Lithic Raw Materials in Hungary: a diachronic presentation on recent advances in Hungarian petroarchaeology

INTRODUCTION

Lithic raw materials represent a diachronic source of information. The use of various lithic resources is not confined to the Palaeolithic, though certainly they are prevailingly important in the earlier periods of prehistory. The author had the possibility to report on current issues of lithic raw material research in present-day Hungary important for the Palaeolithic period in a former meeting of the Carpathian archaeologists in Krosno (‘Starsza i środkowa epoka kamienia w Karpatach Polskich /The Older and Middle Stone Age in Polish Carpathians’, Gancarski 2002; Biró 2002).

This communication is intended to give an overview on recent development since that time; moreover, given the wider chronological framework of the present meeting, give more details on post-Pleistocene utilisation of lithic resources.

THE SPECIFIC NATURE OF LITHIC RESOURCES

Lithic materials have, unlike most of the elements of material culture preserved in the archaeological record, a double spatial and temporal signal: that of Site and Source. The lithic items found at a certain location and context (settlement, grave, depot etc.) representing a given chronological period; they can be traced back, with more or less effort and certainty, to an individual Geological Source or Source Region with other spatial and temporal co-ordinates: place of occurrence and time of formation. This process involves a lot of philosophical catches like the object transported will no longer be part of the original geological context; the assumed provenience can be many but the actual place of origin is strictly one.
The form (typology) of the lithic finds may and does carry temporal information as well, especially on the level of lithic assemblages from a site: more for the Palaeolithic period, and much less for the lithic elements of later prehistoric and early historic cultures. In the younger periods, associated finds and context help to date the very conservative lithic element in a site inventory. To give a good examples: hammerstones made of quartzite pebbles were used over a vast period of time and their form and applicability did not change much. Quartzite is also a good example of a blurred prov-

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Fig. 1. Draft of main uses of lithics materials in the archaeological records. Ryc. 1. Projekt głównego wykorzystania kamiennych materiałów w dokumentacji archeologicznej.
Enhance signal: obviously, it was taken from somewhere but it is impossible to allocate it to an exact geological source, partly, because the rock is far too common, partly, because it typically originates from secondary sources lying at any distance from a primary source which does not necessarily exist any more and partly because the information we could use for provenancing – structure, texture, chemical composition etc. is all too common. Another extreme example is obsidian: it is rare, geochemically characteristic, confined (geologically) to small and well defined areas. Moreover, obsidian as a raw material may even have chronological information as well (exploited by FTD\(^1\) or OHD\(^2\)), for both Site and Source. Most rocks found on archaeological sites are in between these two extremes and carry more or less provenance information that can be exploited with some work and degree of certainty. Fig. 1 gives a draft on the utilisation of lithic resources in a diachronic scale.

Looking at the archaeological material on a broader scale we shall find that even most elements of material culture preserved can be traced back to mineral resources which can be investigated with petrographical and geochemical methods. Composite materials, chemically altered and recirculated substances, however, make study and interpretation more difficult.

**WIDENING THE SCOPE**

The most effective way of a systematic investigation of provenance is a collection and database approach (Biró 2005). Prehistoric people were very selective in their choices, especially on the level of long distance trade. We made a study of glassy andesite axes made from raw material till finished implements at the Lengyel Culture site Aszód-Papi földek (Biró 1992; Judik et al. 2001) and though we performed extensive surveys on the potential source areas, we could not come up with the quality collected, worked and used by the prehistoric craftsmen. Quality was an important criterion; no wonder; because it was really a question of 'life and death' for them. Searching for quality lead to careful prospecting and labour-consuming activities of exploitation like mining and transport of heavy load. Permian red sandstone and basalt, for example, was transported across Lake Balaton in blocks over a hundred pounds for quality grinders (Biró, Markó 2007) already in the Early LBC phase.

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\(^1\) FTD: Fission Track Dating (Michael-Ralph 1971).

\(^2\) OHD: Obsidian Hydration Dating (Michael-Ralph, ibid.).
The quality requirements of the past allow us to trace the specific materials much in demand.

