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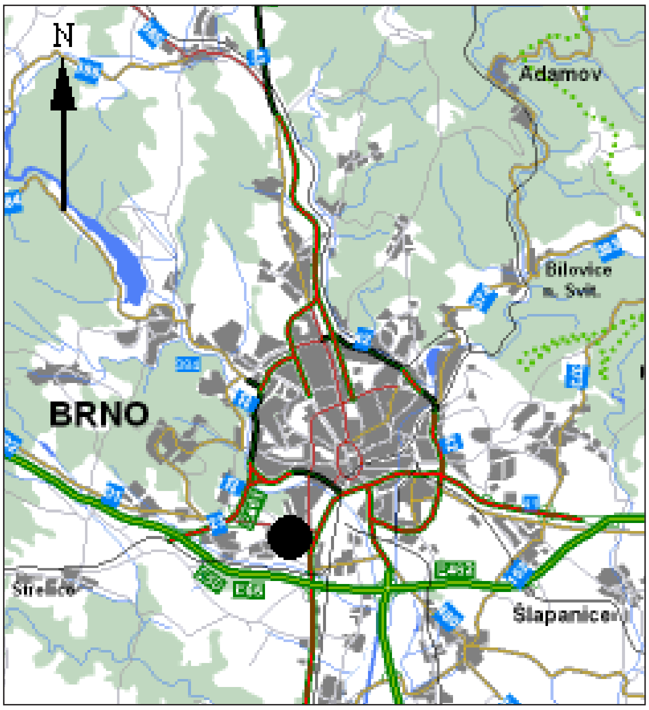
ANALYSIS OF A BURNT CLAY FRAGMENT FROM THE PALEOLITHIC SITE BRNO-BOHUNICE I

ABSTRACT: A piece of burnt clay was found in the assemblage coming from the Paleolithic site Bohunice-Kejbaly located in South Moravia. The fragment is supposed to be associated with the Early Upper Paleolithic occupancy of the site, particularly with the Bohunician culture. This fact led us to undertake a series of analyses that shed a light on the character of this extraordinary specimen.

KEY WORDS: EUP complex – Czech Republic – South Moravia – Bohunician – Burnt clay – Analysis

INTRODUCTION

During a revision of chipped stone artefacts from the Brno-Bohunice I locality (*Map 1*), 10 pieces of hematite and lump of burnt clay (partly reconstructed from several fragments) were found in the collection of the Anthropos Institute. The find was marked with acquisition number 3/78 from the Bohunice Ic – Kejbaly IV locality. In the book of finds at the Anthropos Institute, only a stone industry is recorded under this number, there is no reference to any lump of hematite.



MAP 1. Map section. Bohunice-Kejbaly locality marked in a circle.

Part of the material from the Brno-Bohunice locality was acquired for the Moravian Museum between 1969–72 during the construction of a factory (Bohunice I – Kejbaly) together with finds from the brickyard at Červený kopec.

The first finds of Paleolithic stone industry in Bohunice come from 1969 from a site crossed by a local road (Kejbaly – part I, author's note). During 1971–1972 rescue excavation took place there (Valoch *et al.* 1976); another bigger excavation was carried out there by the Anthropos Institute, led by of K. Valoch in Kejbaly in 1982 (Valoch 1982).

