The raw materials of the stone tools from Tell Gorzsa (SE Hungary, Tisza Culture, Late Neolithic)

[*Gorzsa tell településről előkerült kőeszközök nyersanyag típusai (DK Magyarország; Tisza kultúra, késő Neolitikum*)]

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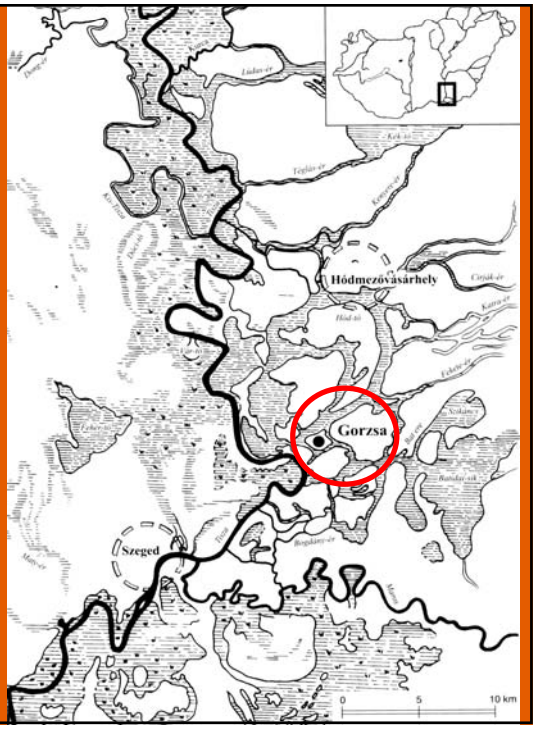
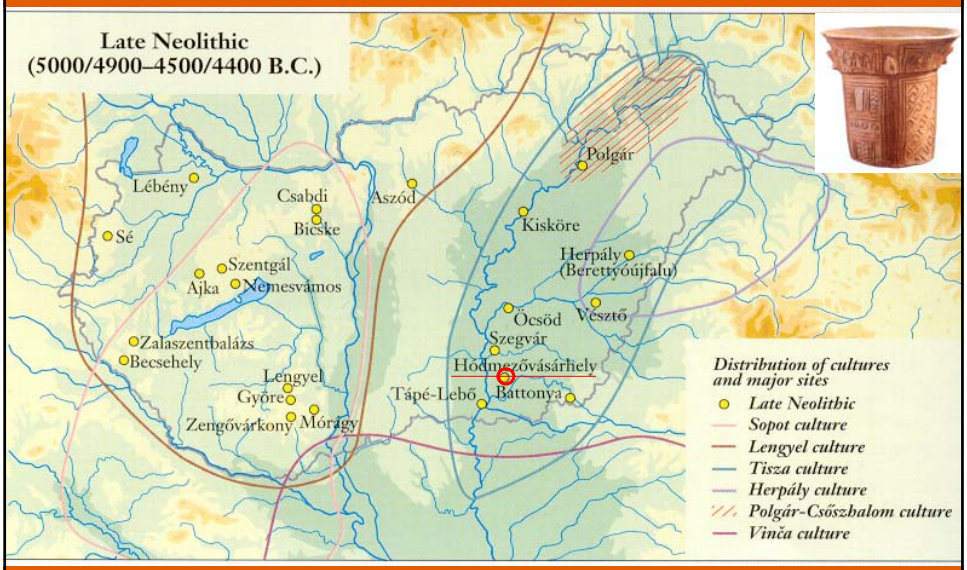
Archeometriai Műhely - May 30th 2008

Location of the site

This is a preliminary report on the analyses of the Neolithic stone assemblage from the site of **Hódmezővásárhely-Gorzsa**, a **Tisza Culture *tell*-site**. The site lies at the confluence of the Tisza and Maros rivers, in South Hungary. The most recent excavations began in 1978, directed by Ferenc Horváth, of the Móra Ferenc Museum of Szeged (Horváth 2005).