As the key concern of lithic raw material sourcing, undoubtedly, is for chipped stone tools, provenance studies were naturally started tracing their origin. Already in the second half of the 19th century, pioneering studies on obsidian characterisation and distribution were made (Szabó 1876; Rómer 1876). Palaeolithic archaeology also maintained a constant interest in the correct identification and possible provenancing of the important Hungarian Palaeolithic sites. The archaeological research of prehistoric and younger periods, however, seemed to realise the importance of the lithic evidence much later (Patay 1976; Lech 1981), with notable exceptions (Wosinszky 1890; Dobosi 1968; 1978; Bácskay 1976).

The Lithotheca project

Due to a systematic series of field surveys in the Hungarian Geological Institute and an international conference at Sümeg (Biró ed. 1986, 87) by 1986 a representative collection of chipped stone tool raw materials used in the Carpathian Basin was collected and organised into a regular collection within the Hungarian National Museum (Biró 1992). The collection has so far two catalogues (Biró, Dobosi 1991; Biró et al. 2000). The starting fond on Hungarian raw materials is available, in Hungarian and in English on the internet (www.ace.hu/litot, Fig. 2.) Today the collection has more than 1500 inventorised items. The main tendency observed is an increase of international exchange material and there is a growing contribution of polished stone tool raw materials and other stone utensils used extensively in prehistory (Biró-Szakmány 2000; Biró 2008).

The Raw Material Atlas project

The extension of the scope naturally lead to an interest in other raw materials with an aspect of provenance. In a 4-year project sponsored by the Hungarian National Scientific Grant (OTKA-T-025086, ‘Raw material atlas of Non-metallic prehistoric raw materials on the territory of Hungary and adjacent regions’) we were trying to collect and map available data on various aspects of material culture investigated for place of origin, all of them having important implications for prehistoric trade (Biró et al. 2002; http://www.ace.hu/atlas/).

The Historical Quarries project

During the implementation of the *Atlas* project we started to work on remaining elements of a famous collection stored at the Budapest Technical University (BME). The historical collection containing the remains of a systematic collection from all existing Hungarian quarries operating at the turn of the 19th and 20th century. The collection was established and published by Ferenc Schafarzik (Schafarzik 1904). Only part of this valuable material survived. In the framework of a Culture 2000 project ‘Erosion and Humidity’, we had the possibility to continue the work and also to revitalised the collection by visiting the existing quarries and documenting the current conditions. (Biró 2005; Balak 2005). This work has a continuation within the same EU framework, Culture 2007⁴. Many of the quarries operating in 1904 were planted on lithic resources important for prehistoric communities as well (Fig. 3, Szakmány-Nagy 2005).

⁴ ‘Historic Quarries’; project leader Christian Uhlir, Salzburg University.
Archaeometry Database and Collection

The most recent development on the field of collection and database is the establishment of the Archaeometry Reference Collection and Database in the Hungarian National Museum. This special collection was founded in 2008 and its primary goal is to collect evidence and comparative material in relation to the archaeometrical investigation of the museum's objects (Biró 2008). It is difficult sometimes to decide scopes and limits because there is a lot of common interest with the Lithotheca Collection but we hope to establish standards in the near future.
CURRENT PROBLEMS AND SOLUTIONS
IN THE RECOGNITION AND PROVENANCING
OF LITHIC RAW MATERIALS

In the meantime, several case studies were performed on the archaeological lithic material. Especially important for us is the collaboration with ELTE University, Institute of Geography and Earth Sciences, the Isotope Institute and the Geochemical Research Institute of the Hungarian Academy of Sciences. Essential advances have been accomplished on the following fields:

Obsidian

A summary article was prepared for the International Symposium on Archaeometry (Zaragoza 2004) on the current state of research of Carpathian obsidians (Biró 2004; 2006).

Non-destructive PGAA\(^5\) investigations were extended to obsidian (Kasztovszky, Biró 2004; 2006). A fairly large data library was put together, including samples, apart from Hungary, also from Romania, Croatia and the Ukraine (Kasztovszky et al. 2008; Buric 2008; Kasztovszky, Tezak, Gregl 2008). New obsidian source was identified/authenticated by the help of Ukrainian colleagues, Sergey Rhyzov and Béla Rácz (Rácz 2008).

