, and their opinion about what should be taught in human evolution.

Results and discussion

The overall results draw a fairly positive first picture. More than 75% of the Austrian pupils included in this study were generally interested in human evolution, and 87% had the opportunity to hear about the topic in school. A similar outcome was achieved from the interviews of teachers. Most of the pupils were also aware of at least two important facts: 70% knew that our closest living relative is the chimpanzee, and almost 80% answered that the relative size of the brain correlates with its performance.

However, other questions, even quite simple ones as, for instance, the approximate period when our own species emerged, could not be answered correctly by even half of the pupils, some others only by an absolute minority of one or two individuals. Particularly it seems that there is a need to catch up with present-day developments. While, as noted, most of the pupils got in touch with the topic human evolution, they were not well informed about more current findings in this field of research (where we define "current" as having emerged from the last ten or twenty years). Instead, outdated "wisdom" seems to persist for quite long. The prime example is the direct connection between bipedalism and tool production which still dominates the perception of 17% of the respondents. We have evidence for upright locomotion from *Ardipithecus ramidus* from about 4.4 million years ago (White *et al*. 2009) and very likely also for *Orrorin tugenensis* from 6 million years ago (Pickford *et al*. 2002). The first stone tools, in contrast, emerge millions of years later (3.3 mya) in Lomekwi (Harmand *et al*. 2015; the indirect evidence for tool use based on cutmarks in Dikika 3.4 mya is rather vague and heavily disputed, see McPherron *et al*. 2010; Dominguez-Rodrigo *et al*. 2012). Of course we do not know if teachers obstinately continue to teach a view on hominid evolution dating from the 1960s or if pupils just stubbornly refuse to take notice of newer results. But at least at the teachers' front we could make some progress if we educate them further and provide newer books. There is of course always confusion about phylogenetic developments and their order in time. For instance, 7% of the pupils think that the formation of a vertebral column is one of the crucial developments of the last few million years that characterizes particularly humans. Obviously, there are not only gaps in knowledge about human evolution but with regard to evolution of vertebrates and invertebrates per se.

Things are changing fast in evolutionary sciences. Thus it is not easy to keep an up-to-date overview, even for experts and teachers. The question of who is currently the oldest known hominid in our potential ancestral line is difficult and cannot be answered with confidence. The intended choice in our questionnaire would have been *Sahelanthropus tchadensis*, published in 2002 by Brunet *et al*. Only two pupils (1.3%) checked this box, about three-quarters opted for australopithecines or *Homo erectus*. Sahelanthropus' position in the hominid line is unclear, nevertheless we would have expected that this spectacular finding dating from 7–6 mya and, not less important, originating from Central Africa instead of East Africa, would have made its way into the class room. On a closer look it turned out that the two successful subjects with regard to this question (out of 157) had both chosen human evolution as their major.

While we might consider the oldest hominid, which is in doubt anyway, as a minor gap in knowledge, the period when we anatomically modern humans appeared is certainly something central for education. More than a quarter (26.8%) of the pupils were stumped and gave no answer at all (the highest percentage for all questions), 10% opted for the correct dimension "200, 000 years", 17% for the adjacent time interval "50, 000 years" (which is true at least for Europe) and 11.5% chose "500, 000 years". Hence there is a strong tendency to under- or overestimate the time frame. In the extreme case, some pupils (1.3%) thought that modern humans did not emerge before 1,000 years ago, which would exclude Aristotle, Caesar, and Attila the Hun from our current species. Further 16% are of the mind that modern humans appeared only 10, 000 years ago which is approximately the onset of our civilization, but not of our biological rise.

The extent to which biology lessons were conducted in those schools involved in our study was quite similar. On average, biology is taught for three years in secondary schools, 54% of the pupils had no more than a meager one to four hours (in total over the years) devoted to human evolution, around 24% five to six hours, and only 7.6% heard more on the topic which was only due to the special interest of their teachers. Demonstration materials such as written und visual supplementations in the shape of TV documentaries and slide presentations are used frequently. Casts of human fossils are used more rarely (only about 34%) because they need too much time for handling and, as some teachers claimed, are not too informative. However, the polled teachers would be interested in new teaching aids, but mostly under the condition if they are offered together with time-saving working sheets for the class. The financial aspect also seems to be an important part in the acquisition of new demonstration materials, as teachers stated.

The training of future teachers at universities can be characterized as being rudimentary with regard to human evolution. There is no obligatory specialized course regarding this topic during their education. The university professors interviewed could confirm this situation and added that freshmen in biology hardly increase their knowledge about human evolution during their studies. The education at colleges in the United States is also similarly rudimentary, as some experts reported.

The results here concern only alumni of secondary schools, thus schools which focus on general education. We left out professional schools (for instance, technical schools) because there is often no biology class at all. The polled university professors, especially the paleoanthropologists in the US, think that human evolution should be part of the school curriculum in any case. With regard to the extent of such an education, even the experts do not agree. Nevertheless, the interviewed professors stated that younger pupils, approximately from ten years of age, are able to understand human evolution if it is offered adequately (Kattmann), and that the topic should be a central theme in all biology classes with connections to other fields as well (Pass). Attention should also be drawn on geological epochs because pupils have comprehension problems with this field of science (Elton).

Our results also show that there is a significant association between the use of demonstration materials and the knowledge about human evolution. A score of correct answers for questions regarding hominid evolution was computed. Those pupils who stated that demonstration materials had been used in class reached a significantly higher score than the others ($Z = -2.185$, $p = 0.029$). This suggests that it could be favourable if the frequency for using demonstration materials would be increased. No other variable (schools with focus on natural science vs. others, more years of biology vs. less years, touching the topic of human evolution in biology vs. avoiding the topic, using fossil casts vs. not using them, interest in biology vs. disinterest, particular interest in human evolution vs. disinterest) led to any significant difference in the scoring of knowledge.

Conclusions

In summary, human evolution is taught in most of the secondary schools in Austria, although the extent can be regarded as minor, and often with only little or no relation to the current scientific literature. The religious creation myths such as Intelligent Design and Creationism do not seem to have a big influence in our Austrian sample (only 5% stated that humans do not derive from ancestral primates). There is a good chance for improvements since the survey highlights the distinct interest of pupils in biology and human evolution. This interest influences the knowledge of the pupils in a positive way and should be brought forward. Education in human evolution could be started in lower grades because children of this age are likely able to understand this topic, especially in companion with other topics in biology. Cross links from evolution to other topics might improve the understanding of this complex issue considerably, and at the same time create comprehension in other topics such as medicine or genetics (e.g., with regard to diseases of civilization). The reflexive question about one's own nature can only be approached if evolution is considered (cf. Simpson 1966) or, as C. T. Dobzhansky (1973) phrased it: "*Nothing in biology makes sense except in the light of evolution*". Otherwise the biology class offers only a shortened view on the question "How do we function", but it does not shed light on the question "Why are we functioning this way?".

Acknowledgements
We are deeply grateful to all the pupils who volunteered to take part in our survey. We also thank our interview partners for their time and willingness to participate: Sarah Elton, Dean Falk, Walter Hödl, Leo Holemy, Donald Johanson, Ulrich Kattmann, Andrew Kramer, Gerd Müller, Günther Pass, Luitfried Salvini-Plawen, Jeffrey Schwartz, Horst Seidler, Fred Smith, Tanya Smith, Ian Tattersall, and eight anonymous biology teachers at Austrian secondary schools. We particularly thank Mag. Sonnberger for his support.

Résumé
Cet article a pour but d´évaluer l´importance de l´éducation scolaire dans l´apprentissage de l´évolution humaine dans les sociétés contemporaines modernes, à lumière du statu quo actuel caractérisant le système éducationnel autrichien. Dans le cadre d´une étude pilote, 157 élèves de terminale, âgés de 18 à 20 ans, et issus de différents types de gymnases dans quatre entités fédérées (Basse Autriche, Haute Autriche, Styrie, Vienne) ont été interrogés. Un questionnaire a permis de faire le point sur la structure générale de la classe et le niveau d´apprentissage en biologie. La seconde partie du questionnaire visait à évaluer, plus particulièrement, le niveau de connaissance des élèves en matière d´évolution humaine. Enfin, des interviews structurées avec des enseignants, des professeurs d´université, ainsi que des experts en pédagogie et en paléoanthropologie, ont été menées et analysées. Bien que l´évolution humaine soit enseignée dans la plupart des écoles secondaires en Autriche, notre étude démontre que son importance est mineure, par rapport aux domaines de la biologie cellulaire et moléculaire. Par ailleurs, l´enseignement de l´évolution humaine n´est que rarement mis en relation avec la littérature scientifique récente. Or, il est avéré que l´emploi de matériel de démonstration en classe contribue significativement à l´enrichissement de la connaissance. Les mythes créateurs de type Intelligent Design et Créationnisme ne semblent pas exercer d´influence significative dans l´échantillon autrichien pris en compte. Les possibilités de perfectionnement sont nombreuses, d´autant plus que notre étude démontre tout l´intérêt porté par les élèves à la biologie en général, et à l´évolution humaine en particulier. Les liens croisés de l´évolution humaines avec d´autres thèmes devraient à l´avenir permettre d´améliorer considérablement la compréhension de ce champ d´étude complexe.

Zusammenfassung
Der Artikel diskutiert die Bedeutung der Bildung hinsichtlich menschlicher Evolution in modernen entwickelten Gesellschaften und macht den Versuch, die aktuelle Situation in

Österreich einzuschätzen. In einer Pilotstudie wurden 157 SchülerInnen nach Beendigung ihres letzten Schuljahres (im Alter von 18–20 Jahren) in vier österreichischen Bundesländern (Niederösterreich, Oberösterreich, Steiermark, Wien) und in verschiedensten Gymnasialtypen einbezogen. Mithilfe eines Fragebogens wurden Hintergrundinformationen über die generelle Struktur der Biologiestunden erhoben. Der zweite Teil des Fragebogens versuchte, das gegenwärtige Wissen der SchülerInnen zum Thema menschliche Evolution zu beurteilen. Darüber hinaus wurden strukturierte Interviews mit Schul- und UniversitätslehrerInnen geführt, sowie mit ExpertInnen in biologischer Didaktik und Paläoanthropologie. Zusammenfassend kann gesagt werden, dass menschliche Evolution in den meisten Oberstufen der Gymnasien in Österreich unterrichtet wird, wenngleich auch in einem sehr geringen Ausmaß, vor allem im Vergleich mit Zell- und Molekularbiologie. Auch weist der Unterricht nur sehr wenig bis gar keine Verbindung mit der gegenwärtigen wissenschaftlichen Literatur auf. Die Benutzung von Anschauungsmaterialien erhöhte das Wissen signifikant. Religiöse Kreationsmythen wie Intelligent Design oder Kreationismus scheinen noch keinen großen Einfluss in Österreich zu haben. Es gibt eine gute Chance für Verbesserungen, da die Studie das deutliche Interesse der SchülerInnen an Biologie und menschlicher Evolution belegt. Querverbindungen von der Evolution zu anderen Fachbereichen könnten beträchtlich helfen, das komplexe Thema verständlicher zu machen.

BEČOV IV – EIN FUNDORT DES JUNGACHEULÉEN IN BÖHMEN

Ivana Fridrichová-Sýkorová

Zusammenfassung

Obwohl Bečov IV eine Oberflächenfundstelle ist, stellen wir sie aufgrund der Analyse der Steinabschlagindustrie sowie der geologischen und geomorphologischen Ansprache an den Beginn des Mittelpaläolithikums, und zwar an den Anfang des Saaleglazials (OIS 8; vor ca. 300.000–250.000 Jahren). Kulturell gehört das Artefaktinventar mit der geringen Menge an Faustkeilen sowie mit dem Nachweis der Levalloistechnik bei der Verarbeitung des Steinrohmaterials in das Jungacheuléen. Für einen vergleichbaren Fundplatz halten wir Markkleeberg (Sachsen) in Deutschland.

Schlüsselworte

Mittelpaläolithikum, Typologie der Steinartefakte, Siedlungsstruktur, Tschechische Republik, Bečov

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Einleitung

Das Areal der mittelpaläolithischen Besiedlung auf der Gemarkung der Gemeinden Bečov und Břvany kann heute auf einer Fläche von ca. 22 ha (das ursprüngliche Ausmaß betrug um die 60 ha) auf dem Südhang der Anhöhe „Písečný vrch“ (260 m ü. NN) erfasst werden (Abbildung 1). Aus makrogeologischer Sicht gehört dieses Gebiet zu den westlichen Ausläufern des Komotauer Abschnitts des nordböhmischen Braunkohlebeckens. Die Ostpartie ist Teil des „Eger-Mittelgebirges“ (Ohárecko-středohorská oblast) des böhmischen Kreidebeckens. Das gesamte Gebiet mit dem deutlich ausgeprägten Flusstal der Eger (Ohře) hat ein flaches bis sanft gewelltes Relief und wird überragt von den deutlichen Erhebungen der Neovulkanite.

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Abbildung 1: Ansicht des Fundorts Bečov IV. Vorn: Versickerung der Mineralquelle; im Hintergrund: die intensive Landwirtschaft bedingt die unwiederbringliche Zerstörung des Fundorts.

Bečov IV befindet sich im flachen Tal des Hrádecký-Bachs, der schon während der Besiedlung dieser Landschaft durch die Jäger des Jungacheuléen eine wichtige Entwässerungsachse des untersuchten Gebiets bildete. Die Landschaft wurde im Mittelpleistozän im Verlaufe des Elster-Komplexes geformt und ist im Wesentlichen bis in die Gegenwart erhalten geblieben.

Forschungsgeschichte und Geologie des Fundorts Bečov IV

Bečov IV wurde schon Mitte der 60er Jahre des 20. Jhdts. entdeckt (Fridrich 1980, 1982, 2005, 2007). Allerdings fanden die letzten Geländearbeiten erst Ende der 90er Jahre statt. Damals ist die Lokalität durch die intensive landwirtschaftliche Nutzung systematisch zerstört worden. Heute ist der Fundort Bečov IV praktisch vernichtet. Bedeutend für eine Beurteilung des untersuchten Fundorts ist seine Lage am Rand des breiten und flachen Tals am Unterlauf des Hrádecký-Bachs. Der Bach selbst befindet sich 1.5 km südlich des mittelpaläolithischen Siedlungsareals. Das Tal ist von den deutlichen Erhebungen der Neovulkanite begrenzt, welche die umliegende Landschaft um 250 m überragen. Der Hauptfluss dieses Gebiets – die Eger – war ca. 3.5 km entfernt und floss schon damals in die heutige Richtung. Geschützt durch die umgebenden Neovulkanite nahm das Tal zur Zeit der Besiedlung durch die Jäger des Jungacheuléen eine mikroklimatisch sehr begünstigte Lage ein. Die Tatsache, dass sich das Siedlungsareal zum Süden hin am Fuß der Anhöhe „Písečný vrch“, die die umliegende Landschaft um ungefähr 60 m überragt, befindet, hat dieses günstige Mikroklima noch gefördert. Überdies wird das Siedlungsareal von natürlichen Wasserquellen versorgt, die von Tiefenmineralwasser gespeist werden.