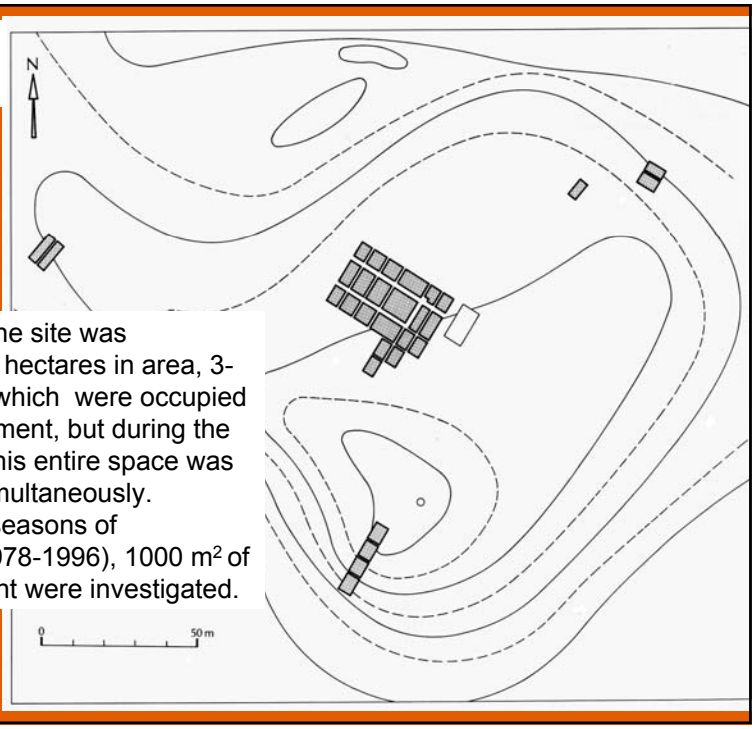


Chronological framework and cultural connections



(modified map from: Hungarian Archaeology at the turn of the Millennium, Budapest 2003)

Map of the excavations



The surface of the site was approximately 5 hectares in area, 3-3,5 hectares of which were occupied by the tell settlement, but during the Late Neolithic, this entire space was not inhabited simultaneously. During several seasons of excavations, (1978-1996), 1000 m^2 of the tell settlement were investigated.

ARCHAEOLOGICAL FRAMEWORK

According to the stratigraphy and the typology of the objects, the Neolithic occupation of the tell was determined to comprise **five different phases of occupation**, with no hiatus.

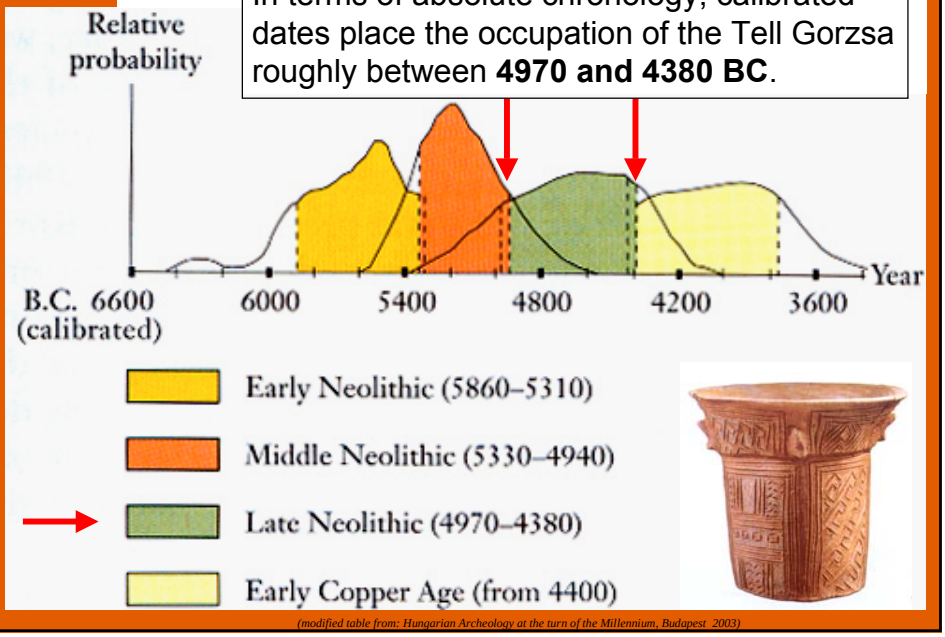
In terms of comparative chronology, the main phases of the development of the Tisza Culture (Phases I-V) are considered contemporary to the **Proto-Lengyel** and **Lengyel I-IIIa Culture**.

Relative chronology of the Tisza Culture

(modified table from: Hungarian Archaeology at the turn of the Millennium, Budapest 2003)

Absolute chronology of the Late Neolithic

In terms of absolute chronology, calibrated dates place the occupation of the Tell Gorzsa roughly between **4970 and 4380 BC**.