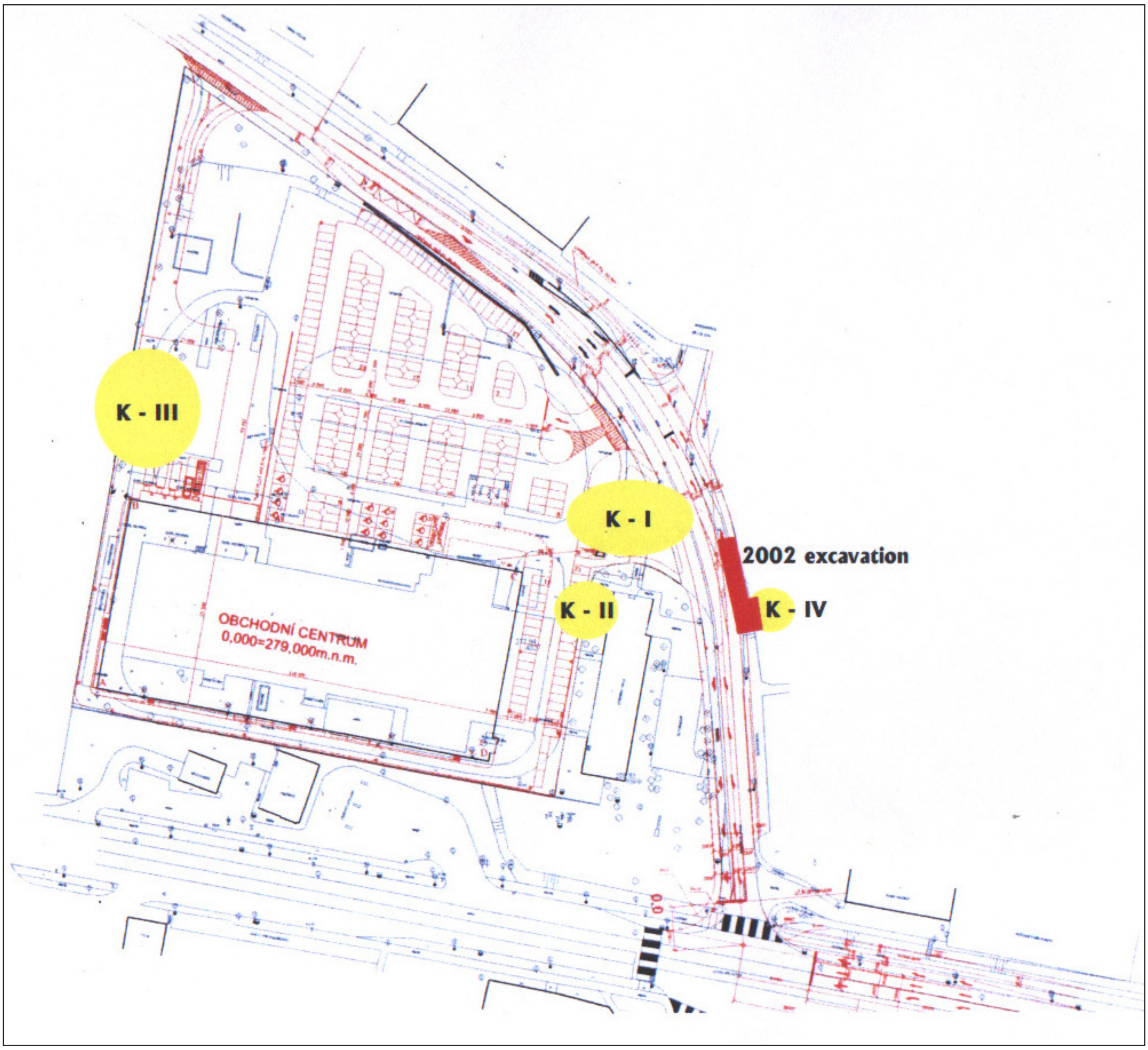
The stone industries come from several places marked by K. Valoch as Bohunice-Kejbaly part I–IV. From the location Kejbaly I, which was the biggest concentration of finds in spread, there came the biggest number of artefacts. They were spread on a relatively large area, e.g. also in the locality of the road, yet before its bend. The finds probably continued also behind the road (northward, author's note).

Kejbaly II concentration was located in an excavation of a house foundations (in the map it can be identified with the first parallel building to the left of the road, author's note).

Finds of stone artefacts from the location marked as Kejbaly III were picked from a narrow trench, probably for a gas connection line, which explains their scarcity in number and lack of both technological and typological distinction. According to K. Valoch, areas I–III should have shared an integral space, areas I and IV should be neighbouring (K. Valoch pers. comm. 23. 2. 1998).

Kejbaly IV were located east of the road, in the gradually quarried brickyard surface. The distance between areas I and IV should be about 70 m north-eastward (Valoch 1982, 32). In the original book (Valoch *et al.* 1976), areas I–III and the brickyard are described within Kejbaly, the brickyard was later denominated as Kejbaly IV (Valoch 1982, *Map 2*).

The find of a lump of burnt clay was never published (compare: Valoch 1982, Nerudová 2003), probably also due to the fact that the circumstances of its discovery were not quite clear. This is why we subjected this object to an analysis that was to determine whether it can be identified with the occupation of the Bohunician culture, or it is a random intrusion, without any connection with the other Paleolithic finds. In connection with the discoveries of textiles and papillary lines printed on the lumps of burnt clay from the Pavlovian settlements



MAP 2. Detailed plan of Brno-Bohunice locality I–IV (according to Škrdla-Tostevin, in print).

