

# Archaeometrical analyses of polished stone artefacts of the Ebenhöch-collection

(Hungarian National Museum, Budapest, 2008)

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Archeometriai Műhely, 30th May 2008

## POLISHED STONE ARTEFACTS OF THE EBENHÖCH COLLECTION

It was collected by Ferencz Ebenhöch, abbot-canon in Győr.

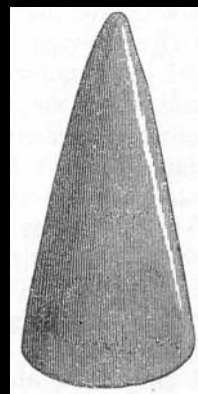
(1821-1889, Győr)

This collection is unique not only because of the quantity of prehistoric stone artefacts, but also for the beauty of the tools.

It comprises nearly 700 pieces.

They are presently divided between the Hungarian National Museum → ~ 650 pieces, and Xantus János Museum, Győr → 44 pieces.

Polished stone tools were collected as surface stray finds from sites dating from the early Neolithic to the Bronze age and located in North Transdanubia, in the area of Győr



Ebenhöch's original drawing of a stone axe  
(Ebenhöch, 1876)

## THE AREA OF PROVENANCE OF THE POLISHED STONE TOOLS ARTEFACTS COLLECTED IN THE XIX CENTURY



## MAIN OBJECTIVES, METHODOLOGY

### Main objectives:

The present investigations are aimed at the scientific identification and description of the raw materials of the artefacts and if possible, to determine their geological provenance. This, from the archaeological point of view, will be helpful to shed light on long-distance cultural connections during prehistoric time.

### Methodology

I made a detailed macroscopic study of the complete set of artefacts. On selected samples, polarising microscopic studies were made on the basis of macroscopically distinguished type groups. For the more specific determination of the rock types we completed our investigations with magnetic susceptibility measurements ( $\kappa$ , MS), chemical analyses by PGAA method and mineral chemical analysis by SEM-EDS.

## GREENSCHIST TYPES



Greenschist type I.

Fine-grained massive rocks. They are light green in colour. Coarse-grained aggregates of feldspar. They show a well-developed, thin spaced foliation.

Artefacts types: flat chisel, rarely shoe last chisel

They are dark, very fine-grained and very well foliated rocks. Foliation is due to the alternation of < 1mm thin, sharply separated dark green and black bands. Shoe last chisel shape dominates amongst them, but flat types are also represented in the collection.



Greenschist type II.



Greenschist type III.

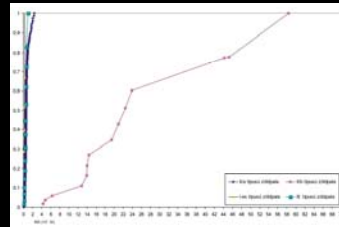
They are dark green coloured, less foliated rocks, containing coarse-grained feldspar aggregates. According to their appearance, these lithotypes are different from the previous groups. From these rocks both flat chisels and shaft hole axes were made.

## GREENSCHIST TYPES

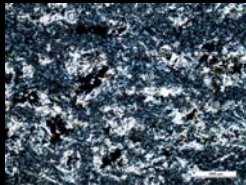


Greenschist type I.

Actinolite, albite, chlorite, opaque minerals (ilmenite), epidote



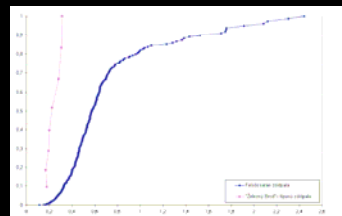
Amphibole, saussuritised plagioclase and opaque minerals



Greenschist type II/a.



Greenschist type II/b.

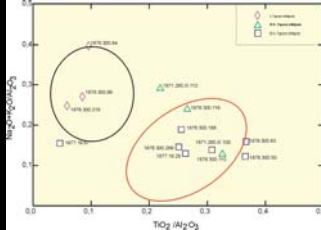


Two main subgroups are separated by magnetic susceptibility values.