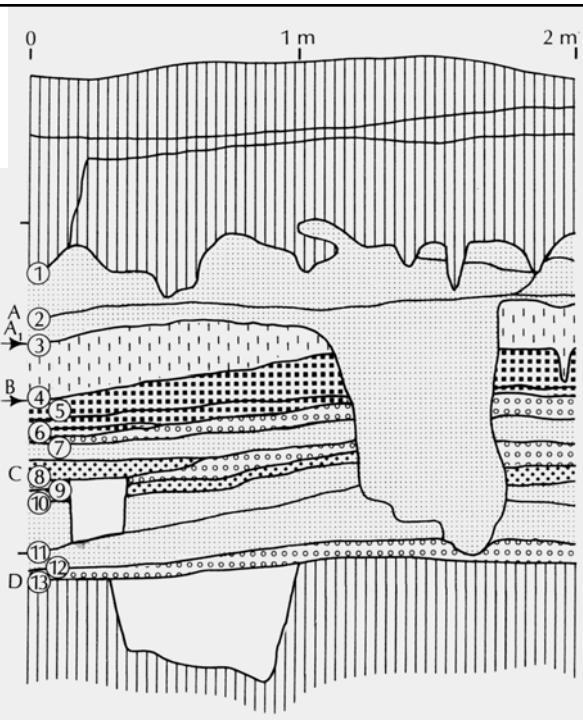


(modified table from: Hungarian Archeology at the turn of the Millennium, Budapest 2003)

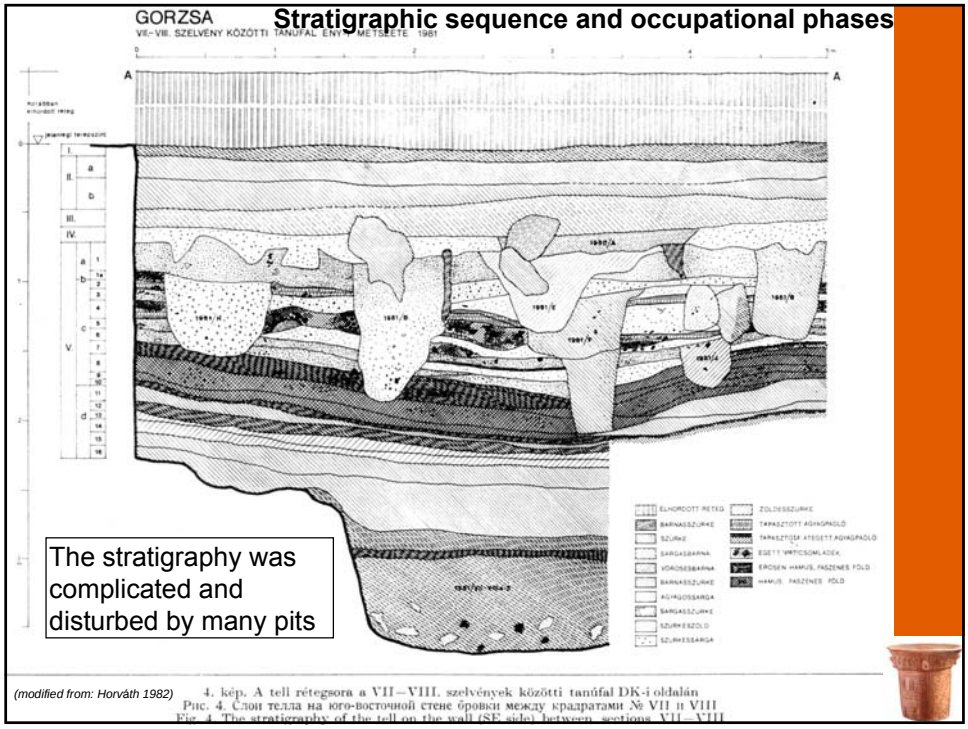
Stratigraphic sequence and occupational phases

The layers of the settlement formed a sequence that was 2,60 to 3 m thick and contained remains from **Late Neolithic** to the period of the Sarmatians.

The thickest layer was 180-200 cm and was that of the Late Neolithic, dating to the **periods II-V of the Tisza Culture**.



Stratigraphic sequence and occupational phases



Settlement features: details of Room 2 in House 2

Several **houses** of wattle and daub were uncovered, subdivided into three rooms with lengths between 16 and 18 meters, the best preserved of which was **House 2** (Horváth 1991).