(e.g. Adovasio *et al.* 1999), we were trying to find out, before the analysis itself, whether there were any impresses on the surface of the lump. Unfortunately, except for herbage, there are no other imprints on it (not even imprints of textiles or papillary lines). In the Institute of Geological Science at the Faculty of Natural Science, a sample of the clay was taken for micro-petrographic analysis. The material composition of the lump was also compared with the composition of the layer itself the so-called "Bohunician soil" and of its underset loess. For comparison, samples were also taken from the rescue excavation in Brno-Bohunice, carried out by P. Škrdla in co-operation with G. Tostevin (Škrdla, Tostevin, in print) at the relict spot of the former brickyard (i.e. not far away from the original discovery location; *Map 2*).

ANALYSIS OF A CERAMIC CLAY FROM BOHUNICE

We obtained a sample to analyse – burnt clay from Bohunice (*Figures 1, 2* and *3*), in which it was not quite clear whether it came from the context of the Paleolithic occupation of the locality. That question was to be answered using exact methods. From the methodological point of view, we proceeded by comparison of characteristics of the burnt loam to samples of the so-called Bohunician soil and underset loess in proximity of the original find. For this purpose, a convenient situation arose in the summer of 2002 when rescue research was carried out in Bohunice and samples of soil were picked directly from the profiles. As parts of the problem solution, these basic methods were used:

1. Optical microscopy.
2. Differential thermic and thermo-gravimetric analysis.

To characterise the burnt ceramic material and raw material samples from the soil optical microscopy was used. Microscopical evaluation of ceramic/pottery samples is usually done on thin slices of about 0.03 mm, which are sampled from sides of vessels, crocks or burnt loam. Analysis of soil is rather more problematic. Mostly it is loose material that must be toughened by epoxy resin before grinding. Slice preparatives are observed under transient or polarised light of the microscope, the image

Micro-petrographic analyses:

Sample description:	Bohunice – underset loess
Colour:	Light tawny
Texture:	Omnidirectionally grained
Structure:	Aleuritic
Microstructure:	More than 90% fragment minerals of 0.001–0.05 mm size.
Modal composition of the mixture:	**Sabulous fraction**: quartz, plagioclase, common mica, Fe-hydrated oxides, fractions of carbonated microfossils **Powdery fraction**: quartz, plagioclase, amphibole, carbonate, apatite, zircon, titanite, rutile, common mica, garnet, biotite, Fe-hydrated oxides, fractions of carbonated microfossils, rarely occurring gypsum. **Clay fraction**: clay minerals + physical clay (formed by fractions of minerals mentioned above within the powdery fraction (size of particle under 0.01 mm)
Note:	Prevailing part of the studied loess is formed by soft quartz powder and carbonates (*Figure 7*). There are more than 20% carbonates in the dirt. Share of clay minerals approximates 15%.

Sample description:	Bohunice – Bohunician soil
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Note:	Prevailing part of the studied loess is formed by soft quartz powder and carbonates (*Figure 7*). There are more than 20% carbonates in the dirt. Share of clay minerals approximates 15%. In comparison with the preceding sample it contains relatively bigger splinters of carbonate shells of microfossils, and the share of sabulous fraction is also higher. Vague, unidentified carbonated particles (*Figures 4, 5*) were captured in the dirt.

Sample description:	Bohunice-Kejbaly, 95.211.
Colour:	Grey-black
Porosity:	3 %
Binding agent:	Slightly anisotropic
Texture:	Softly grained
Microstructure:	Omnidirectionally grained
Modal composition of the mixture:	Quartz (*Figure 6*), plagioclase, biotite, carbonates (primary and secondary), tourmaline, Fe-hydrated oxides, muscovite.
Note:	Prevailing part of the studied loess is formed by soft quartz powder and carbonates (*Figure 7*). There are more than 20% carbonates in the dirt. Share of clay minerals approximates 15%. The burning temperature was low. Pleochronism is still rather clearly visible on some grains of biotite. On the basis of biotite pleochronism change, the burning temperature could be near 500°C.

FIGURE 1. DSCN0325: Bohunice-Kejbaly 95.211, burnt "ceramic material".