Eine wichtige Rolle für die Auswahl des Orts, die von den hohen Ansprüchen zeugt, die von den Jägern und Sammlern an die Lage des Siedlungsareals gestellt wurden, spielt die Anhöhe Písečný vrch, die als „strategischer Beobachtungsposten“ genutzt werden konnte. Von hier aus konnte ein beträchtlicher Ausschnitt der umliegenden Landschaft kontrolliert werden, wie die Furt, der Flusslauf des Egers und das Delta des Hrádecký-Bachs. Diese Funktion der Anhöhe schließt auch eine Nutzung als Rückzugsgebiet nicht aus, was die in dem Abri an seinem Abhang dokumentierte Industrie des Acheuléen belegt. Das Vorkommen eines Rohstoffs von hervorragender Qualität – dem Quarzstein, dessen lokale Variante als Quarz vom Typ Bečov bezeichnet wird, bot einen weiteren Grund zur Besiedlung dieses Gebiets. Dieser Silizit stellt einen hoch amorphen, perfekt spaltbaren Steinrohstoff dar, welcher zur Zeit des Jungacheuléen in Bečov IV zur Hauptquelle bei der Herstellung der Abschlagindustrie (93.72%) wurde. Weitere Silizite, die die Ansprüche der Jäger und Sammler an das lithische Rohmaterial erfüllten, wurden nur ergänzend verwendet und stammen aus der näheren Umgebung, so etwa Porzellanite aus Verpánek (aus ca. 1 km Entfernung) oder aus Dobrčice (ca. 6.5 km), Gerölle aus den Anschwemmungen der Ur-Eger („Paleoohře“) (ca. 3 km) sowie Quarze des Typs Skršín (ca. 5.5 km).

Typologie der Steinartefakte

Von der Oberflächenfundstelle Bečov IV konnte ein Inventar von insgesamt 5.577 Steinartefakten geborgen werden, die Spuren von Windschliff aufweisen (Abbildung 2). Diese wurden nach der klassischen Typologie in 25 Typen geordnet (die überdies noch in weitere Untertypen und Varianten differenziert wurden). Zu den technologischen Artefakten zählen wir Kerne (Abbildung 3), Abschläge, untypische Bruchstücke sowie sogenannte Thermolithe; zu den Geräten Bifaces s. l., Keile, Schlagsteine, Unterlagen, Schaber, Messer, Spitzen, Stichel, Bohrer, gekerbte Stücke, Schlägel, Meißel, Locher und Polyhedrone s. l. Im Fall der Kerne registrieren wir eine außerordentlich hohe Variationsbreite (insgesamt 11 Untertypen), die auf einen ausgeklügelten Prozess der Steinbearbeitung, z. B. bei den Levalloiskernen hinweist. Es treten allerdings auch amorphe Kerne auf, die von einer einfachen Gewinnungsart der Abschläge zeugen. Dieser Trend hängt vermutlich mit der hohen Verfügbarkeit des Steinrohmaterials zusammen. Die Abschläge (unterschiedliche

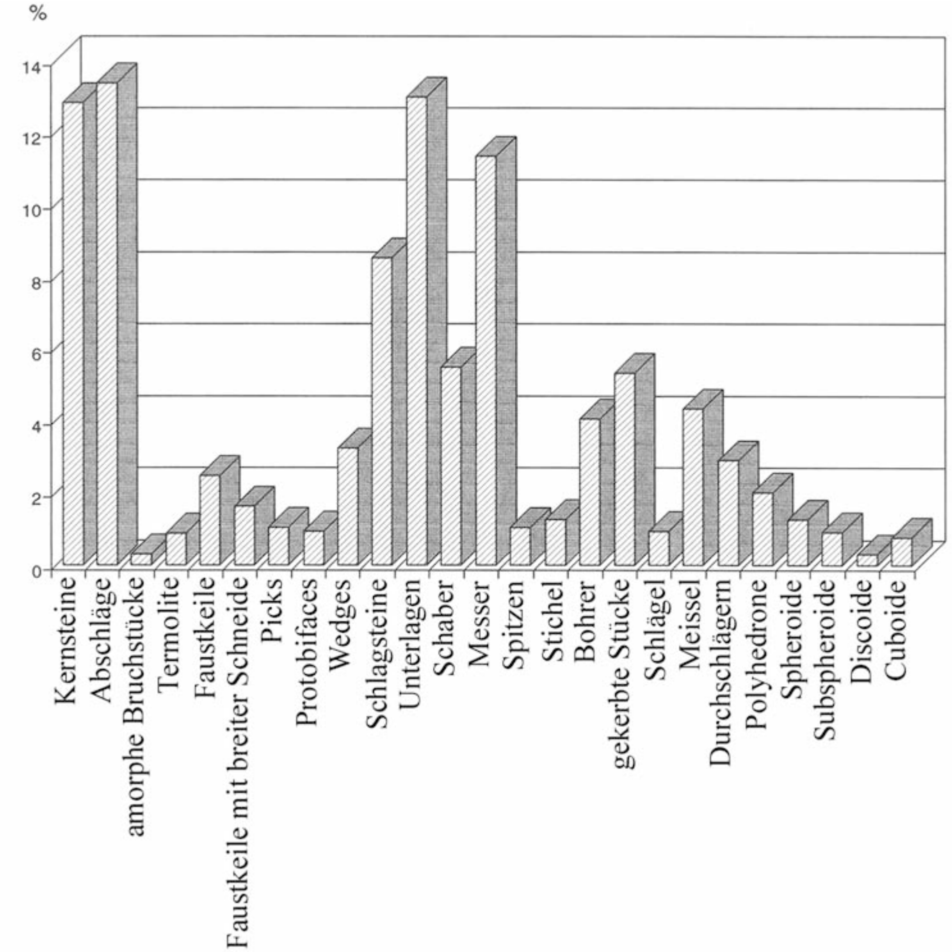

Abbildung 2: Bečov IV bei Most. Beispiele einzelner Typen der Steinabschlagindustrie.

Formen von Levalloisabschlägen), die sich durch eine hohe handwerkliche Qualität auszeichnen, stützen diese Beobachtung. Andererseits befinden sich im Inventar auch grobe massive Abschläge (gelegentlich direkt für konkrete Arbeitsaktivitäten wie Schneiden oder Hacken bestimmt) ohne Spuren einer vorangegangenen komplexen Zurichtung.

Im Zusammenhang mit technologischen Artefakten sollte das Vorkommen der sogenannten Thermolithen erwähnt werden. Diese belegen die Verwendung von Kochsteinen und damit auch die Feuernutzung in diesem Siedlungsareal. Im Fall der Geräte treten Typen auf, die mit der altpaläolithischen Tradition in Verbindung stehen. Zu diesen können nicht nur die Bifaces s. l., wie Faustkeile, Faustkeile mit breiter Schneide, Picks, Protobifaces, sondern auch die Polyhedrone, wie Spheroide, Subspheroide, Discoide und Cuboide u.a. gezählt werden. Während die Bifaces eine gewisse Formenfreiheit bei der Herstellung zeigen, müssen die Polyhedrone als sehr konservativ bewertet werden.

Die Standardausstattung im Inventar bilden die Schaber. Diese können in 22 Varianten unterteilt werden. Vor allem Schaber mit gekerbter oder gezähnter Kante

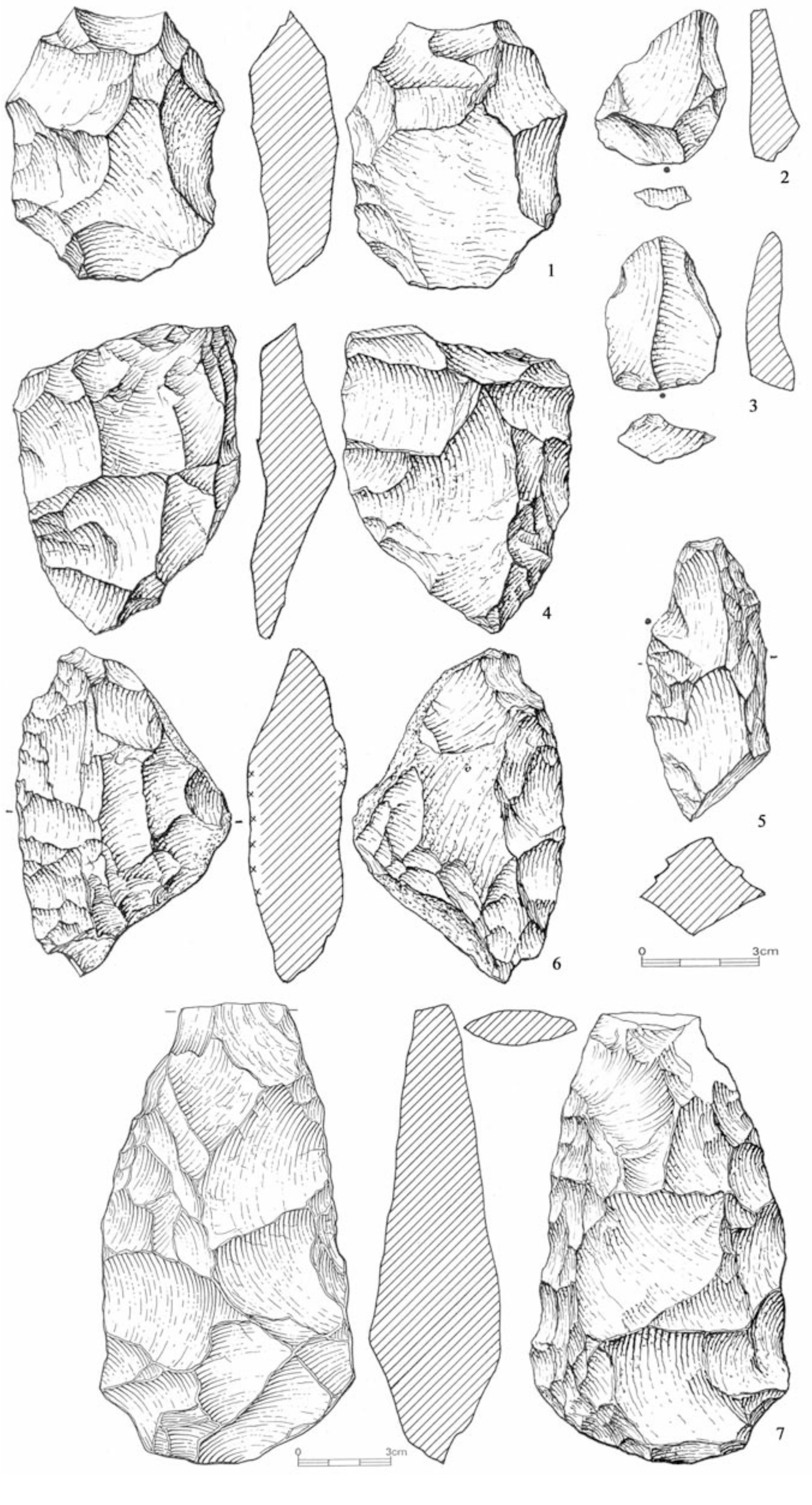

Abbildung 3: Bečov IV bei Most. Die Steinabschlagindustrie. Legende: 1 – Diskuskern; 2, 3 – Levalloisabschläge; 4 – Levalloiskern; 5 – Spitze des Typs Quinson; 6 – Keilmeser; 7 – Langgestreckter Faustkeil.

und kurz retuschierte Schaber sind typisch. Ähnlich häufig kommen Messer (in 11 Varianten unterteilt) vor. Es handelt sich um Keilmesser und Messer mit Stichelschlag, d. h. irgendeine Art „Proto-Prondnikmesser". Die Spitzen treten in zehn Varianten im Inventar auf. Es sollen hier vor allem die Blattspitzen sowie die Spitzen des Typs Quinson erwähnt werden. Das gewählte Rohmaterial bedingt offenbar den geringen Anteil der Schlägel. Das Vorkommen der Locher ist mit der Bearbeitung der organischen Materialien – vor allem von Leder – verbunden. Eine große Gruppe unter den Geräten stellen Schlagsteine und Unterlagen dar, d. h. Artefakte zur Herstellung weiterer Stein-, Holz-, Knochen- und Geweihgeräte. Die Geräte aus organischen Materialien haben sich allerdings an diesem Fundort nicht erhalten. Die Schlagsteine werden gemäß den Arbeitspuren als Artefakte zum Abschlagen und Brechen sowie zum Schleifen oder Zerkleinern (Schlagsteine-Reibsteine) bezeichnet. Im Fall der Unterlagen ist ein ähnlicher Ansatz verwendet worden. Neben Unterlagen, deren Verwendung am besten vom Terminus „Amboss" beschrieben wird, wurden sogenannte „Paletten" (zum Brechen und Anreiben pflanzlicher Produkte oder Mineralfarbstoffe) bestimmt.

Das umfangreiche Inventar der Steinabschlagindustrie aus Bečov IV ermöglichte auch die Durchführung einer morphometrischen Analyse. Dabei wurde festgestellt, dass das untersuchte Inventar einen einheitlichen mittelpaläolithischen Komplex mit einem hohen Maß an Standardisierung bei der Gerätherstellung darstellt. Einzelne Artefakttypen oder ganze Gruppen entstanden nach einem vorgegebenen Herstellungsschema, welches ein hohes Niveau an Spezialisierung belegt. Das Gewicht aller von uns aufgenommenen Artefakte bewegt sich um die 2.700 kg. Fast 13% der Artefakte weisen Brandspuren auf. Die Durchschnittslänge der Artefakte (9.87 cm) sowie der Durchschnittswert des Spherizität-Index (0.56) stellen das Inventar aus Bečov IV in die Reihe der größeren, mittelrobusten Industrien des Mittelpaläolithikums.

Diskussion

Ausgehend von der räumlichen Verteilung der Artefakte auf dem Fundplatz teilen wir diesen in zwei Grundzonen. Eine Existenz von Wohnstrukturen setzen wir für die westliche Zone voraus. Dagegen können wir in der östlichen Zone mit Herstellungs- und Verarbeitungsaktivitäten rechnen. Diese zwei Zonen befanden sich auf flachen Erhebungen in der Nähe der Wasserquellen. Aus der Tatsache, dass Artefakte eines breiten Typspektrums auf dem Fundplatz vertreten sind, folgern wir, dass die Lokalität Bečov IV als Basislager einer großen Gemeinschaft (oder mehrerer Gruppen) von Jungacheuléenjägern diente, da es auf einen organisierten Raumes innerhalb des Siedlungsareals hinweist.

Obwohl Bečov IV eine Oberflächenfundstelle ist, stellen wir sie aufgrund der Analyse der Steinabschlagindustrie sowie der geologischen und geomorphologischen Ansprache an den Beginn des Mittelpaläolithikums, und zwar an den Anfang des Saaleglazials (OIS 8; vor ca. 300.000–250.000 Jahren). Kulturell gehört das Artefaktinventar mit der geringen Menge an Faustkeilen sowie mit dem Nachweis der Levalloistechnik bei der Verarbeitung des Steinrohmaterials in das Jungacheuléen. Für einen vergleichbaren Fundplatz halten wir Markkleeberg (Sachsen) in Deutschland (Fridrich und Sýkorová 2005; Fridrich und Fridrichová-Sýkorová 2009, 2010; Šajnerová-Dušková *et al.* 2009). Bečov IV repräsentiert einen weiteren großen Fundort, der zum Verständnis des Besiedlungsprozesses Mitteleuropas am Anfang des Mittelpaläolithikums beitragen könnte.

Résumé

L´assemblage lithique de Bečov IV représente une collection de surface, caractérisée par un faible pourcentage de bifaces, ainsi que par la présence de la technique Levallois. Le site date du début du Paléolithique moyen, au début du Saalien (OIS 80–250,000 ans avant le présent), sur base de l´étude de l´industrie lithique et du contexte géologique et géomorphologique du site.

Summary

The assemblage of the Bečov IV site represents a surface collection of artifacts, characterized by a small number of hand axes and presence of the Levallois technique in stone raw material processing. According to the stone industry analysis and geological and geomorphological evidence the site is dated to the beginning of the Middle Paleolithic, namely to the beginning of the Saale glacial (OIS 8; circa 300.0 to 250.0 ky).

A NEW PALEOLITHIC OPEN-AIR SITE AT KONOJEDY IN NORTHERN BOHEMIA?