The raw materials of the chipped stone artefacts

- several raw materials are represented in the sequence, among which the most significant are:

-**Mecsek radiolarite**

-**Central Banat chert**

- **Tevel flint**

-**Transdanubian radiolarite**
(both Szentgál and Úrkút Eplény variants)

(data from T. Biró 1998 and Starnini et al. 2007)

The raw materials of the chipped stone artefacts

-Less frequently occur raw materials from northern, medium and long distance sources:

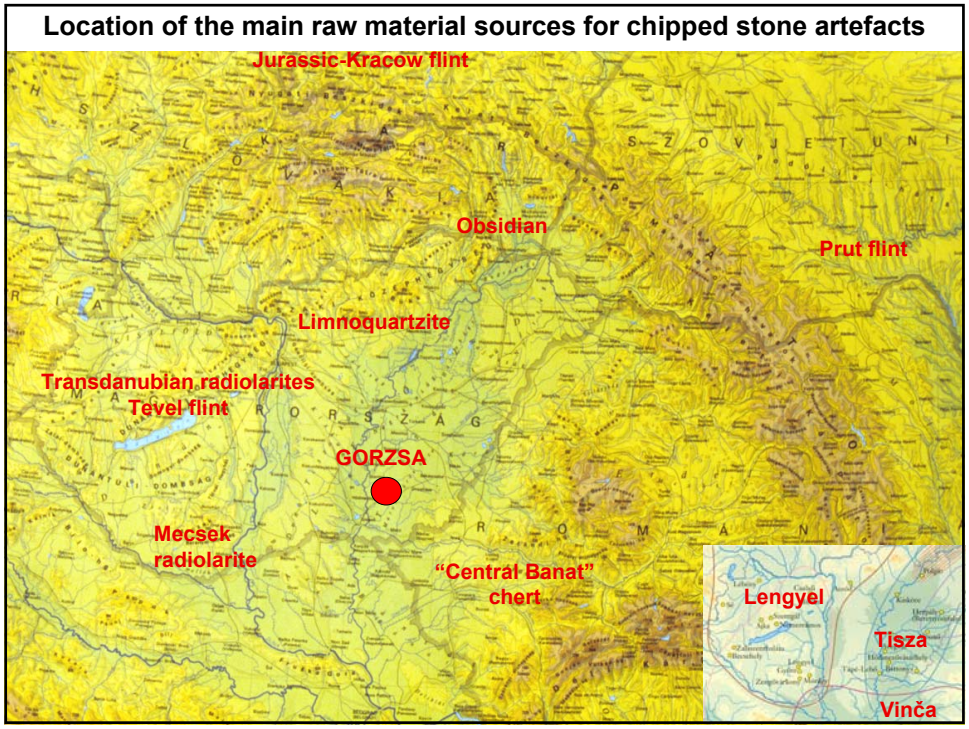
-**Jurassic Kracow flint**

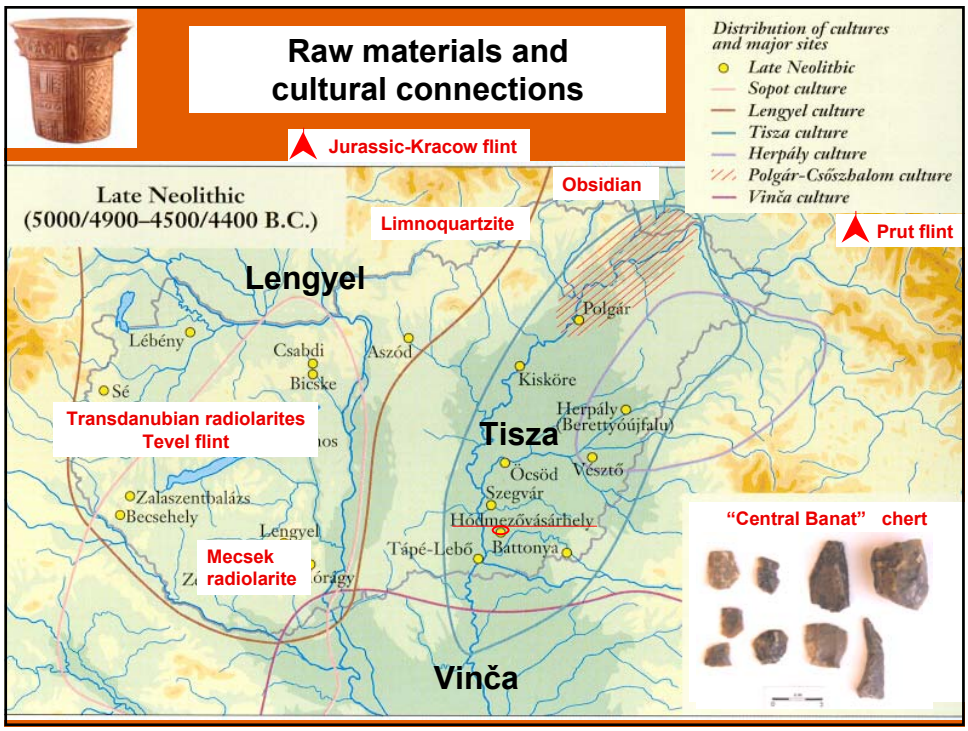
-**Chocolate flint**

-**Volhynian/Prut flint**

-**Carpathian obsidian**

-**Limnoquartzite** from the western Mátra Mountains
(data from T. Biró 1998 and Starnini et al. 2007)


Location of the main raw material sources for chipped stone artefacts
Jurassic-Kracow flint
Obsidian
Prut flint
Limnoquartzite
Transdanubian radiolarites
Tevel flint
GORZSA
Mecsek
radiolarite
"Central Banat"
chert
Lengyel
Tisza
Vinča


Raw materials and
cultural connections
Jurassic-Kracow flint
Late Neolithic
(5000/4900–4500/4400 B.C.)
Obsidian
Limnoquartzite
Prut flint
Distribution of cultures
and major sites
Late Neolithic
Sopot culture
Lengyel culture
Tisza culture
Herpály culture
Polgár-Csőszhalom culture
Vinča culture
Lengyel
Polgár
Lébény
Csabdi
Aszód
Bicske
Sé
Kisköre
Herpály
(Berettyóújfalu)
Transdanubian radiolarites
Tevel flint
Tisza
Ócsöd
Vésztő
Szegvár
Zalaszentbalázs
Becsehely
Hódmezővásárhely
Lengyel
Tápé-Lebő
Battonya
Mecsek
radiolarite
"Central Banat" chert
Vinča

Raw materials of the polished and ground stone artefacts

AIMS AND METHODS OF THE ANALYSIS

During the excavations about 900 polished and ground stone artefacts were collected, **700** ca. of which have been already examined.

Aim: to **characterize** the rocks and determine the **provenance** of the lithic raw materials of **polished** (axes, adzes, chisels, hammer-axes) and **ground** (grinding stones, abraders, pestles, etc.) **stone tools** which might help to reveal, together with those of the chipped stone implements, the network of the cultural connections existing at Gorzsa during the development of the Tisza Culture and the trade and exchange systems active at that time.