FIGURE 2. DSCN0326: Bohunice-Kejbaly 95.211, burnt "ceramic material".

FIGURE 3. DSCN0327: Bohunice-Kejbaly 95.211, burnt "ceramic material".

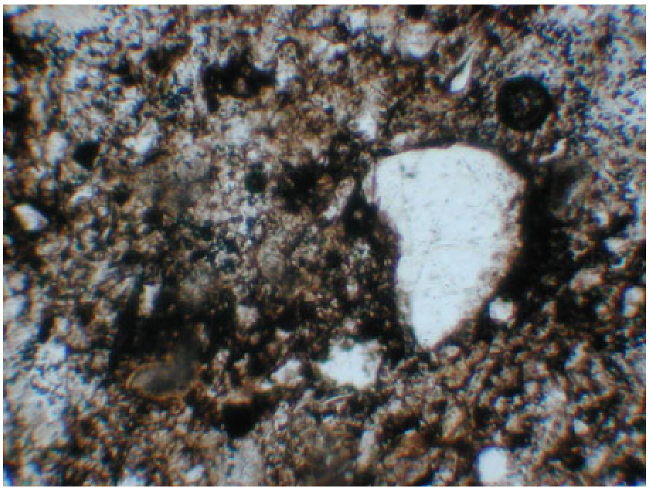

FIGURE 6. DSCN0050: Bohunice-Kejbaly 95.211, microstructure of burnt "ceramic material". Quartz surrounded by loess binding material. IN, 10×.

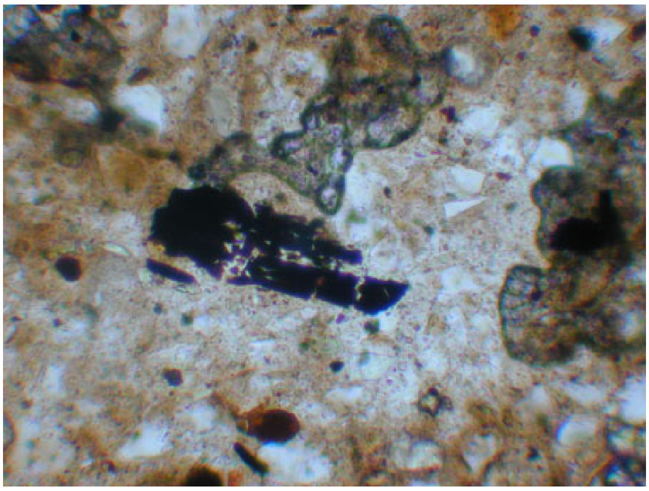

FIGURE 4. DSCN0047: Bohunice, microstructure of Bohunician soil. Charred vegetal relics. IN, 10×.

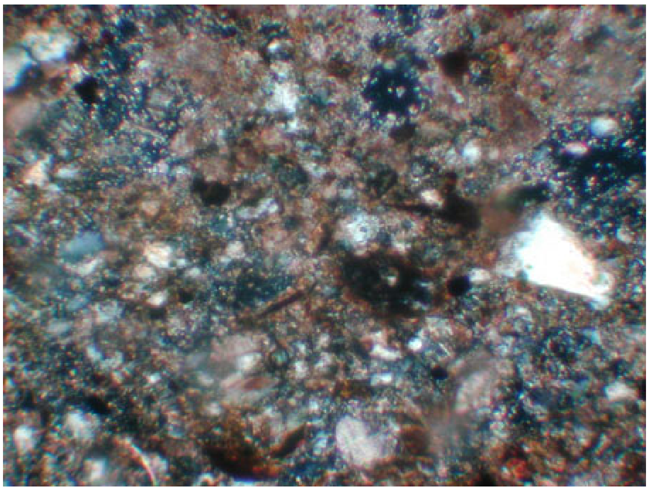

FIGURE 7. DSCN0054: Bohunice, microstructure of the underset loess. Fragmental quartz in loess. IN, 10×.