Vladimír Peša

Abstract
The main Paleolithic open-air sites (Stvolínky, Holany) are situated on sandstone elevations above swamps in the southwestern part of the Česká Lípa district. The new artifact found by antiquarian Zdeněk Fidrhel in 2013 near Konojedy is a quartzite hand axe dated to the Middle Paleolithic.

Keywords
Middle Paleolithic, stone artifacts, Czech Republic, Konojedy

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The territory of Northern Bohemia is one of the best-known Paleolithic regions outside the karst landscapes in the Czech Republic. The settlement patterns of the Middle and Late Paleolithic have been studied since the 1970s by Jiří Svoboda (1980, 2001), together with Mesolithic occupation in different zones of the sandstone landscape (Svoboda 2003; Svoboda *et al*. 2013). The main Paleolithic open-air sites (Stvolínky, Holany) are situated on sandstone elevations above swamps – presently ponds – in the so-called Jestřebí Basin in the southwestern part of the Česká Lípa district (Figure 1). Tertiary volcanic mountains of the Central Bohemian Uplands frame the north border of this basin, and they divide the Paleolithic area into lowlands in Lusatia and Saxony (Germany). The neighboring areas in the south consist of rocky sandstone landscapes with many rock-shelters without known Paleolithic finds or sediments.

An antiquarian, Mr. Zdeněk Fidrhel (Česká Lípa), informed the author in 2013 about an artifact from his collection found previously at Konojedy village in the adjacent district of Litoměřice, a distance of about 8 km from the closest Paleolithic site, Stvolínky I. The location near Konojedy, however, is in a different natural

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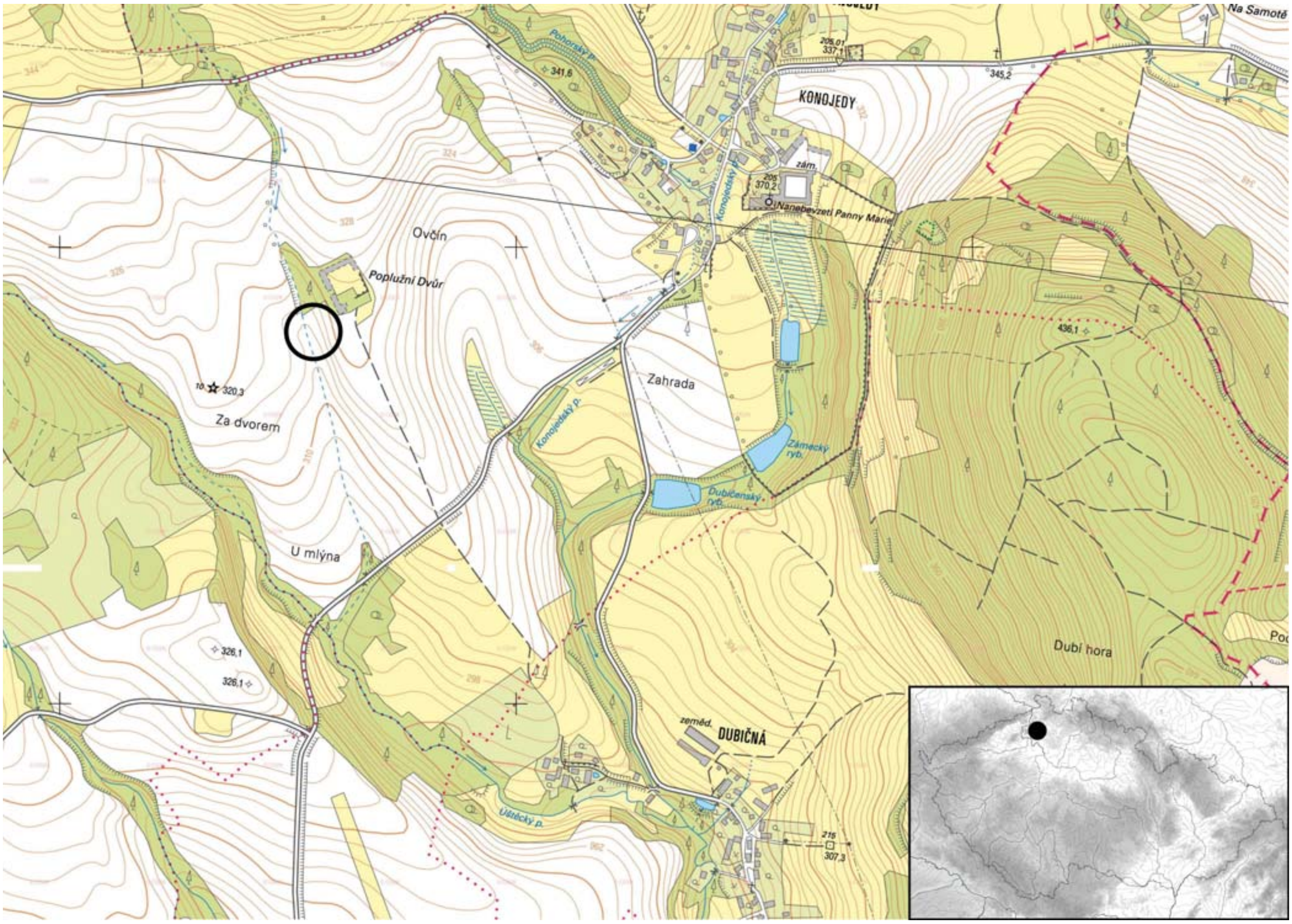

Figure 1: The site at Konojedy in Northern Bohemia. The map background was downloaded at: http://www.mapy.cz/zakladni?x=14.3520100&y=50.6276154&z=12&q=Konojedy by Seznam.cz, a.s. 2011, NAVTEQ; 10. 1. 2014.

formation than the above-mentioned sites in the Jestřebí Basin. It spreads along the sloping elevation of the southern foothills of the Central Bohemian Uplands near the disused farm of Poplužní Dvůr cca 1,200 m east of Konojedy in an area called "Za dvorem", cca 320 m a.s.l. The artifact is a quartzite hand axe approximately 14.5 cm long and approximately 9 cm wide (Figure 2). A brown patina covers the whole artifact. The site is planned to be investigated.

Résumé

La partie sud-ouest de la circonscription de Česká Lípa (nord de la Bohême) est une région qui présente des occupations allant du Paléolithique moyen jusqu'au Tardiglaciaire (cf. les différents articles publiés depuis une trentaine d'année par J. Svoboda). En 2013, la nouvelle découverte d'un biface provenant du site Konojedy, situé à 8 km du site paléolithique de Stvolínky I a été signalée.

Figure 2: A quartzite hand axe (diameters: 14.5 × 9 cm). Photo by Vladimír Štěpánský.

Zusammenfassung

Der südwestliche Teil des Bezirks Česká Lípa in Nordböhmen gehört zu den Gebieten mit einer belegten Besiedlung schon im Mittel- und Spätpaläolithikum. Im Verlauf der letzten 30 Jahren wurde diese Besiedlungsgeschichte fortlaufend von Jiří Svoboda veröffentlicht. 2013 wurde der Fund eines Faustkeils aus einer unbekannten Lage beim Ort Konojedy bekannt, in nur 8 km Entfernung vom paläolithischen Fundplatz Stvolínky I. Eine weitere Untersuchung der Fundstelle bei Konojedy wird geplant.

UPPER ACHEULEAN OCCUPATION OF WESTERN BOHEMIA

Pavel Břicháček[1] and Petr Šída[2]

Abstract
Recently, several new sites dated to Upper Acheulean were discovered during the systematic prospection of surface done by P. Brichacek in Western Bohemia region. In this paper will be discussed only three sites, namely Stříbro, Hromnice I, II and Břetislav with medium to large collections of stone artifacts, including bifaces as a significant element of this chronological period. Additionally, two dozen sites yielding smaller, insignificant collections were detected in this region.

Keywords
Lower Middle Paleolithic, Czech Republic, Stříbro, Hromnice, Břetislav, settlement, stone artifacts

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Introduction

Settlement of the lower Middle Paleolithic in Bohemia has been systematically examined since the 1950s. The first findings of bifaces were made in the fifties by František Prošek near Srbsko village (Prošek 1947; Fridrich 1982) and Mojmír Mazálek in Putim-Ražice village (Pikarna hill) near Písek town (Mazálek 1952, 1953; Žebera 1958; Fridrich 1982). At the end of the decade Vladimír Stárka and Karel Žebera discovered one of the largest sites of this period near Mlazice village near Mělník town (Žebera 1969; Fridrich 1982). Since the 1960s Jan Fridrich has examined the largest complex of Upper Acheulean sites around the hill Písečný Vrch near Bečov by the town Most (Fridrich 1982; Fridrich and Sýkorová 2005). And also in the sixties Fridrich Hammer and Jan Fridrich discovered a small site in Mutějovice (Fridrich 1982). In the seventies Jiří Svoboda (1979) identified the first

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northern Bohemian Upper Acheulean site in Stvolínky village. This was for a long time the only one dated to this age in the North Bohemian sandstone region. New findings indicate the presence of Lower Middle Paleolithic sites in the area located eastwards, in the Bohemian Paradise (Chloumecko hill); the first occasional finds were made by Jaroslav Černohouz (1953). Eastern, Western and Southern Bohemia, however, remained until recent times without significant sites of the lower phase of the Middle Paleolithic. Eastern Bohemia still remains a blank spot on the map, and in Southern Bohemia, apart from Putim-Ražice village, some other small sites were discovered in the Budějovice Basin (namely Sedlec, Lékařova Lhota). On the border between Central and Western Bohemia explored during 1980s Pavel Břicháček one of Acheulean largest sites around Stašov village. Since then thanks to the systematic surface survey, several new sites of this period have been discovered in Western

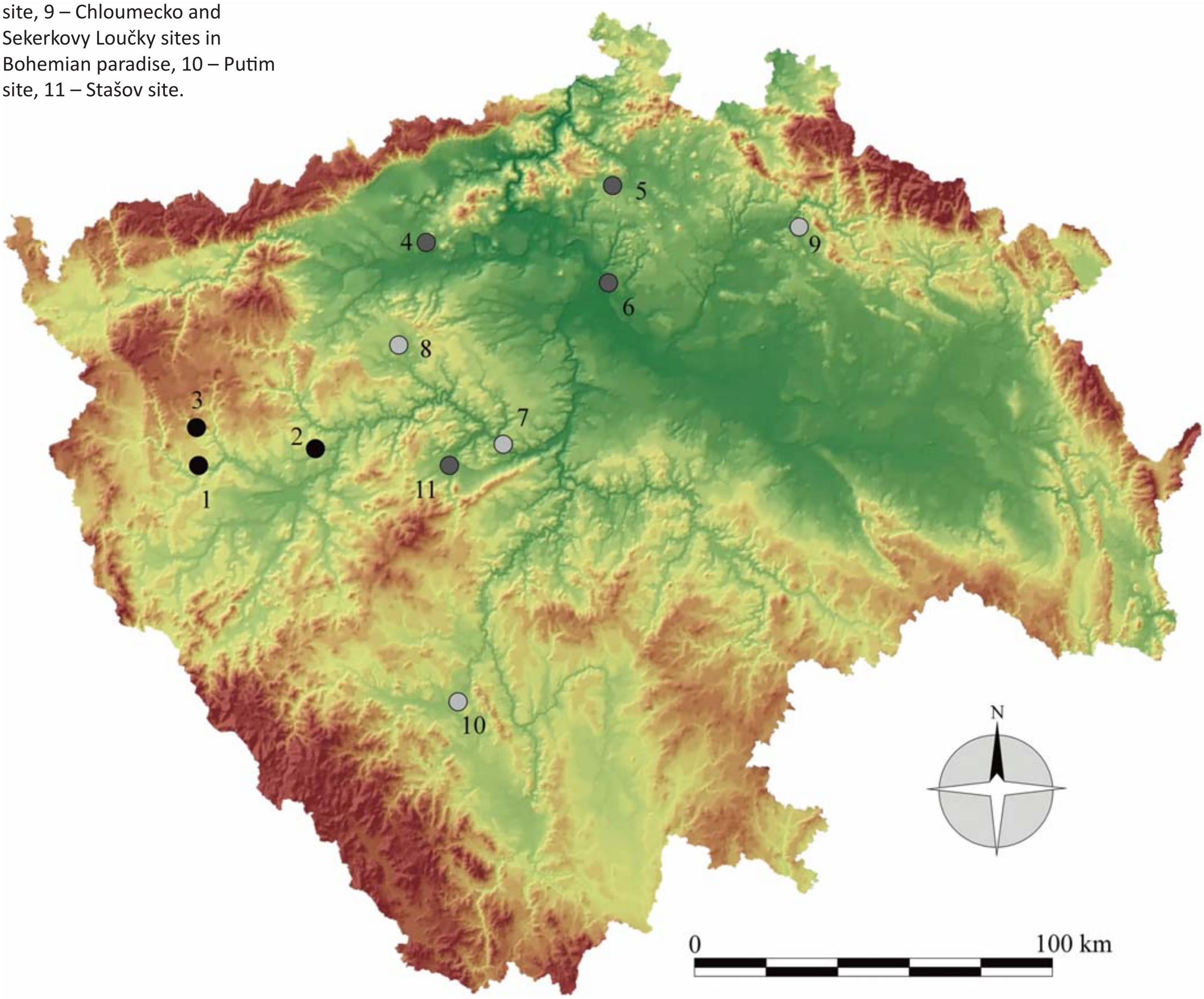


Figure 1: Bohemia. Upper Acheulean sites in Bohemia. 1 – Stříbro site, 2 – Hromnice site, 3 – Břetislav site, 4 – Bečov site, 5 – Stvolínky site, 6 – Mlazice site, 7 – Srbsko site, 8 – Mutějovice site, 9 – Chloumecko and Sekerkovy Loučky sites in Bohemian paradise, 10 – Putim site, 11 – Stašov site.

Bohemia (Břicháček 2010). Besides about two dozen sites yielding smaller, insignificant collections, which are not discussed in this text, there are three sites with medium to large collections with bifaces – a significant element of this chronological period; namely Stříbro, Hromnice (I and II) and Břetislav (Figure 1).

Western Bohemia in many ways is reminiscent of the whole of Bohemia in miniature. It is a basin enclosed on all sides, drained by a single river (the Berounka) to the northeast. From all sides it is encircled by mountain ranges and uplands (from the south, the Šumava Mountains, Český Les, Teplá, Křivoklát Highlands and Brdy Mountain). Among these ranges are passes that enable communication with the surrounding regions: Northwestern and Central Bohemia, Southern Bohemia and south to Bavaria. The distribution of river networks and the mountain ranges has not changed significantly in the last 250.0 ky, except there was a rejuvenation of the relief associated with significant sinking river beds during the last three glacial periods. In general we can use the characteristics of the relief as it appears today for the studied period.

Western Bohemia is a region which has no resources of quality silicites, but it is rich in large accumulations of Tertiary and Quaternary gravels, which contain a number of large boulders of sedimentary quartzite, quartz and quartzites. These may in some cases achieve a high quality (as in the case of Stříbro site), which is comparable to silicites. The largest accumulation can be found along the Mže river (Stříbro site), in the region of the river Třemošná (Hromnice site) and then in a belt stretching across the Rakovník region to Northwestern Bohemia. This boulder material was eroded throughout the Quaternary and was transported by the Berounka River to the north, where it appears in the river terraces and in archeological assemblages of this period around the Berounka River.