Centred around the new obsidian sources in Ukraine, an INAA\(^6\) study was performed on our obsidian samples including bona fide obsidians (Carpathian 1. Slovakia (Viničky environs); Carpathian 2. Hungary (Southern part of the Tokaj Mts.), the newly authenticated Ukrainian sources (near Rokosovo) (Carpathian 3.). Further samples of perlite were also investigated which are not workable obsidian (marked in this article ‘Carpathian 4’ and ‘Carpathian 5’, respectively (Rosania et al. 2008). A special study was dedicated to the issue of red obsidian, very rare but existing on the Carpathian 2b (Tolcsva) source area (Biró et al. 2005).

Szeletian felsitic porphyry

The important raw material of Palaeolithic cultures in NE Hungary, Szeletian felsitic porphyry was also systematically studied recently. In a classical study by L. Vértes and L. Tóth (Vértes, Tóth 1963), this raw ma-

\(^5\) PGAA: Prompt Gamma Activation Analysis (Kasztovszky et al. 2008).
\(^6\) INAA: Instrumental Neutron Activation Analysis (Tite 1972).
terial was separated from similar-looking grey siliceous rocks by XRD\(^7\). PGAA proved to be an effective non-destructive method for the same purpose. The motive for the new series of analyses was the discovery of a large number of new Palaeolithic sites in the Cserhát Mts., with essential amount of Szeletian felsitic porphyry identified among the raw materials (Markó 2007). The results were first presented in Athens on an archaeometry conference in 2003 (published in Markó et al. 2008); later on a larger set of samples were presented in the periodical Acta Archaeologica Hungarica (Markó et al. 2003). Our intention is to check further distant claims for the occurrence of this raw materials outside the present territory of Hungary as well.

‘Grey flint’

Flint is typically an ’imported’ or LD (long distance) material on the Hungarian archaeological sites. There is one notable example, Tevel flint (Biró 2003) found in the Upper Cretaceous layers of Tevel Mt. at Nagytevel, close to Pépa (W Hungary). In the past few years (2005–2008), excavations were made on the prehistoric quarry area (Biró, Regenye 2007). A large mining field was identified. Formerly collected distribution data indicate that the use of this raw material was not started in essential quantities (Bácskay, Bihari 1989); the focus of utilisation centred on LBC and Lengyel Culture.

It is important, though, to have a clue for separating both Tevel flint and the other s.s. flint varieties found on prehistoric sites all over Hungary. We tried the potentials of PGAA on these objects, too, because it was imperative to find a non-destructive technique to be used on the valuable LD imports. The first trial was presented on the International Symposium Archaeometry in Amsterdam, 2002 (Kasztovszky et al. 2005). The second run was made after essential fieldwork in the Ukraine by András Markó, in the framework of the ECONET projects organised by F. Djindjian (see papers in Archeometriai Műhely/Archaeometry Workshop Budapest, Magyar Nemzeti Múzeum 2005 2/4), results presented on ISA 2006, Quebec (Biró et al. 2009).

In general, we can say that sourcing flint is much more difficult than that of obsidian and/or felsitic porphyry. The SiO\(_2\) content is very high, (>95%) consequently, the contribution of other elements is very low. This is true,

\(^7\) XRD: X-ray Diffraction Analysis (Herz, Garrison 1998).
however, for the other siliceous rocks as well, so these rocks are best studied together given the very low number of analyses we had the possibility to do so far (Kasztovszky et al. 2008). Different genetical types of siliceous rocks tend to stick together, same as series of ‘import’ flint on archaeological sites – these features offer some hope, but we are far from a reliable solution as yet.

**Radiolarite**

Radiolarite is the most important element for post-Pleistocene lithic inventories (Biró 1998, Fig. 30). It constitutes over 80% of the chipped stone raw materials in Transdanubia. Its role is comparable in long distance trade to that of obsidian. Unlike obsidian, however, the sources are not point-like and unique but fairly widely spaced; suppositions on provenancing based on macroscopic observations has to be supported by more objective ways of scientific investigation.