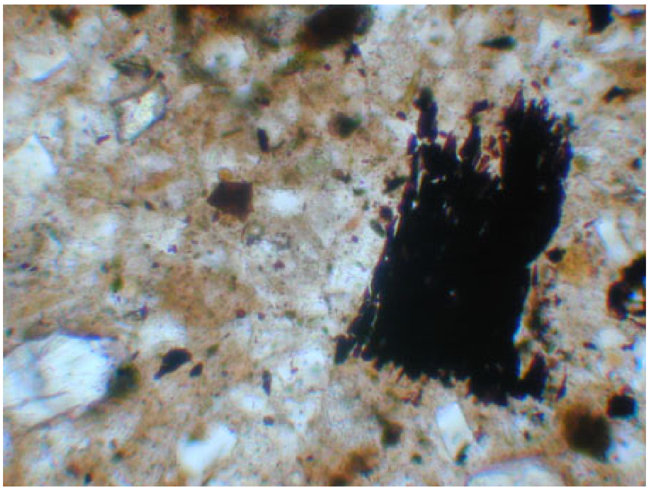

FIGURE 5. DSCN0049: Bohunice, microstructure of Bohunician soil. Charred vegetal relics. IN, 10×.

is recorded by a digital video-camera and processed by graphic software. In evaluation of slice preparations from Bohunice, we observed the following criteria:

- *Microstructure*, which is set by the arrangement of minerals (in ceramic material as well as in rocks) and pores. By comparison of loess and the Bohunician soil it could be concluded that the analysed sample of burnt loam was probably treated and modified (by tempering and mixing with foreign substances).
- *Mineral content*. Minerals in pottery and raw materials are identified, based on their optical properties. In the description their shape, size, colour and changes caused by temperature-caused reaction are characterised. To identify the raw material source, the abundance of the so-called accessory minerals is important (volume under 1%).
- *Abundance of foreign substances*. Ceramic material often contains organic substances, which leave identifiable marks after the stove-burning, or these substances simply carbonise. Minerals generated during a long-term deposit in pore system are also documented very positively.
- *Determination of stove-burning temperature*. On the slice preparative, it is possible to distinguish whether the ceramic material