Stříbro site

Description of site

The site is located north of the town center on a large flat area of Doubrava hill at an altitude of 432–446 m. It is 48–62 m above the present level of the Mže River, which flows around the southern edge of the site at a distance of 1.2–1.5 km (Figure 3). The bedrock consists of Proterozoic phyllites over almost the entire area, but on the top of the mountain are also preserved sandy gravels and gravelly sands dated to the Neogene (Břicháček 2010). They together with phyllites were eroded and created deluvial sediments on the southern slope. Raw material for stone industry was collected from Tertiary sediments in the area of the site. In the whole area of the hill top there are no significant Quaternary sediments; so that all artifacts are today in the topsoil and certainly have high frequency of changes in their position.

The site was explored by Pavel Břicháček in 2008 during archeological supervision of construction of sewage and communications for a newly built residential area on the southern edge of the site. The density of artifacts is not high in this space; in squares of 5 × 5 m just one to three artifacts were located. In the

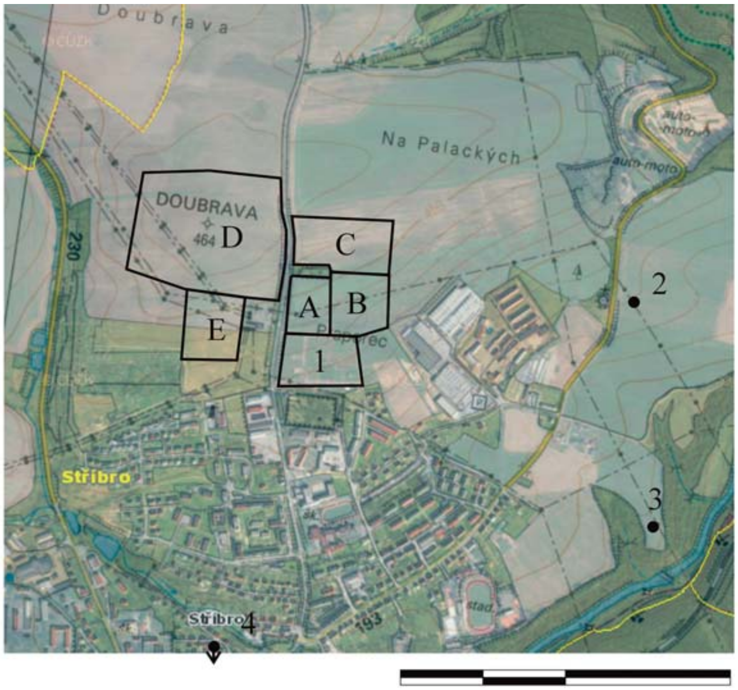


Figure 2: Stříbro site. Extent of artifact dispersion. A–E – area of surface collecting, 1 – area of rescue excavation on house construction, 2–4 – single, until now isolated, finds.

Figure 3: Stříbro site. View from area C to southeast to the Mže river valley.

central part of the position on the hill top the number of finds rapidly increased (Břicháček 2010). This area has been subjected to intensive surface survey, which so far has yielded more than 1,200 artifacts. Their evaluations are still running, thus this paper presents only one-third of achieved results. Artifacts were distributed over an area 800 × 600 m, but exploration continues, and findings outside the central concentration (Figure 2: 2–4) foreshadow a much greater range of settlement.

Raw material sources

The main source of raw material at Stříbro site consists of quartzite boulders of very good quality (Table 1). They can be found in the relics of Tertiary and Lower Pleistocene terraces around the site. According to color we recognize the varieties of white quartzite and honey colored quartzites and a transitional form between them. The original source of these high-quality quartzites remains unknown; so far we know them only from the terraces. In the already evaluated part of the collection from Stříbro site, the 60.4% of the assemblage consists of this material. Another raw material used is quartz, again found in boulder form in the terraces. This constitutes 39.2% of the assessed assemblage. We distinguish between the white and "blue" variety. The translucent blue variety probably comes from pegmatites, the white probably comes from the quartz wall of the Bohemian forest hills. Both types of materials are the local raw material source (within a distance of 5 km). The only stone to come from a longer distance is limonite breccia, probably brought from the area of carboniferous Pilsen basin (about 20 km). The fragments of limonitic rocks are more frequent at Stříbro site, which could be most probably explained by their usage as pigments (Břicháček 2010).

Stone artifacts

Technotypological composition of the collection is significantly influenced by the methodology of collecting artifacts, based on selective surface collecting when the attention was focused on the distinctive types of findings, and state of processing of the whole collection (Table 1). Therefore, the retouched tools are strongly overestimated in comparison to the debitage (ratio of almost 1:1). Debitage is represented by standard types of artifacts, namely fragments, flakes (including Levallois forms), cores and unfinished bifaces. High variability displays the category of cores, where cores with reduced technology and also full Levallois cores with all stages of treatment can be detected.

Bifaces make up more than 7.0% of the collection (23 artifacts). They are documented as bifaces of particular types, and their reduced smaller variants. The largest part of the retouched tools is traditionally sidescrapers (20.3%), which are characterized by enormous variability in shape. Besides their combinations with notches and burins, endscrapers and points can be detected within the assemblage. In smaller number are represented knives, burins and borers, and choppers are also frequent (5.4%). Other artifacts are represented by hammerstones and manuport of raw material (probably used like a pigment) (1.6% of total collection).

The composition and morphology of tools within the Stříbro collection is fully comparable with large sites of the Upper Acheulean (such as Bečov IV, Markkleeberg). With good cleavage raw materials are typically present as variant cores with all phases of preparation developed and Levallois flake technology and Levallois points are also used. Reduction of the technological process (cores with protruding boulder surface, simple lemon-quarter cores, and chopper cores) is not used commonly. Some of the artifacts have been exposed to very weak eolization and corrosion, these are very transparent to understand of technological processes, but some other pieces are affected very strongly to the border of readability. The good quality local quartzite has not yet been published anywhere else, so we chose the name quartzite of Stříbro type for this raw material (Figures 4 and 5).

Table 1: Stříbro. Technotypological and raw material composition of evaluated assemblage.

type	white quarzite	brown quarzite	white--brown quarzite	quarzite	*quarzites total*	white quartz	blue quartz	*quartz total*	limonite brekcia	total	%
fragment	14	10	1		25	36	1	37		62	19.6
flake	26	10	1	1	38	24	1	25		63	19.9
pseudolevallois point	1				1					1	0.3
core	20	6	4		30	8	1	9		39	12.3
unfinished biface	4	1			5	1		1		6	1.9
debitage	*65*	*27*	*6*	*1*	*99*	*69*	*3*	*72*	*0*	*171*	*54.1*
biface	4	3			7	3		3		10	3.2
wedge	2				2	11		11		13	4.1
bifaces	*6*	*3*			*9*	*14*		*14*		*23*	*7.3*
sidescraper	33	11	2		46	18		18		64	20.3
sidescraper - notch	1				1					1	0.3
sidescraper - burin	1				1					1	0.3
endscraper	1	2			3					3	0.9
point	3	2		2	7	2		2		9	2.8
notch	4	3			7	7		7		14	4.4
knive	1	2			3					3	0.9
burin		2			2	1		1		3	0.9
chopper	9		1		10	7		7		17	5.4
borer	1				1	1		1		2	0.6
retouched tools	*60*	*25*	*3*	*2*	*90*	*50*	*0*	*50*	*0*	*140*	*44.3*
hammersone						2		2		2	0.6
core/hammerstone	2				2					2	0.6
manuport									1	1	0.3
other finds	*2*				*2*	*2*		*2*	*1*	*5*	*1.6*
total	**127**	**52**	**9**	**3**	**191**	**121**	**3**	**124**	**1**	**316**	**100**
%	40.2	16.5	2.8	0.9	60.4	38.3	0.9	39.2	0.3	100	

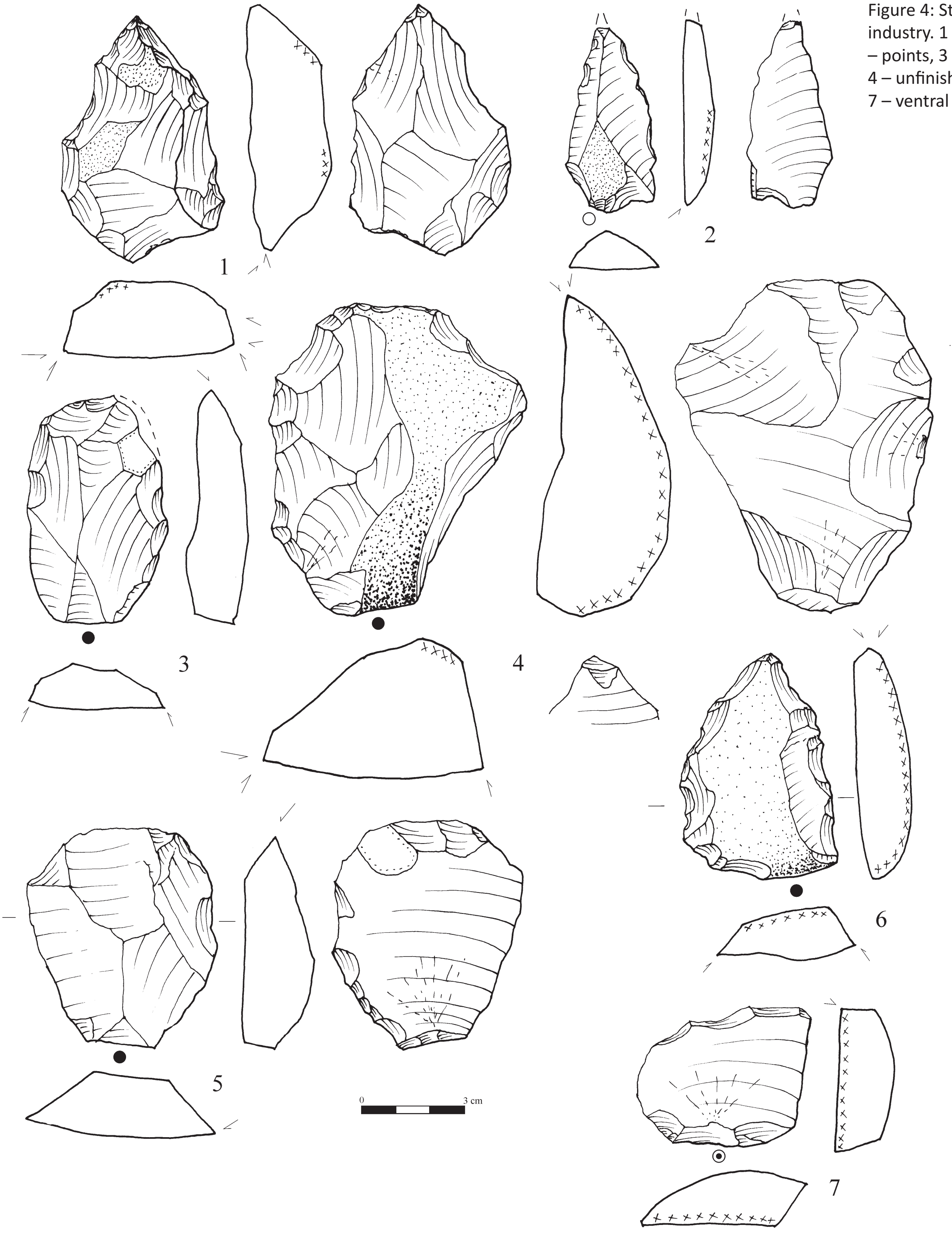


Figure 4: Stříbro, stone industry. 1 – biface, 2, 6 – points, 3 – endscraper, 4 – unfinished biface, 5, 7 – ventral sidescrapers.

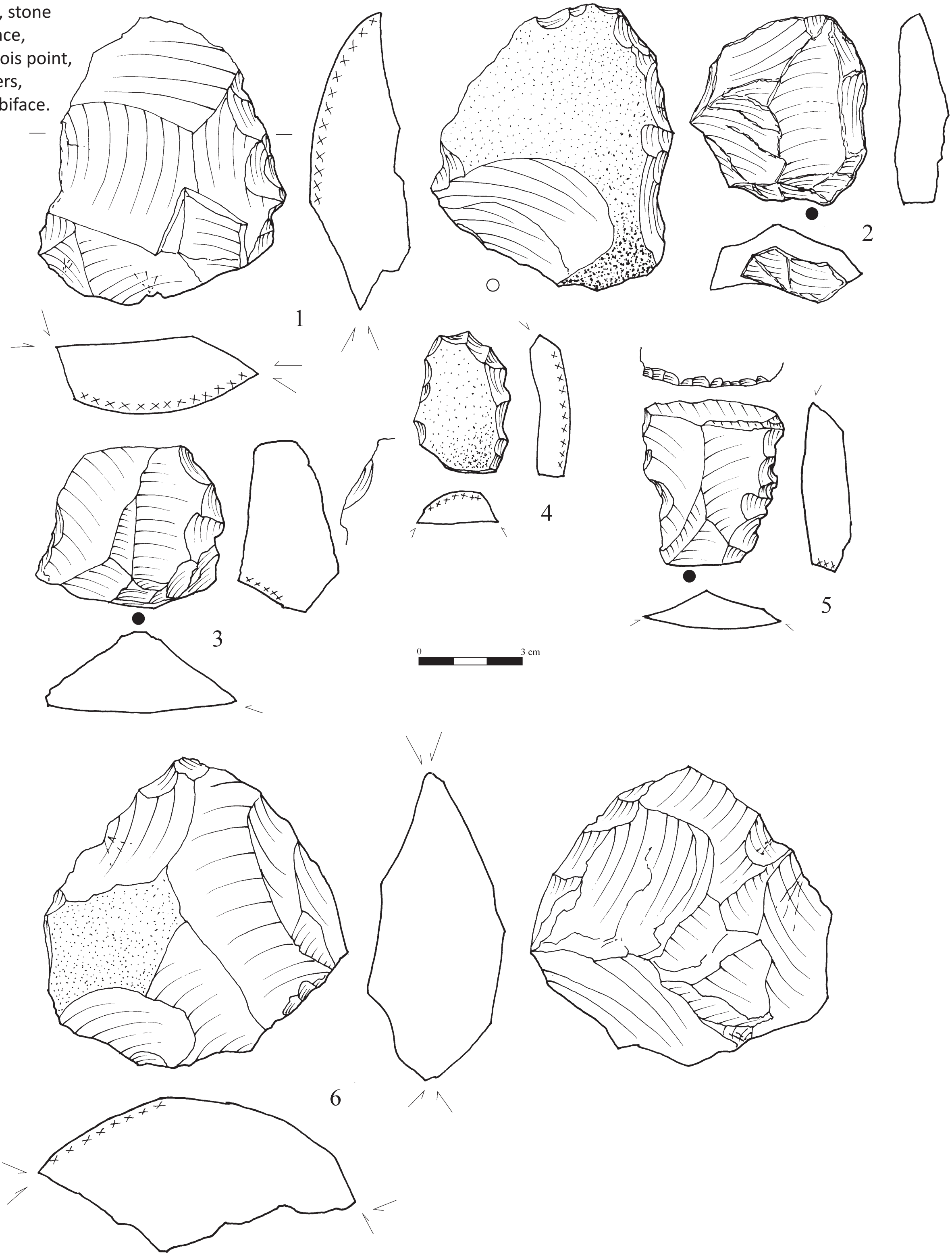


Figure 5: Stříbro, stone industry. 1 – biface, 2 – pseudolevallois point, 3–5 – sidescrapers, 6 – fragment of biface.