→  $0,1 - 2,6 \times 10^{-3}$  SI

→  $4 - 60 \times 10^{-3}$  SI

## GREENSCHIST TYPES



### PGAA results:

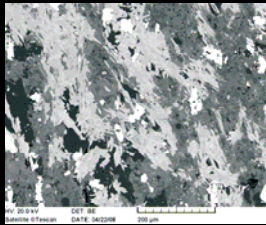
The chemical results confirm that greenschist type I is highly similar to the rock samples from Eastern Alps, from Felsőcsatár, and the greenschist type II is nearly related with the greenschist from the Bohemian Massif.

Red circle→Bohemian Massif, black circle→Felsőcsatár.  
(Gy. Szakmány and Zs. Kasztovszky, 2004)

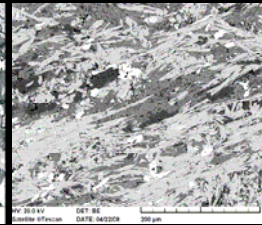
### (II/a):

- amphibole 1 (dominant) → magnesiohornblende
- amphibole 2 (rare) → antophyllite / cummingtonite
- basic plagioclase,
- quartz,
- ilmenite,
- albite,
- apatite

### SEM-EDS results from type II greenschists:



Greenschist type II/a.



Greenschist type II/b.

### (II/b):

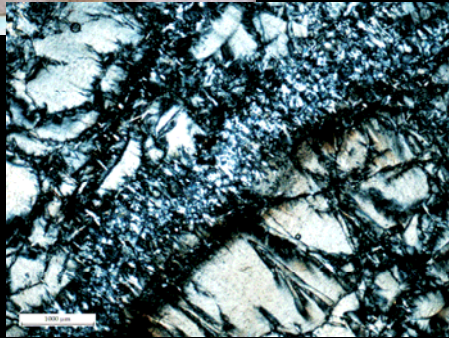
- amphibole → antophyllite / cummingtonite
- basic plagioclase,
- quartz,
- ilmenite,
- pyrite

## SERPENTINITE



They are fine- or very fine-grained rocks. They have various colours: green, greenish yellow or sometimes reddish yellow (due to alteration). The typical mineral composition is antigorite, chrysotile, opaque minerals and occasionally pyroxene relicts. Newly formed amphibole also may occur.

Most of the artefacts from this raw material are perforated hammer-axes, followed in quantity by flat chisels.



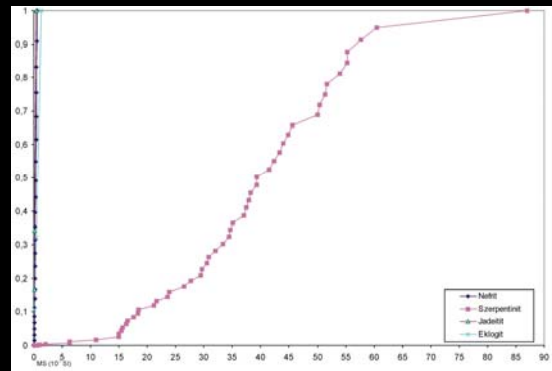
## SERPENTINITE

MS values are variable within a wide interval ( $5-65 \times 10^{-3}$  SI).

In some cases, measurements taken on different sides of the artefacts yielded quite different values.

This means that the magnetizable minerals are inhomogeneously distributed in these rocks.

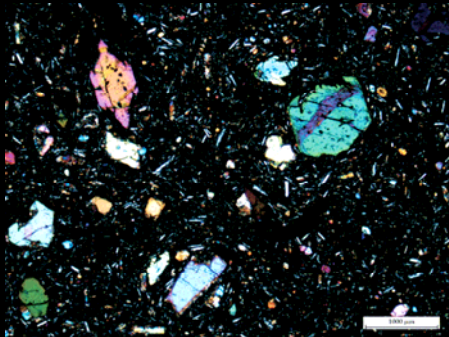
Weathering can also have an influence on the MS response.



## BASALT

They are black or dark grey, fine- or very fine-grained, massive rocks.

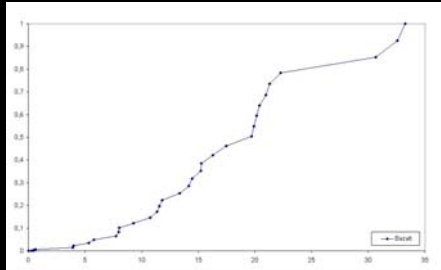
Mainly flat chisels and axe/adzes blades, rarely shoe last chisels were made from this raw material.