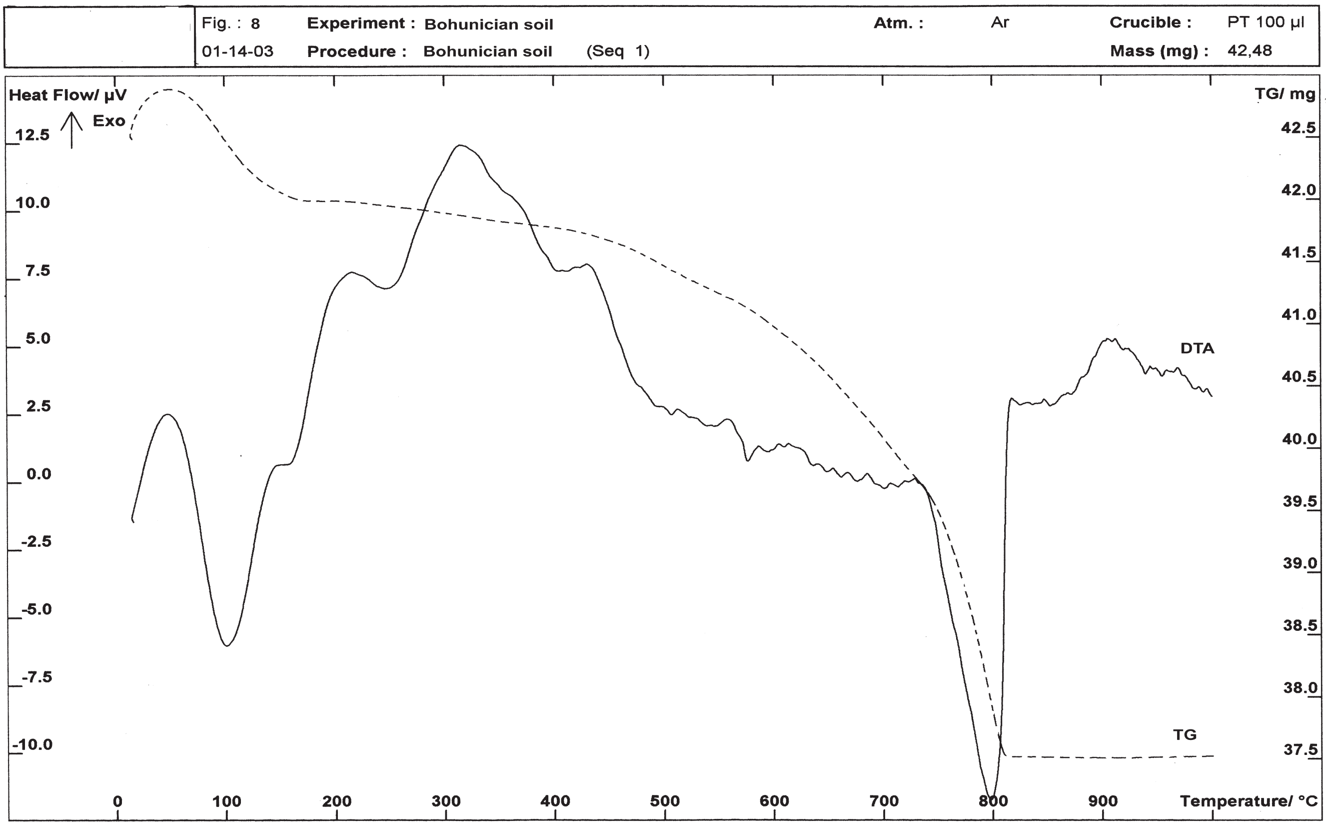

FIGURE 8. TG-DTA analysis of the cultural layer the so-called "Bohunician soil".

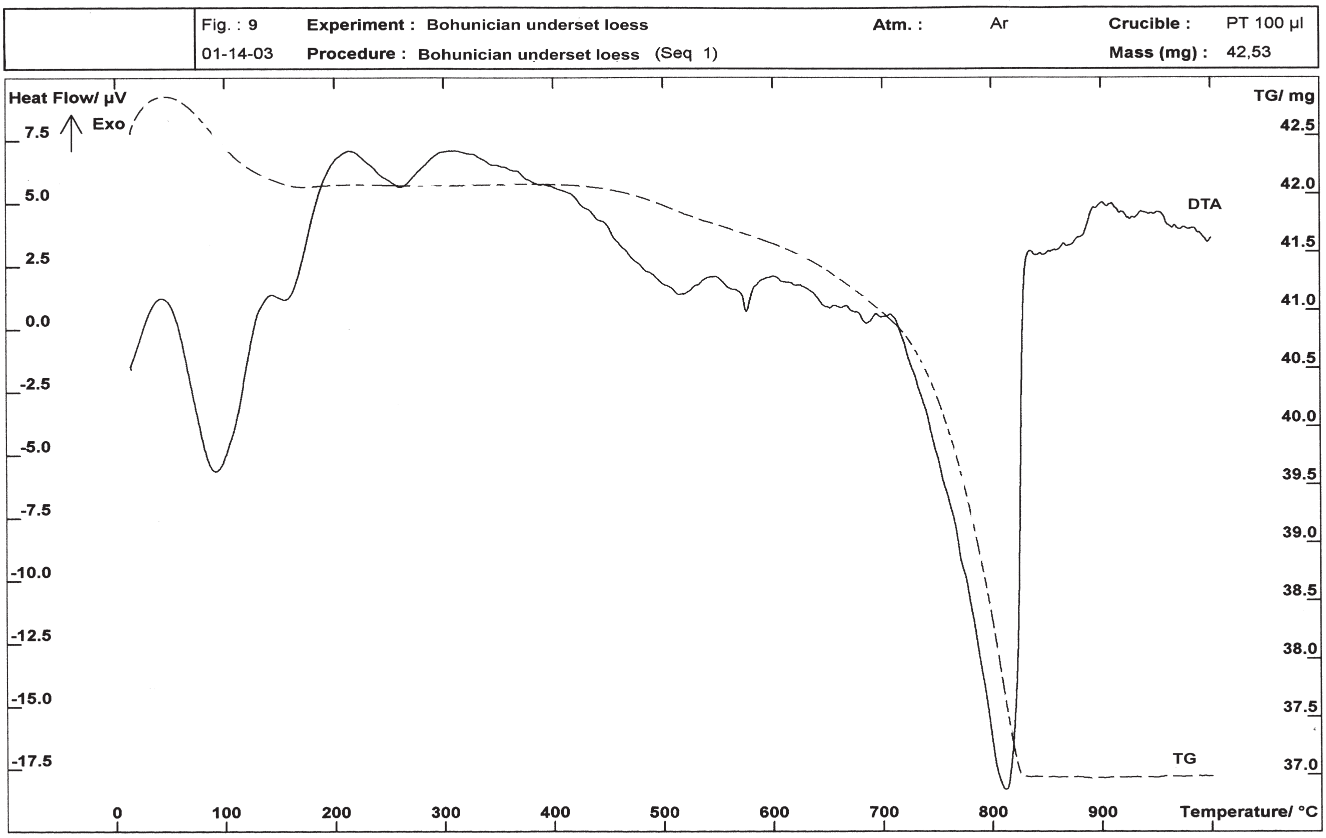

FIGURE 9. TG-DTA analysis of the underset loess.