Hromnice I and II (distr. Plzeň-north) sites

Description of site

Hromnice I

This site is located northwards from the center of village on the tiered southern slope of Kosina hill (plots no. 2549, 2591, 2602). The bedrock here consists of undifferentiated Proterozoic sediments (see list of Geological maps of the Czech Republic Plzeň region, 12–33), but in close proximity (the lowest terrace level above the Hromnický stream and above village) Miocene fluvial gravelly sands are preserved. The sediments are covered by loess loams with a thickness of 0.2–0.8 m, which compensates for the irregular shape of a staircase hill in almost continuous southern slope, finished at the lowest level by the flat terrace, running into a sharp

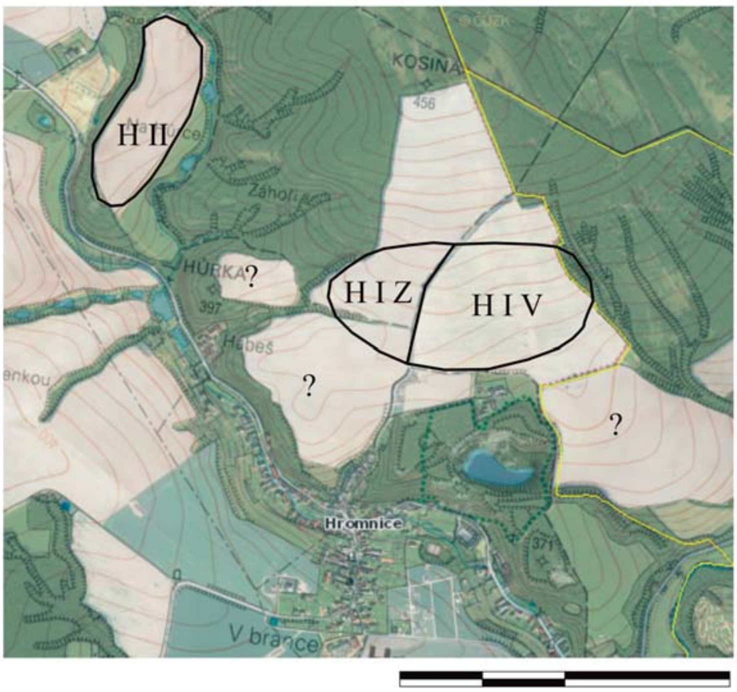


Figure 6: Hromnice site. Extent of artifact dispersion.
H I Z – Hromnice I, west part,
H I V – Hromnice I east part,
H II – Hromnice II.

Figure 7: Hromnice site. View from area H I V to southeast to the Třemošná river valley.

escarpment above the Hromnický stream. Especially on the southeast side of the hill there are significant erosion furrows in the loess loams, around which many Late Bronze Age sunken features can be found. The elevation of the central part of the site is about 46 m above the Hromnický stream and 85 m above its confluence with the river Třemošná (Figure 7).

The site was discovered in the autumn of 2013 during the archeological survey (Čechura et al. 2013) in the area of construction impacts (construction of a flood control ditch) almost in the middle of the southern slope of hill (about 401 m a.s.l.). The topsoil and loess sediments were removed, and in the gravel or in weathered rocky bedrock below a ditch was excavated to effect east-west drainage. It has a length of 720 m, a funnel shape with a width of 47–50 m and depth of 1.8–2.0 m from the raised edges, so that the recess in the surface of the ground is about 0.6 m. The excavated sediment was left in place, so it was possible to collect stone artifacts (in total of several dozen pieces) from the piles of soil and directly in the open trench. Subsequently, the uppermost layer was returned onto the surface of the trench and the rest of material was spread around the construction area.

In the western part of site one trench has purchased a large feature with pottery in the filling dated to the late Prehistory (probably late Bronze Age) with a strong stone roof. The structure has a weight of several hundred kilograms, because was composed of the biggest boulders collected from the site. Some nearby boulders were affected during construction of the structure. Additionally, many Paleolithic large cores were found during the excavation of this structure (grave?).

Artifacts were found in the 700 m length of the drainage ditch. In its western half the layer with artifacts was covered by loess, so the artifacts were hardly visible on the surface and we were not able to found them. Thus, the real range of site cannot be detected here. In its eastern half were detected a layer with artifacts, which were exposed by erosion grooves, and the material was detected lying on the surface within the range of about 500 m down the slope. The total extent of the site might be estimated to an area up to 800 × 500 m (Figure 6).

Hromnice II

Like previous site I, the Hromnice II site is located on the slope of Kosina hill. Contrary to the first site, this one is situated on the significantly steeper western slope and forms the lowest level of the flat terrace above the river (plot no. 2459–2467). It is a north-to-south sloping tongue-like promontory with a distinctive flat summit. It lies in a distance of 1 km from the western part of site I and is separated by the sharp notch of recent stream. The Hromnický stream flows around the western and southern part of the promontory.

The bedrock consists of Proterozoic phyllites and sediments of the Kladno Formation (Westphalian) dated to Carboniferous. They are covered by preserved relics of deluvial stone-loamy and loamy sediments (see Geological map of Czech Republic region Plzeň, sheet 12–33). Although the relic is determined as Quaternary, the raw material spectrum corresponds to surrounding Miocene fluvial sandy gravel.

Additionally, the site altitude is 396–397 m and the elevation above the Hromnický stream is about 22 m. The site was discovered by P. Břicháček in the autumn 2013 during the surface survey in the vicinity of site I. Artifacts can be collected within the area of 200 × 500 m.

Raw material sources

Raw materials used in the Hromnice site come mainly from local terrace accumulation of the Tertiary and Quaternary eras (Tables 2 and 3). The available materials differ significantly from the Stříbro site. Here the available sedimentary quartzites are in colors from gray up to ocher and red shade. By intense metamorphism they have changed to metamorphous quartzites. Their origin should be detected in the southwestern part of the Barrandian region, which is intensively metamorphosed. In Hromnice I these raw materials make up to the 70.1% of collection, and up to 58.1% in the case of Hromnice II site. The origin of raw materials in this area demonstrates the highly metamorphosed orthogenesis with garnet in Hromnice I. Another important raw material is quartz, coming also from river terraces. In Hromnice I this raw material forms the 20.5% of whole collection and 38.7% from Hromnice II collection. In both collections pebbles of lydite are also presented, coming also from the terrace material (lydites are bound to Barrandien Precambrian sediments). An exceptional raw material in Hromnice I is quartz-porphyry. Its nearest outcrop is in Žernoseky village (90 km), but we cannot exclude the existence of an unknown smaller outcrop situated closer to this site. Additionally, local raw materials are consistently used. Their quality is significantly worse than at the Stříbro site, due to a higher degree of metamorphism. This makes quartzites extremely hard and difficult to chip. This fact considerably influenced the technologic features observed in the collection.

Stone artifacts

The Hromnice site was discovered in the autumn 2013, and until present days only a small portion of collection was already analyzed. Nevertheless, it is possible to determine at least the cultural affiliation and to describe the main features of this assemblage.

Although the first surface collections can be connected with much more informative character, we test their representativeness (Tables 2 and 3). The ratio between debitage and retouched tools in both positions is more consistent with the original composition of assemblages (Figure 7–8: 2–3 in favor of debitage). Both assemblages are characterized by reduced technology of core preparation, which leads to their considerable simplification. Very often the preparation of the flaking platform and bottom side is eliminated. Lemon-quarter flake cores are frequently used, where preparation is reduced completely. Levallois cores are not present, although signs of reduced Levallois technology are known from Hromnice II (levalloid point, without prepared base, replaced by a boulder surface). This reduction is due to the extreme

Table 2: Hromnice I. Technotypological and raw material composition of evaluated assemblage.

technotype	core quartz	quartz	ochre quarzite	red qurzite	quarzites	quartz porfyre	orthogneiss	lydite	total	%
fragment	1	3	4	2	1				11	20
flake	1		11	4	2		1	1	20	36.4
cores	1	2	5	3	1		1		13	23.6
debitage	*3*	*5*	*20*	*9*	*4*		*2*	*1*	*44*	*80*
biface				1		1			2	3.6
sidescraper		1		3	1		1		6	10.9
borer		1							1	1.8
knife		1							1	1.8
chopper				1					1	1.8
tools		*3*		*5*	*1*	*1*	*1*		*11*	*20*
total	**3**	**8**	**20**	**14**	**5**	**1**	**3**	**1**	**55**	**100**
%	5.5	15	36	25	9.1	1.8	5.5	1.8	100	

Table 3: Hromnice II. Technotypological and raw material composition of evaluated assemblage.

technotype	quartz	red quartzite	ochre quartzite	lydite	total	%
fragment	2	2	2		6	19.4
flake	5	5	1		11	35.5
levalloid point	1				1	3.2
core	2		1		3	9.7
debitage	*10*	*7*	*4*		*21*	67.7
biface		1			1	3.2
sidescrapers	1	1	2	1	5	16.1
retouched flake		1			1	3.2
chopper		1			1	3.2
borer	1	1			2	6.5
tools	*2*	*5*	*2*	*1*	*10*	*32.3*
total	**12**	**12**	**6**	**1**	**31**	**100**
%	38.7	38.7	19.4	3.2	100	

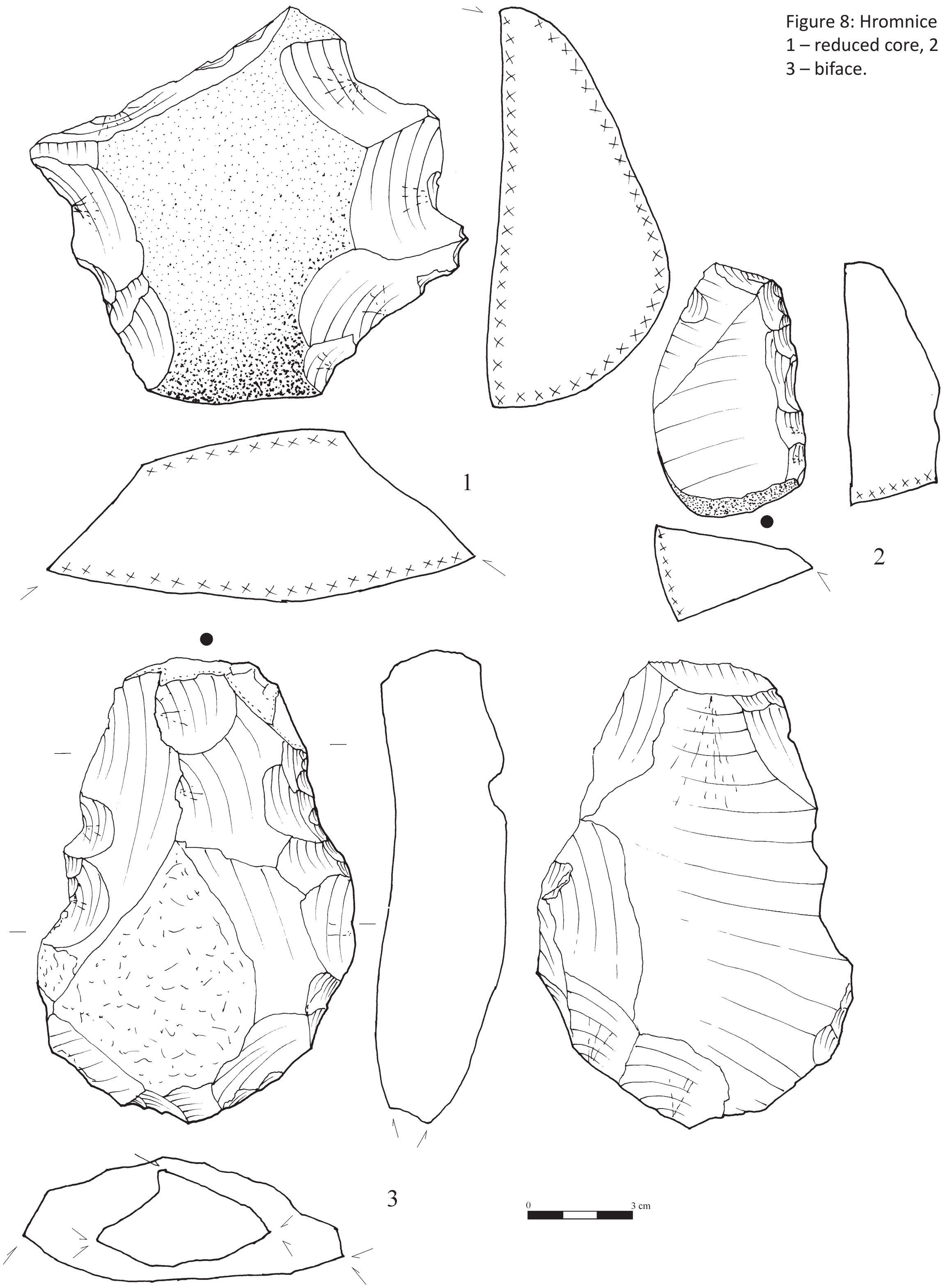
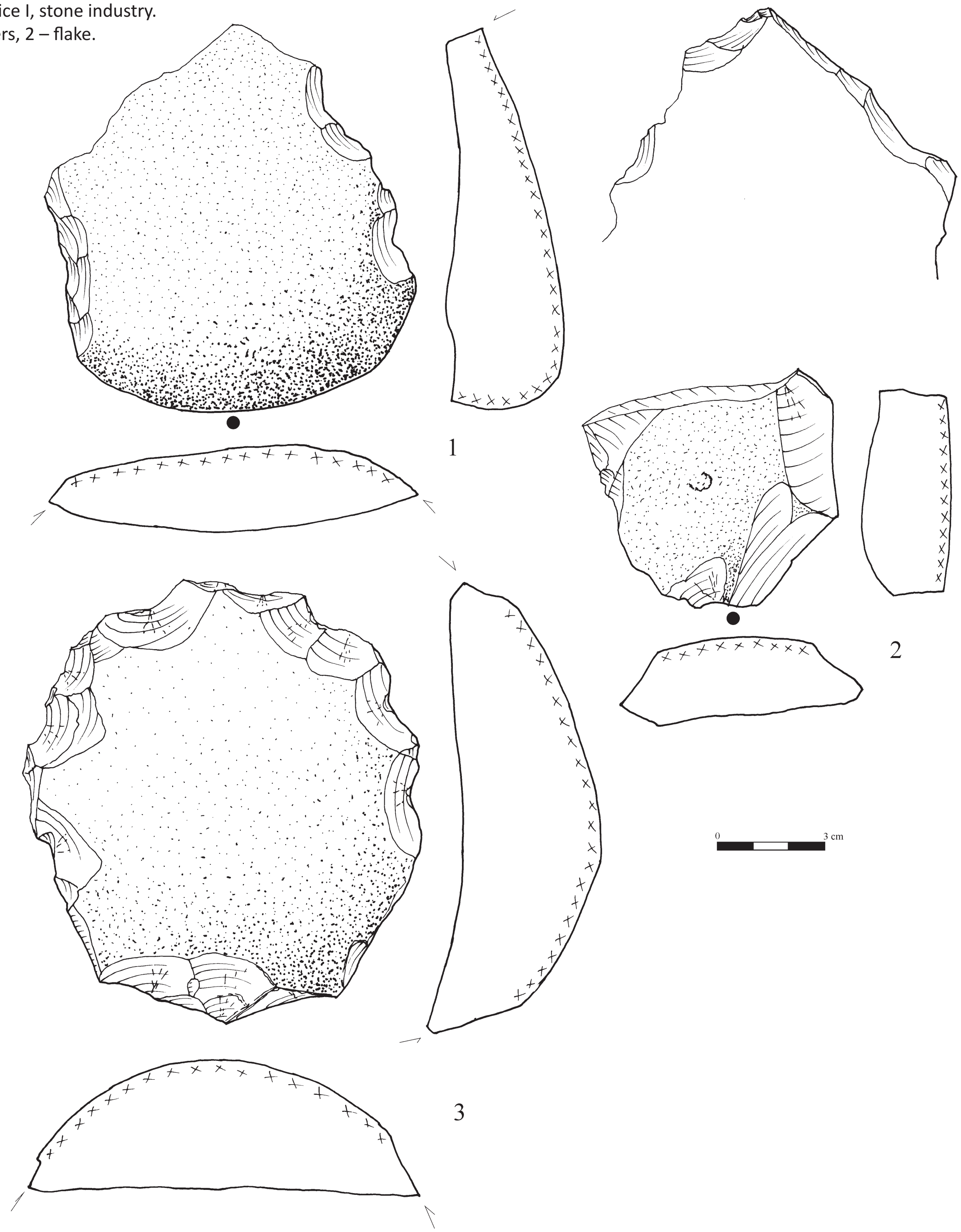


Figure 8: Hromnice I, stone industry.
1 – reduced core, 2 – sidescraper,
3 – biface.