Their minerals are olivine and clinopyroxene phenocrysts in fine-grained, partly glassy matrix, and basic plagioclase.

In some cases crustal inclusions can be observed.

## BASALT

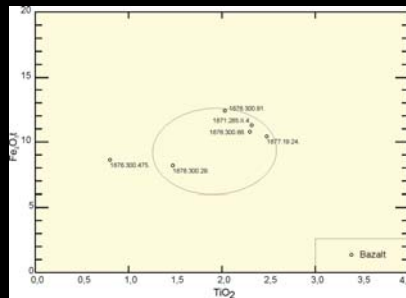


## Magnetic Susceptibility

Two possibly main subgroup of basalt artefacts were identified on the cumulative curve: one group with values lower than  $1 \times 10^{-3}$  SI and the other with values from  $4-33 \times 10^{-3}$  SI.

## PGAA

The results show that the basalt raw material could originate from the Balaton Highland - Little Hungarian Plain, and only a small part of the basalts artefact are produced from basalts from other source areas (Füri *et al.*, 2004).



## OTHER ROCK TYPES

Andesite



Metamagmatite



Amphibolite



Nephrite





## OTHER ROCK TYPES

Mylonite



Hornfels



HP metamorphites (eclogite/  
jadeitite/omphacitite)



Crystalline schist



## OTHER ROCK TYPES

Sandstone



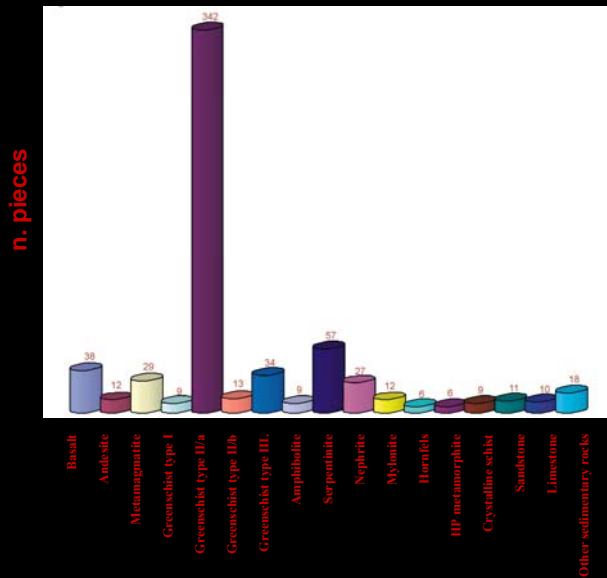
Limestone



Quartzite



## Distribution of the raw material types of the Ebenhöch polished stone stools collection



## SUPPOSED AREA OF ORIGIN OF THE ROCKS

### Greenschist types

Greenschist type I. → Felsőcsatár

Greenschist type II/a. → „Železný Brod” (Bohemian Massif)

Greenschist type II/b. → „Želešice” (Bohemian Massif)

Greenschist type III. → Other greenschists

Serpentinite → ? The origin is questionable because these rocks are quite widespread, however the most probable sources are located in Eastern Alps-Penninic Unit and/or Gogolów – Jordanów Mountain

Basalt → Balaton Highland or Little Hungarian Plan.

Hornfels → In the whole area of the Carpathian-basin (South, or South East Carpathian-basin)