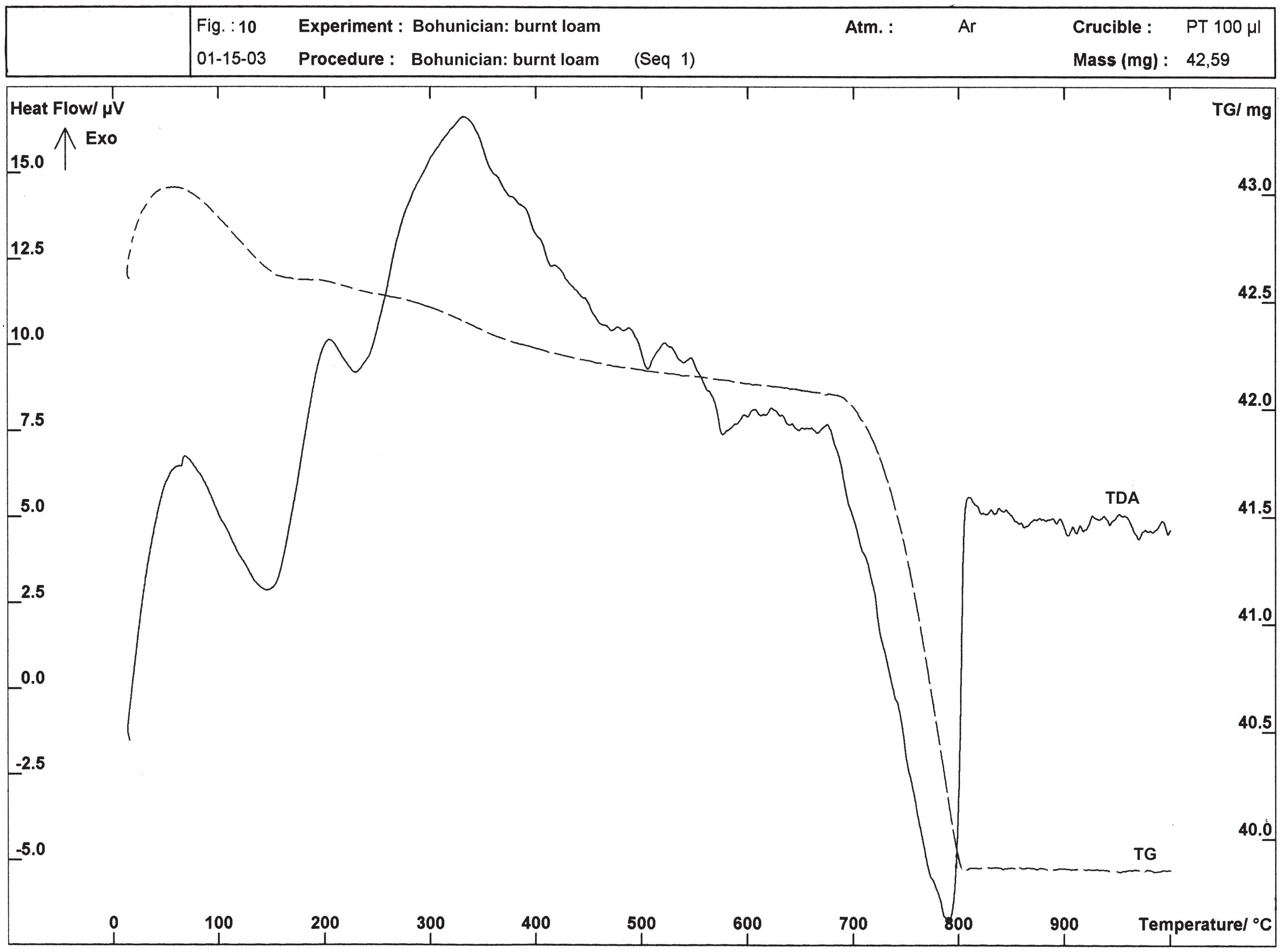

FIGURE 10. TG-DTA analysis of the burnt clay.

was burned in oxidized or reduction environment, or whether it was exposed to secondary fire influence. On the basis of transformation of some minerals we are able to determine the burning temperature.