Figure 9: Hromnice I, stone industry.
1, 3 – sidescrapers, 2 – flake.



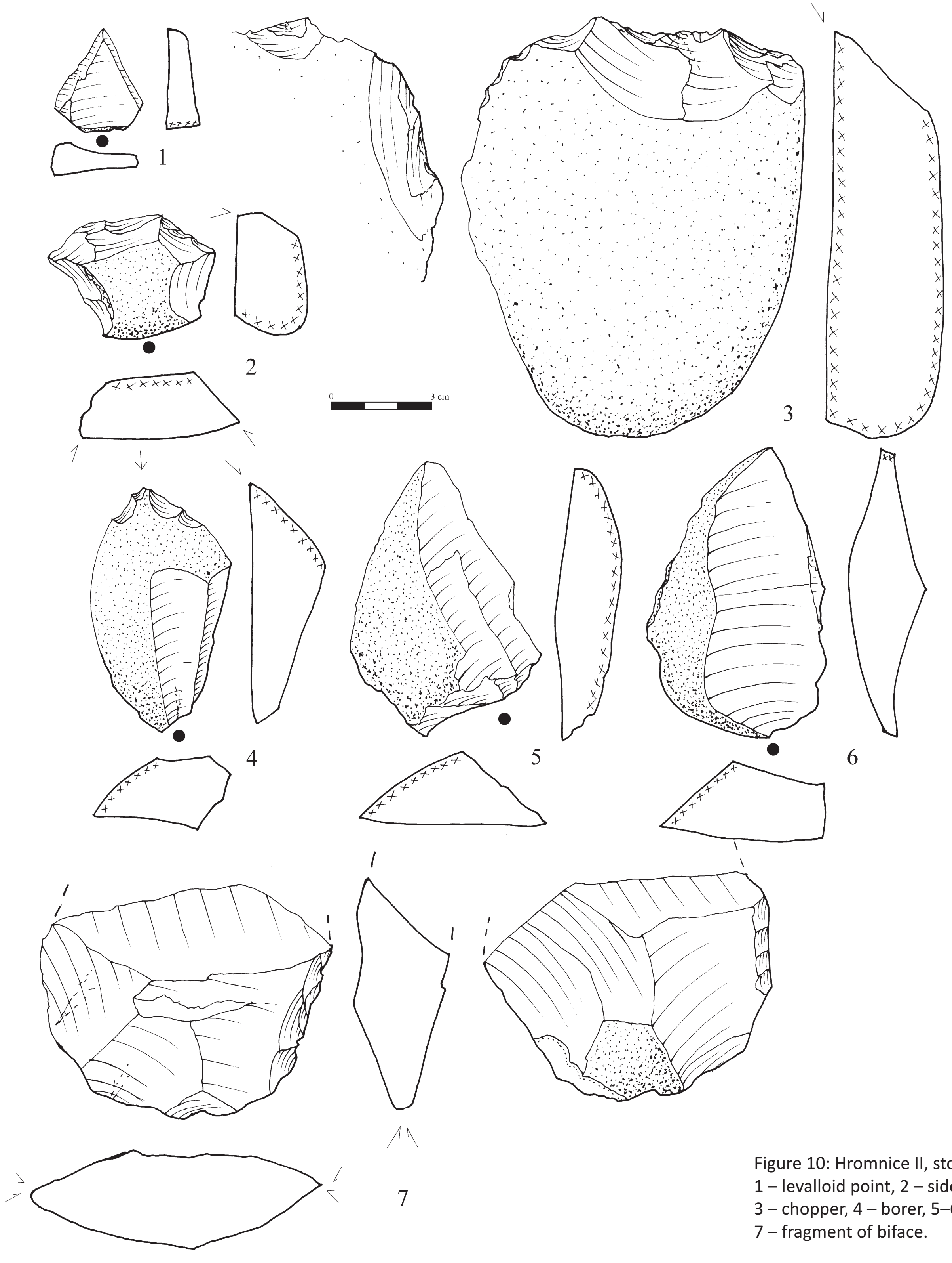


Figure 10: Hromnice II, stone industry.
1 – levalloid point, 2 – sidescraper,
3 – chopper, 4 – borer, 5–6 – flakes,
7 – fragment of biface.

character of the raw material which does not allow one to perform complex core preparation (considerable hardness limited the usable striking angle to a very small extent).

The composition of tools is comparable to the Stříbro collection, although their variation range is not as wide (again due to the poor quality of the raw material). In the collections we can find bifaces and dominant sidescrapers. To a lesser extent, there are borers, knives, choppers and retouched flakes. Eolization of stone artefacts is more frequent and stronger than in Stříbro site (Figure 8–10).

Břetislav (Konstantinovy Lázně, distr. Tachov) site

Description of site

Artifacts laid on the flat top of a hill at the western foot of the distinctive basalt hill of Okrouhlé Hradiště near Konstantinovy Lázně town (plots no. 921, 922), north of Břetislav village. The bedrock is formed by Upper Proterozoic metamorphic rocks (graphitic phyllites). This is covered with brown soils. The elevation of the highest point of the hill is 523.5 m, the artifacts were collected on a plateau with an elevation of 520 m. Carboniferous sediments of the Kladno formation with white quartz pebbles, which were used for industry production, can be found 1.0–1.5 km west on the southern outskirts of the Kokašice village. Recent watercourses enclose the hill almost all the way around (except for a small section in the northeast). The elevation above the Čelivský creek is about 32 m. The site was found by Pavel Břicháček during the surface survey in spring 2013. Artifacts can be collected over an area of 300 × 200 m (Figure 11).

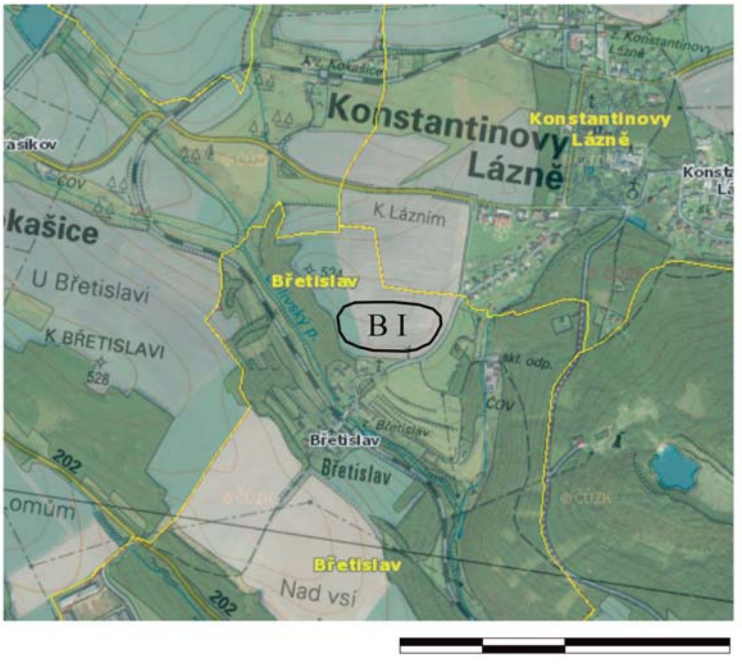


Figure 11: Břetislav site. Extent of artifact dispersion.

Raw material sources

This site is located outside the area of the Tertiary and Lower Pleistocene gravel accumulations. Thus, there were no quartzite pebbles of a good quality. There were only very difficult to work vein quartzes here, both in the form of fragments on outcrops, as well as pebbles in the Quaternary terraces. The poor quality of raw material directly affects the appearance of stone industry.

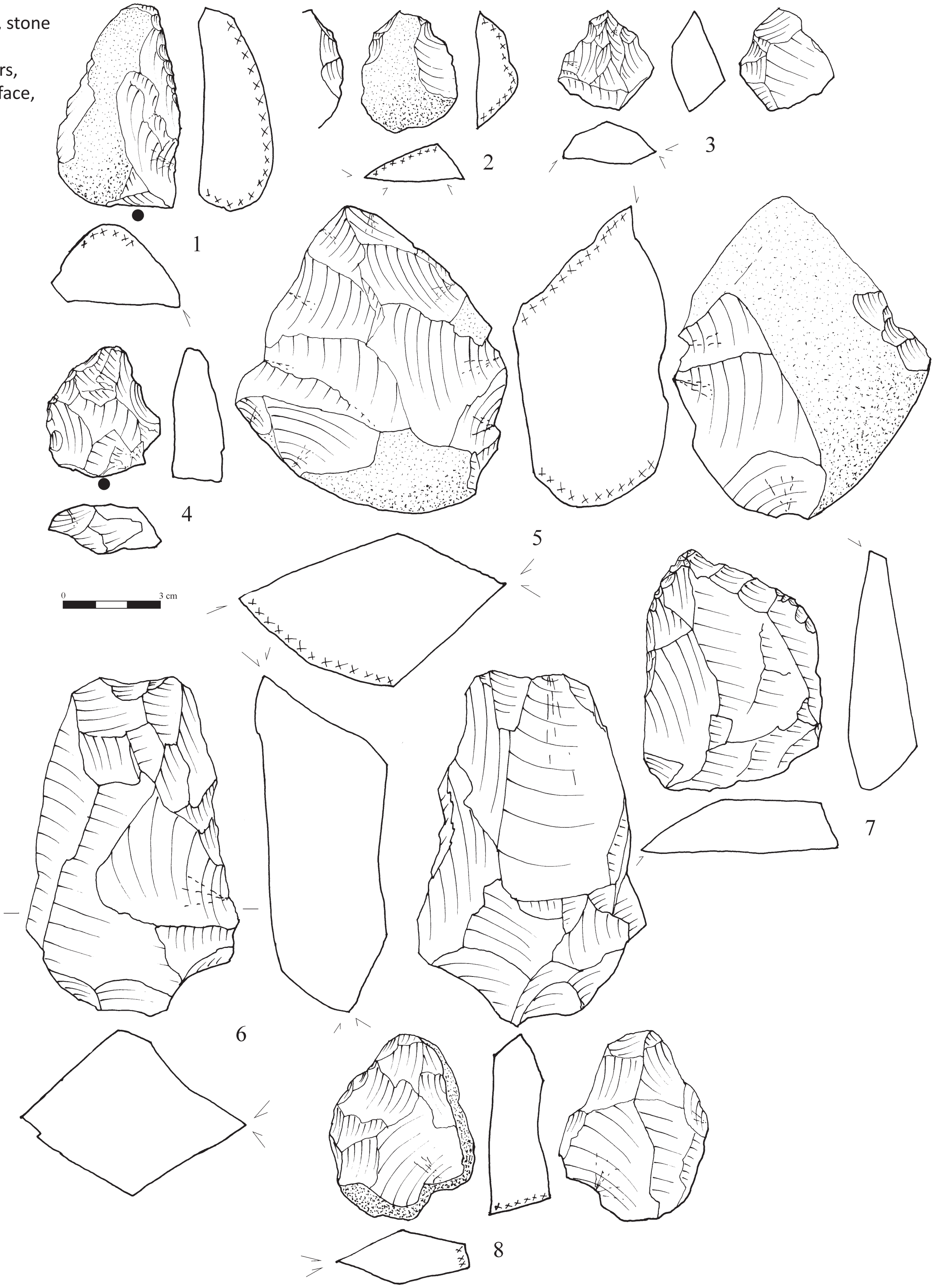
Stone artifacts

So far, in Břetislav we have collected only a small collection of 24 artifacts. The ratio of debitage and retouched tools is 1:1. Due to the poor quality of the raw material fragments are used more than flakes. Cores are represented by three pieces. Among the tools are mostly represented bifaces (documented is biface, protobiface, cleaver and wedge) and sidescrapers, both with a total of four pieces. There is one sidescraper combined with notch and chopper, and two points.

technotype	**core quartz**	**pebble quartz**	**total**	**%**
fragment	7	1	8	33.3
flake	1		1	4.2
cores	3		3	12.5
debitage	*11*	*1*	*12*	*50*
biface	1		1	4.2
protobiface	1		1	4.2
cleaver	1		1	4.2
wedge	1		1	4.2
bifaces	*4*		*4*	*16.7*
sidescrapers	4		4	16.7
notch - sidescraper	1		1	4.2
point	2		2	8.3
chopper		1	1	4.2
tools	*11*	*1*	*12*	*50*
total	**22**	**2**	**24**	**100**
%	*91.7*	*8.3*	*100*	

Table 4. Břetislav. Technotypological and raw material composition of evaluated assemblage.

Figure 12: Břetislav, stone industry.
1–2, 7 – sidescrapers,
3, 4 – points, 5 – biface,
6 – cleaver,
8 – protobiface.



The assemblage of Bretislav site at first glance looks archaic, but this is mainly due to the poor quality of raw material. In this collection we can find prepared cores and sidescrapers on flakes. The bifaces are comparable to those of the Stříbro site. The surface of the artifacts is only corroded; there is no mark of eolization. The Břetislav assemblage also belongs to the horizon of Upper Acheulean (Figure 12).

Conclusions

The largest Bohemian site of the Upper Acheulean is Bečov IV, surveyed from the 1960s by Jan Fridrich (Fridrich 1982; Fridrich and Sýkorová 2005). Artifacts of the Upper Acheulean were also found on the summit of Písečný hill (site Bečov I) and over large areas in the vicinity of both sites. Settlement at Bečov site was linked to an outcrop of high-quality quartzite of Bečov type. Findings from Bečov are analogous to the nearest large area site of the Upper Acheulean in Saxony at Markkleeberg site (Mania and Baumann 1980). The assemblage of the Stříbro site in terms of quality and complexity is fully comparable to the Bečov assemblage. On the Stříbro site a very good local raw material was used – the quartzite of Stříbro type. The extent of settlement in Bečov is very large; artifacts can be found an area of several square kilometers. The Stříbro site is approaching this area, with artifacts spread over at least one square kilometer. Hromnice and the Central Bohemian site of Mlazice and Stašov are both of the same range, but they are not connected to a source of good quality raw material. Other Bohemian sites are significantly smaller, ranging up to several tens of hectares. This includes sites in Stvolínky, and some sites in Bohemian Paradise, namely Břetislav, Mutějovice, Putim-Ražice and Srbsko. Some of them (Stvolínky, Putim-Ražice) lie on a source of good raw material, but others have no good raw material. As it seems, the presence of high-quality raw material in place is not a determining factor in the range of settlements. We know of sites of a large scale without a good quality raw material source, as well as small-scale sites on good quality raw material sources. Whether these differences reflect settlement patterns of Acheulean hunters we are not able to decide at the present state of knowledge. The differences in structure and scale are so striking, however, that it can hardly be a coincidence.

Acknowledgement
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Résumé
En Bohème occidentale, plusieurs nouveaux sites de surface attribués à l´Acheuléen supérieur ont été découverts au cours de ces dernières années grâce aux prospections systématiques de P. Brichacek. Une bonne vigntaine de sites n´ont livré que des collections insignifiantes du point de vue numérique, si bien qu´ils n´ont pas été intégrés dans la

présente étude. Seuls trois sites se distinguent par des collections plus importantes et comprennent notamment des bifaces comme marqueur chronologique significatif pour la période en question : Stříbro, Hromnice (I et II) et Břetislav.