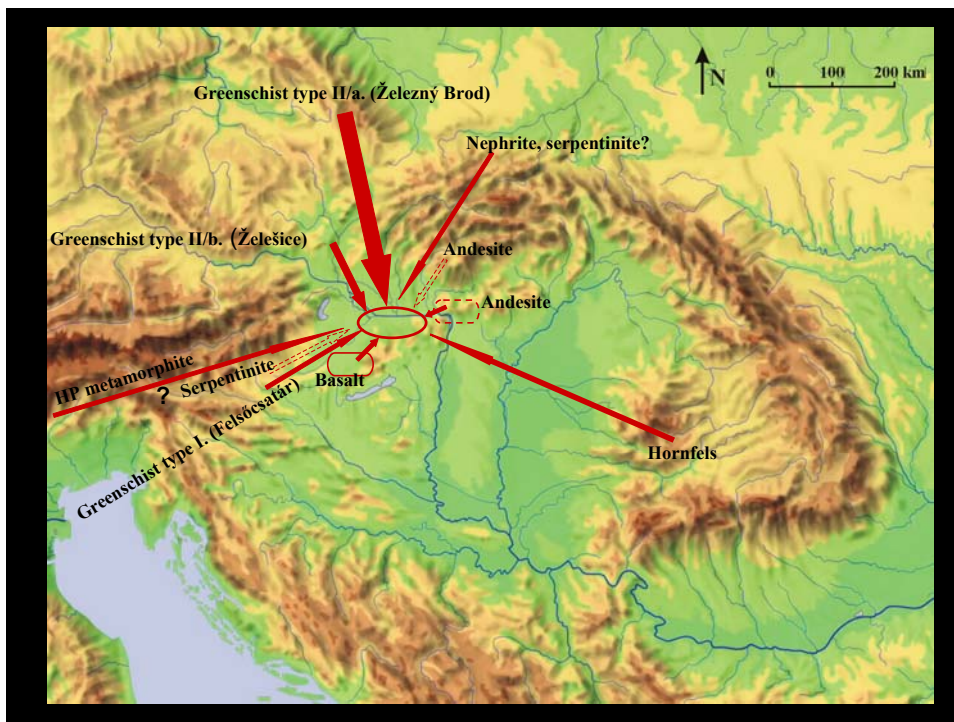
## SUPPOSED AREA OF ORIGIN OF THE ROCKS

Nephrite → Gogolów – Jordanów Mountain (South-Poland) (*Skoczylas et al., 2000*).

HP metamorphite → Footlands of Western Alps (Piedmont: *D'Amico et al., 2000, D'Amico et al., 2003*)

Amphibolite and metamagmatite → ? In the whole area of the Carpathian-basin and neighbouring territory

Andesite → (occurs rarely as polished stone tools) Slovak volcanic area, or from Börzsöny (*Hovorka et al., 1996, Szakmány, 1996*).



## ACKNOWLEDGEMENT

Szokmány György, T. Biró Katalin, Józsa Sándor, Oravecz Hargita, Elisabetta Starnini, Kádár Marianna, Sági Tamás, Kókay Rita and Klébesz Rita (ELTE TTK)

Katona Csaba (National Archives of Hungary)

Egry Ildikó (Xantus János Museum, Győr)

Management of the Hungarian National Museum

Szilágyi Veronika, Kasztovszky Zsolt, and Bendő Zsolt

No. K 62874 of the Hungarian Scientific Research Fund (OTKA).

## BIBLIOGRAPHY

D'Amico, C., Starnini, E. (2000): Eclogites, jades and other HP-metaophiolites of the Neolithic polished stone tools from Northern Italy. - *Krystalinikum*, 26., 9-20.

D'Amico, C., Starnini, E. (2003): Eclogites, jades and other HP-metaophiolites employed for prehistoric polished stone implements in Italy and Europe – *Periodico di Mineralogia*, 73, 17-42, 2003.

Ebenhöch, F. (1876): Győr vidékének kőkorszaki leletei – *Magyar Orvosok és Természettudósok Nagygyűléseinek Munkálatai*, 249-260.

Füri, J., Szokmány, Gy., Kasztovszky, Zs., T. Biró, K. (2004): The origin of the raw material of basalt polished stone tools in Hungary – *Slovak Geological Magazine*, 10. 1-2 (2004), 97-104.

Hovorka, D., Illášová, L. (1996): Neolithic Eclogite hammer from the Nitriansky Hrádok (Western Slovakia) – *Geologica Carpathica*, 47, 6, Bratislava, 1996, 367-370.

Skoczylas, J., Jochemczyk, L., Foltyn, E., Foltyn, E. (2000): Neolithic serpentinite tools of west-central Poland and Upper Silesia - *Krystalinikum*, 26, 157-166.

Szokmány, Gy. (1996): Results of the petrographical analysis some samples of the ground and polished stone assemblage. In: Makkay, J. – Starnini, E. – Tulok, M.: Excavations at Bieske-Galagonyás (part III.). The Notenkopf and Sopot-Bieske cultural phases. *Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia, Quaderno 6*, 224-241.

Szokmány, Gy. and Kasztovszky, Zs. (2004): Prompt Gamma Activation Analysis, a new method in the archaeological study of polished stone tools and their raw material – *European Journal of Mineralogy* 2004, 16, 285-295.

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