It is important that a detailed *macroscopic characteristics* of samples precede the measurements. Description of crockery colour on the outer or inner surface and fracture of the crockery could mean oxidised or reduction burning or secondary exposition to fire.

Differential thermic (DTA) and thermo-gravimetric (TG) analysis. The method is based on a measuring of temperature differences between the analysed sample and inert standard. The increasing temperature causes reactions in a number of substances, connected with release or consumption of heat; those changes are reflected in DTA curves. These reactions can be accompanied by mass or weight decrease recorded by TG curve. It is convenient to combine DTA and TG with X-ray diffractive analysis or micro-petrographic analysis.

All three records of DTA and TG are almost identical (*Figures 8, 9* and *10*), this is why they need not be evaluated independently. Endothermic delay and weight decrease between 80–120°C responds to water bound loosely in pore system of ceramic crockery. Weight decrease up to 300°C testifies the gradual "burn-out" of carbon-abundant components of the ceramic crock and loss of water chemically bound in the structure of re-hydroxylated clay minerals. Endothermic delay at 573°C probably testifies a modificational transformation a to b-SiO_2, or it can be born on the volume of gaseous substances (N, C and H), which are present in carbon ingredients with different percentages. The beginning of endothermic peak at 720°C and its end at 830°C relates probably to the decay of microscopically identifiable carbonates. The decrease of weight can be a sum of the drop of the gradual "burning" of organogenous substances in combination with the drop of CO_2 resulting from the decay of carbonates. The weight decrease on the TG curve testifies an almost identical content of carbonates in all three studied samples.

CONCLUSION

On the basis of micro-petrographic descriptions it is possible to state that all samples are very similar to each other by the representation of minerals. Due to decay of iron minerals in the burnt knob it is not possible to identify all minerals as in the unburnt soil samples. Still it is possible, also by the close character of bigger mineral fragments (shape of grains, colour), to state that the samples are very similar in their composition and that the burnt knob has a relation to both studied soil samples. Especially notable are the remains of carbonised vegetal textures documented in slice preparatives of the Bohunician soil.

The results of the DTA of the studied samples prove that the DTA curves of the Bohunician soil and of the burnt lump are mutually almost identical. Very similar is also the TG record of the underset loess sample. That testifies that by a mere comparison of the course of DTA and TG curves we were able to state that the burnt lump originated by stove-burning of the Bohunician soil. The DTA and TG records also testify a rather low burning temperature. From that we conclude that the knob was burnt in a fire, at temperature around 500 °C. The black-grey colour indicates burning in oxi-reductional conditions under a layer of glowing charcoal and ash.

As is obvious from the performed micro-petrographic analyses, we dispose of a fragment of a ceramic lump which underwent temperature of about 500 °C and the composition of which is practically identical with fossil soil of the so-called Bohunician type (Bohunician paleosol), in which numerous chipped stone artefacts of Early Upper Paleolithic culture were found. The intentionally produced artefacts from burnt clay are, in the context of Moravian Paleolithic, especially with the Upper Paleolithic culture of the Pavlovian. Therefore they date back to a distinctly later (younger) period (compare: Svoboda *et al.* 2002). We have several RC data from the Brno-Bohunice site:

1. GrN-6165 Brno-Bohunice, Ziegelai 42 900 + 1700 B.P. –1400
2. GrN-6802 Brno-Bohunice, Kejbaly 41 400 + 1400 B.P. –1200

on the basis of which we can ponder the approximate dating of the fragment of the ceramic material. In this context, we probably have the oldest record, although almost certainly unintended, of a fragment of burnt ceramic material. It is certainly a pity that due to the character of rescue excavations in the locality we are not able to determine more precisely the circumstances of its discovery in the context of the archaeological locality in Bohunice. Nevertheless, the ascertainment that in the similar context we can expect further discoveries of the kind, is highly positive.

ACKNOWLEDGEMENTS

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