Zusammenfassung

In Westböhmen wurden dank der systematischen oberflächlichen Prospektionen von P. Břicháček in den letzten Jahren einige neue Fundstellen des jüngeren Acheuléen entdeckt. In diesem Artikel sind drei Hauptfundstellen mit mittelgrossen sowie grossen Kollektionen dargestellt, die Faustkeile als markante chronologische Elemente dieser Epoche beinhalten. In Stříbro wurden bisher 1.200 Artefakte dieser Kultur gefunden, die mit den grossen Fundstellen dieser Epoche (Bečov IV, Markkleeberg) vergleichbar sind. In Hromnice wurden bisher mehrere Hundert Artefakte gefunden, die ähnlich zur Kollektion von Stříbro sind. Die kleinste Kollektion stammt von Břetislav, die auch aufgrund der typologischen Zusammensetzung mit den Funden von Stříbro und Hromnice vergleichbar ist.

GROTTE DE LA VERPILLIÈRE II, GERMOLLES, FRANCE: PRELIMINARY INSIGHTS FROM A NEW MIDDLE PALEOLITHIC SITE IN SOUTHERN BURGUNDY

Jens Axel Frick and Harald Floss

Abstract

During the 2006 excavation at the *Grotte de la Verpillière* in Germolles, a team from the University of Tübingen under the direction of Prof. Harald Floss found a new archeological site. The site, now called *Grotte de la Verpillière II*, is situated around 50 m south of the well-known *Verpillière* cave (since then it has been called Verpillière I) in the same communal subdistrict of *Verpillière*. Between 2006 and 2008 mixed sediments and big limestone blocks from a roof collapse were removed to gain entrance to the cave. In 2009, intact layers with Middle Paleolithic artifacts were found and remain under excavation today. The intact find layers contain lithic artifacts, faunal elements and thousands of charcoal fragments that occur in discrete lenses. The lithic industry contains a high percentage of Levallois elements and the uppermost intact find layer (GH 3) yields a bifacial component that can be related to the Keilmessergruppen (assemblages with backed bifacial knifes), Micoquien (sensu Bosinski), Charentian with Micoquian influence (sensu Farizy), Mousterian with Micoque option (sensu Richter) of central Europe or the Mousterian with bifacial tools (sensu Ruebens) in northern France and the Benelux. Here, we provide an overview of the first insights gained from ongoing excavations (here described insights from the campaigns 2006 to 2013) and analyses at this new Middle Paleolithic site in Eastern France.

Keywords

Neanderthals, Eastern France, Saône-et-Loire, Côte Chalonnaise, bifacial elements, Levallois

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Introduction

The Grotte de la Verpillière II (around N 46°53'56,4", E 4°44'31,2"; 212 m a.s.l) is located on the eastern slope of the massive of Montadiot, ten kilometers west of Chalon-sur-Saône, Saône-et-Loire (71), France (Figure 1). It is situated around 50 m south of the Grotte de la Verpillière cave site, which is well known for its Middle Paleolithic assemblages of bifacially backed knives (Desbrosse *et al.* 1976; Desbrosse and Texier 1973; Frick 2010), for the easternmost known Châtelperronian points (Dutkiewicz 2011; Floss 2003, 2005) and Aurignacian implements like carinated pieces and split-base points (Breuil 1911; Dutkiewicz 2011; Floss 2005).

The excavated intact layers of *Verpillière* II contain Middle Paleolithic lithic artifacts, faunal elements and more than 3.000 charcoal fragments, which occur in distinct lenses visible in 3D plots. The lithic industries contain a high percentage of Levallois elements, and nearly the complete *chaîne opératoire* of lithic reduction is represented. The uppermost intact layer (GH 3) also contains a bifacial component (n = 10, mostly asymmetric forms) that can be correlated to a western variation of the *Keilmessergruppen* (or Mousterian with Micoquian Option, younger Micoquian, Charentian with Micoquian Influence, Mousterian with bifacial tool, etc., see Farizy 1995; Frick 2010; Jöris 2003, 2006; Kozłowski in press; Richter 1997; Ruebens 2012, 2013). Similar lithic components have been recovered from the Middle Paleolithic layers at *Verpillière* I, both from recent excavations, older excavations and recently excavated backdirt (Floss 2005; Floss *et al.* 2013a, 2013b, 2014; Frick 2010).

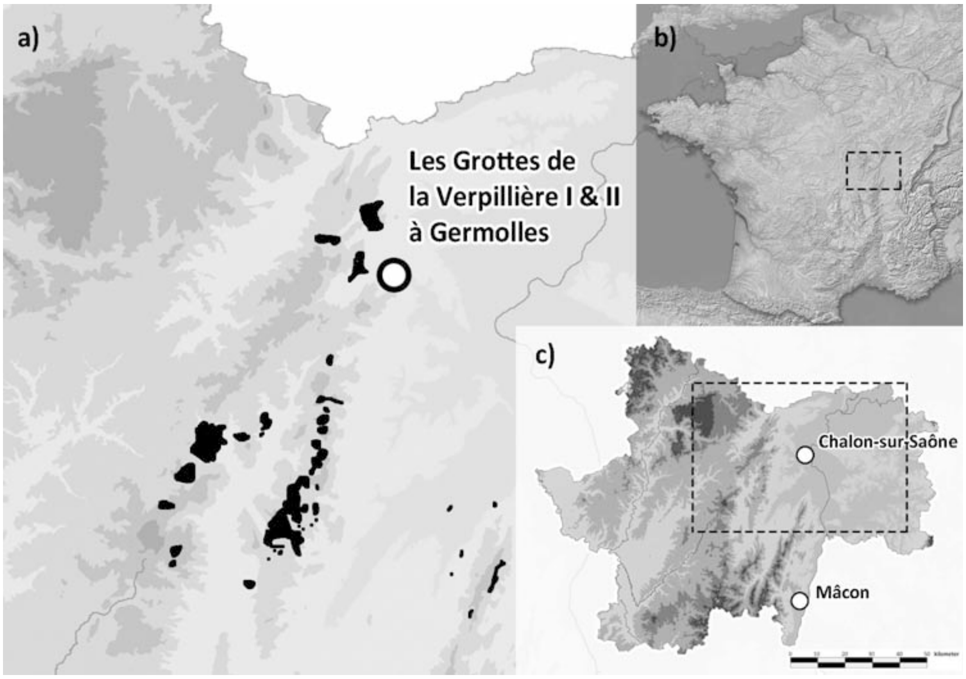


Figure 1: Location of the Grottes de la Verpillière I and II in Germolles, Saône-et-Loire, France. a) The distribution of flint from the argiles à silex in the Côte Chalonnaise (black spots, see Rué 2000) and the location of the Grottes de la Verpillière I & II in Germolles (circle), b) Topographic map of France (the dashed line indicates the Dept. Sâone-et-Loire, SRTM-NASA map from 2003), c) Location (in dashed lines) of the Côte Chalonnaise in the Dept. Saône-et-Loire (see also in Frick et al. 2012, Figure 1).

Site history

In 2006, an amateur collector (J.-N. Blanchot) indicated to Harald Floss the presence of lithic artifacts on top of a large badger den. During the 2006 excavation campaign at the *Grotte de la Verpilllièr*e (I), a test pit of 2 square meters was excavated by the team, revealing the new cave on September 25th. After half a day's work, it was possible to get a glimpse under the cave roof, which showed a tunnel several meters in length. The disturbed sediments of the test pit contained lithics from the Middle and Upper Paleolithic, faunal elements like horse (*Equus*, sp.), bison (*Bison*, sp.) and hyena (*Crocuta,* sp.) and modern materials (plastic and ceramics). The upper layers (GH 1 and 2, GH = geological horizon or layer, a distinctive sedimentological unit) showed evidence of bioturbation and contained small patches of cave sediments (Floss 2006).

In 2007, additional square meters (n = 13) were opened to gain access to the cave entrance. At a depth of 1 meter, a Roman belt buckle was found, as well as patches of cave sediment, and Paleolithic and Neolithic artifacts (Floss 2007). Work continued the following year, during which large limestone blocks (up to 4 meters in greatest dimension) deriving from a substantial roof collapse were excavated, scanned and measured in order to document the collapse history (Floss 2008). GPR surveys conducted in 2009 (P. Leach, John Milner Associates and Ch. Miller, Universität Tübingen) revealed the dimensions of the cave and confirmed that there were stratified sediments underlying the mixed deposits (Leach and Miller 2009). A *sondage* (test pit) of 4 square meters directly under the recent drip line of the cave revealed several layers of these intact sediments (GH 3 to 9), which were buried under the collapse of limestone blocks (Floss 2009). Micromorphological samples taken from these layers indicated moderate bioturbation in the upper parts, but contained no modern material, and also showed that the sediments were formed in place (Bons and Wißing 2009; Floss *et al.* 2010; Wißing 2012). Currently, we have discovered three intact layers containing Middle Paleolithic finds (GH 3, 4x and 4; Floss *et al.* 2014). From 2010 to 2013 (Floss 2010, 2011; Floss *et al.* 2012, 2013, 2014; Frick *et al.* 2011), excavation of 15 square meters of intact sediments was accomplished following the Tübingen excavation system (Frick and Hoyer 2009, 2011, 2012; Frick *et al.* 2013) established by J. Hahn in the 1970s to 1990s (e.c. Hahn 1988). The system combines single-find measurements, documentation of geological and archeological settings, topographical 3D modeling (layers, surfaces, profiles, limestone blocks, cave topography, etc.) and the recording of artifacts by size classes. An experimental archeological component, as for example controlled heating of flints from the *argiles à silex* (Frick *et al.* 2012), has aided in the interpretation of finds from the site. Additionally, during the 2013 field campaign we prepared the site for radiometric dating (ESR, OSL, TL, U-Th), the analysis of which is currently in progress (pers. comm. L. Zöller and M. Richard). From a stratigraphic and typological view, we suggest a late-OIS 5 (a, b or c) date (around 75–100 ky), which would correlate with dates from open-air sites (Champlost, Villeneuve or Vinneuf) in the *Sénonais* in northern Burgundy (Deloze *et al.* 1994; Gouédo 1999; Lhomme 2000), where layers with Micoquian elements are dated to the OIS 5. Also, a datation to the

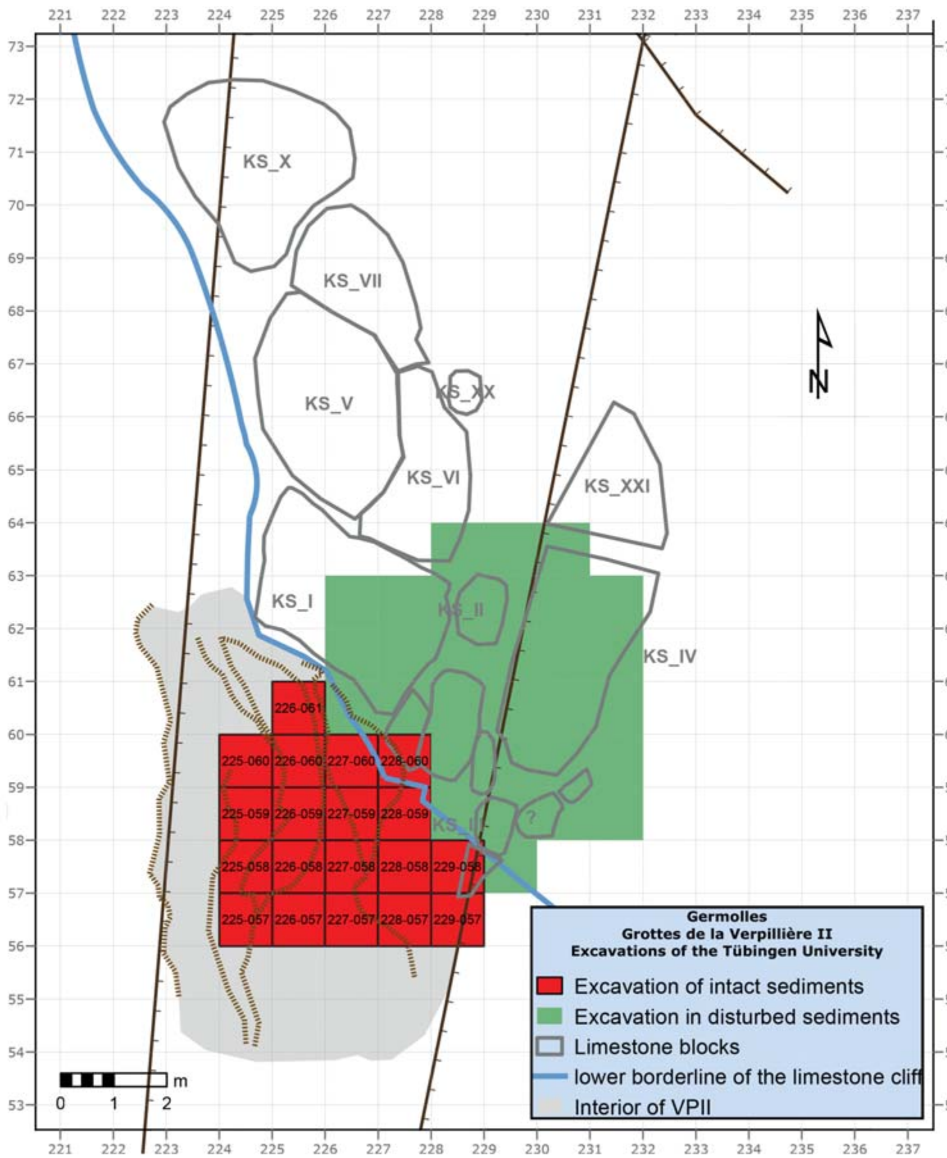


Figure 2: GIS map of Verpillière II with the outlines of the collapsed limestone blocks and the excavated square meters (map by Ch. Th. Hoyer).

OIS 4 or early OIS 3 is possible, because many assemblages from the *Keilmessergruppen* date to these stages (Jöris 2003; Richter 1997).

Analysis of finds and data from the site are continuing under the auspices of three externally funded collaborative projects headed by Harald Floss, and several final academic theses are in progress (e.c. Jens A. Frick).