The number of radiolarite samples investigated is not too much. In the former series of analyses, mainly NAA and PIXE-PIGE⁸ was used (Biró, Pálosi 1986; Biró et al. 2002). The results indicate that the individual radiolarite deposits may be separated on regional level. The radiolarites of the neighbouring countries (esp. Slovakia and Austria) are located and known (Bárta 1961; Ruttkay 1970). We are currently working in collaboration with our Croatian colleagues to survey archaeologically viable radiolarites (Kasztovszky, Tezak-Gregl 2009) and current research is devoted to sourcing and analysing radiolarite from Transylvania (Crandell, Kasztovszky 2008). We expect to find more arguments for geochemical grouping, supporting or not the separation made on the basis of macroscopic features.

**Hydrothermal and limnic siliceous rocks**

The most peculiar element of the chipped stone inventory within the Carpathian Basin is the series of siliceous rocks formed during or after postvolcanic activity related to Late Tertiary volcanism. They are mainly responsible for local and regional raw material supply to the east of the river Danube. New efforts and investigations in this field comprise mainly the work of Adrien Szekszárdi (Szekszárdi 2005; 2007). Her efforts, however,

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⁸ PIXE-PIGE: Proton Induced X-ray Emission Analysis, Proton Induced Gamma-ray Emission Analysis (Biró et al. 2002).
were confined to certain limnic basins of the Tokaj Mts. These rocks – i.e., hydrothermal and limnic silicites have the largest variety and many sources along the Miocene volcanic arch. In relation to new fieldworks and surveys in the Cserhát Mts., a range of new sources of hydrothermal and limnic siliceous rocks were also identified (Markó 2005). Currently, similar surveys are made in Transcarpathian Ukraine by B. Rácz (Rácz 2008).

Other lithic raw materials

Petroarchaeological research of other elements of the lithic evidence had also essential progress in the past few years. They are basically prehistoric and younger, so the previous paper (Bíró 2002) did not deal with them at all (Bíró, Szakmány 2000). It involves a range of rocks used for the production of polished stone tools, some of them important in long distance trade (green schist-metabasite, hornfels; Szakmány, Kasztovszky 2001; 2004; Nagy et al. 2008) and almost local raw materials (e.g. basalt, Füri et al 2004) and further raw materials for other stone utensils like grinders and polishers, typically made of sandstone and different types of volcanites (Szakmány 1996; Szakmány, Nagy 2005). A special study was devoted to raw materials of casting moulds, partly made of stone and also some made of artificial material (burnt clay; Péterdi et al. 2005). Large sets of polished stone tools were investigated as elements of specific collections (Miháldy-Collection, Ebenhöch-Collection: Szakmány et al. 2001; Bradák et al. 2005; Friedel et al. 2008). Oravecz and Józsa investigated the polished stone tools in the Hungarian National Museum with temporal context data (Oravecz, Józsa 2005). Archaeological sites of special importance were investigated in detail (Szakmány 1996; Starnini, Szakmány 1998; Starnini et al. 2007b; Szakmány et al. 2008).

CONCLUSIONS:

The study of lithic raw materials is an ongoing, continuous task that requires
– a growing number and scope of petroarchaeological investigation of archaeological material
– systematic field survey and thematic research on potential raw material sources
– increase of possibly non-destructive instrumental analysis on both archaeological and geological materials.

We hope to supply sound basis for provenance studies that can be integrated into the study of prehistoric exchange systems of historical importance.

ACKNOWLEDGEMENTS

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Kamienny materiał na Węgrzech: ostatnie postępy w archeologii

Streszczenie

Materiał kamienny reprezentuje diachroniczne źródło informacji. Stanowiska archeologiczne są powiązane z surowcami geologicznymi. Studia nad materiałem kamiennym zawsze powiązane są ze środowiskiem naturalnym tj. budową geologiczną i geografią, z naciskiem na szlaki komunikacyjne. Początki rozważań nad zasobami kamiennymi na Węgrzech łączą się z badaniami nad odłupkami kamiennymi, ostatnio rozszerzonymi w skalę i chronologii. Ten referat podsumowuje stan wiedzy z ostatnich badań prezentowanych w Krośnie na konferencji Starsza i środkowa epoka kamienia w Karpatach polskich (2001). Potwierdzeniem aktualnej pracy jest przedstawienie w zarysie kilku projektów (Lithotheca – the raw Material Atlas Project, the Historical Quarries Project). Obecne problemy są przedstawiane ze specjalnym uwzględnieniem kontaktów dalekosiędznych.

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