Site description and site formation

The cave is situated in the Upper Jurassic (Oxfordian) limestone formation of the massive of Montadiot. It formed during the erosion of the weaker components of

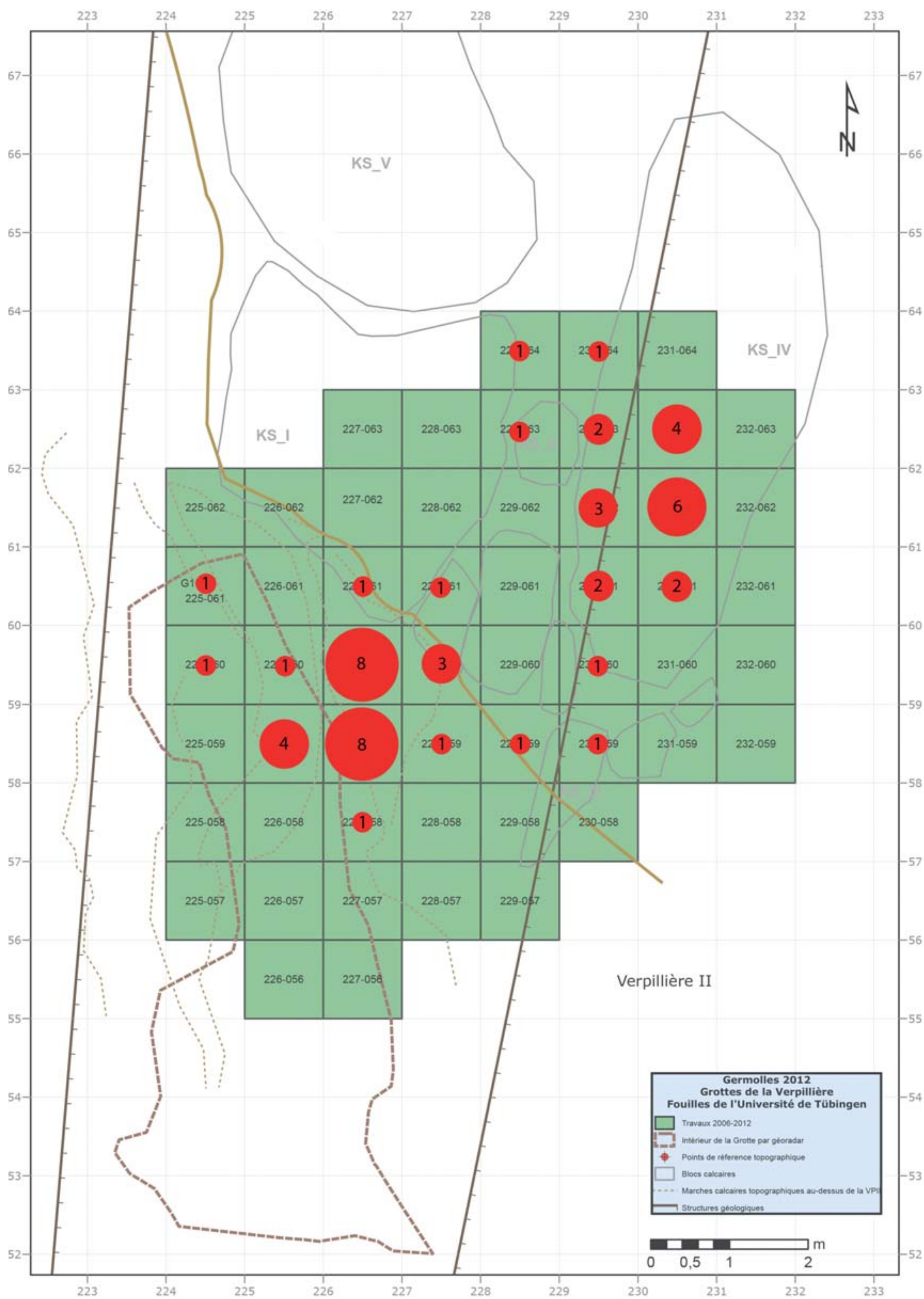


Figure 3: GIS map showing two concentrations of Upper Paleolithic lithic artifacts from GHs 1 and 2 (map by Ch. Th. Hoyer).

the formation, which likely corresponds in time with the extension of the Rhine-Saône-Rhône graben system (Bons and Wißing 2009). The intact layers are buried under a roof collapse of limestone blocks derived from an overhang of the rock face, and are situated at the foot of the cliff face and within the cave chamber (Figure 2). A first phase of roof collapse occurred before the formation of the intact find horizons, depositing large blocks beneath them. During the time of occupation, several small collapses from the cave walls occurred, breaking up the spatial distribution of the artifacts. A final, large collapse after the formation of the intact find horizons closed the cave almost completely.

The intact find layers yield sediments with a mix of fluvial and aeolian components. This suggests that the sediments were deposited in the cave with the erosion of the limestone, blown into the cave from outside, and altered and homogenized in the Upper Pleistocene (pers. comm. L. Zöller, D. Richter, Ch. Miller and P. Bons). The sediment on top of and between the limestones from the roof collapse contains artifacts from the Middle Paleolithic to the Early Upper Paleolithic in secondary context (Floss *et al.* 2013a, 2013b, 2014; Götz 2013). The Middle

Figure 4: Table of the geological layers (GHs) and their content.

geological layer (GH)	status	yield	sediment	thickness
1	mixed	modern material, items from the middle ages, upper and middle paleolithic artifacts	cover soil with many limestones and less humus and throw-off of the badger den (maybe also from the top of the plateau)	around 0.1 m
2	mixed	modern material, items from the middle ages, Upper and Middle Paleolithic artifacts	soil with a big humus content, mostly bigger limestones, limestone blocks of the roof collapse, patches of cave sediments, badger den	0.2 m to 3 m
3	intact	Middle Paleolithic artifacts	mostly aerial soil with a small fluvial component, slightly altered through bio- and kryoturbation	0.4 m to 1 m
4x	intact	Middle Paleolithic artifacts	mostly aerial soil with a small fluvial component, no alteration visible	0.5 m to 0.1 m
4	intact	Middle Paleolithic artifacts	mostly aerial soil with a small fluvial component, no alteration visible	0.1 m to 0.4 m
5	intact	sterile	soil horizon under the contemporary entrance	0.05 m to 0.1 m
6	intact	sterile	weathering horizon of limestones inside the cave	0.05 m to 0.5 m
7	intact	sterile	weathered flowstone	around 0.1 m
8	intact	sterile	concreted limestone blocks	around 0.7 m
9	intact	possibly another find horizon	crusts and blocky deposits of limestone (only in a small depth sondage)	possibly 0.1 m

Paleolithic artifacts occur throughout these disturbed deposits associated with the roof collapse and the badger den, but the Upper Paleolithic artifacts are concentrated in two spots: under the contemporary cave entrance, and 3.5 meters to the north-east (Figure 3). It is unclear at present whether these Upper Paleolithic elements are invasive (deriving from the plateau above) or the remains of otherwise eroded interior deposits.

Currently, we can suppose that the horizontal extent of the site (the area of sediment buried under the collapse and in the cave) is around 100 m^2. Up to this point, excavation has concentrated on the contemporary entrance to the cave, where 15 m^2 have been excavated down to the surface of a concreted layer (with flow stones) of limestone blocks (GH 8). Ground Penetrating Radar (GPR) and structural geological analyses from 2009 suggest that this concreted layer is not the bedrock of the cave (Bons and Wißing 2009; Leach and Miller 2009), which was confirmed by a deep *sondage* in 2009 (Floss 2009). The stratigraphy of the cave contains nine sediment layers and the bedrock in all. Archeological material occurs in GHs 1, 2, 3, 4x and 4 (see Figure 4). The layers GH 3, 4x and 4 are intact Middle Paleolithic horizons. The underlying sediments have thus far proven sterile.

Spatial find distribution

In the mixed layers (GH 1 and 2), some general tendencies can be outlined. Firstly, the Upper Paleolithic finds are concentrated in two main areas (see Figure 3) (Floss *et al.* 2013a; Götz 2013). Secondly, the artifacts of a Middle Paleolithic nature are similar to those from the intact layers below (bifacial, Levallois and discoidal elements). Of the intact find layers (GH 3, 4x and 4), only GH 3 (n = 7,375 single finds) has been excavated and analyzed extensively enough for meaningful spatial analyses to be performed. So far, GH 4 has yielded only n = 145 single finds, but contains complete bones of large Pleistocene herbivores (such as mammoth and rhinoceros). GH 4x was only found over 5 square meters, and yielded only n = 52 single finds.

GH 3 shows several concentrations of single finds, for instance an accumulation of bones and teeth in the western area of the excavated zone, close to the cave wall. Bifacial elements were found in the southern and eastern areas of the excavated zone. The termination of find-bearing sediments against the blocks from the wall collapse to the east is very clear. One of the most striking features of the 3D plots of GH3 are the horizontally stratified lenses of charcoal (n = 3,095) (Figure 5). Further analyses, including spatial distribution and density estimations, workpiece arrangements (Uthmeier 2004; Weißmüller 1995), and lithic and faunal refitting, will confirm whether the finds in this geological horizon (GH) can be divided into discrete archeological horizons (AHs) or even occupation surfaces.

Lithic assemblages

The technological, morphological, functional, typological and provenience analyses of the items from the find layers discussed above are ongoing, but some preliminary

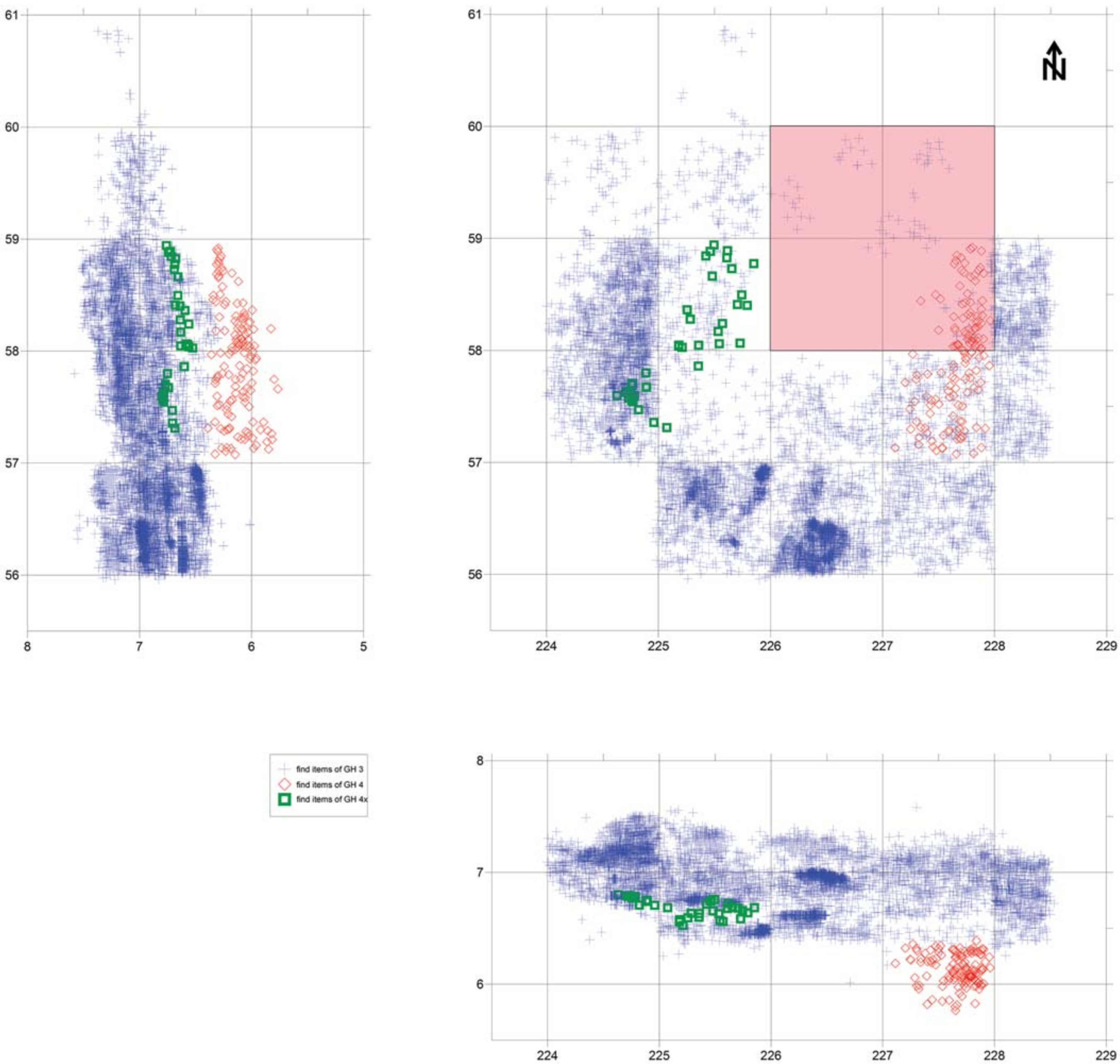
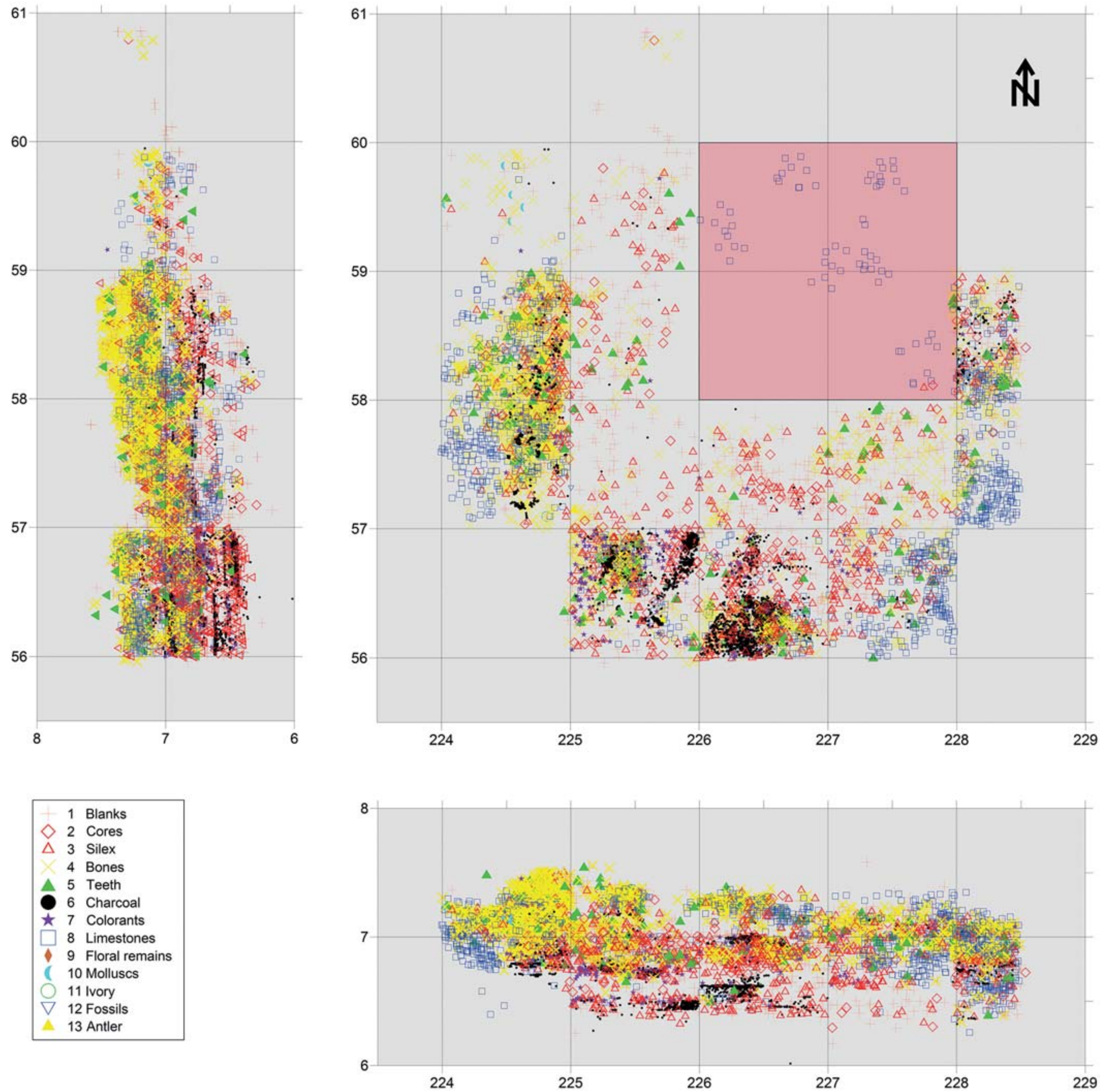


Figure 5: 3D projections of single plotted finds from the intact layers. a) projections of all finds from the layers in top view, view from west to east and from south to north; b) projections of all find items of the GH3 in top view, view from west to east and from south to north (the shaded red square indicates the sondage from 2009, 3D projections by Ch. Th. Hoyer, images by J. A. Frick).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229
N
1 Blanks
2 Cores
3 Silex
4 Bones
5 Teeth
6 Charcoal
7 Colorants
8 Limestones
9 Floral remains
10 Molluscs
11 Ivory
12 Fossils
13 Antler