Analytical methods at this stage of research:
macroscopic (all artefacts) **and polarizing microscopic description** in thin section (150 samples)
combined with

magnetic susceptibility (MS) measurement performed with a portable device **Kappameter KT-5**

Raw materials of the polished and ground stone artefacts

MAGNETIC SUSCEPTIBILITY (MS)

one of the more rapid, cheap and **non-destructive** method of analysis (Williams-Thorpe & Thorpe 1993) not yet widely employed in archaeometry. In Hungary it was first employed for the characterization of prehistoric polished stone tools raw materials (Bradák *et al*. 2005)

In many cases the results of measuring are influenced by the characteristics of the stone artefacts:

heterogeneity, uneven dispersion of magnetic mineral in magnetic fabric of the rock, weathered surface, surface irregularity or injure on surface, shape of analysed implements (the measured surface does not cover the active face of the MS meter)

Portable Kappameter KT-5 device

Raw materials of the polished and ground stone artefacts

MAGNETIC SUSCEPTIBILITY (MS)

This fast method of analysis in many cases allows the precise discrimination between different lithotypes due to characteristic different values of REAL (=corrected) MS:

Siltstone/limy silicified mudstone: **none** (0 $\times 10^{-3}$ SI)

Hornfels: **low** and with a strict range (0.2-0.4$\times 10^{-3}$ SI)

Andesite: **medium,** ranging between 2-8$\times 10^{-3}$ SI)

Basalt: various, but generally **high** (7-27$\times 10^{-3}$ SI)

However, this method must be combined with a more detailed petrographic analysis (macro and microscopic investigation in thin section)

Portable Kappameter KT-5 device

CUTTING-EDGED, POLISHED STONE TOOLS

HORNFELS

Petrography: it is the commonest rock, pale green-greyish green-grey-greyish white, very fine grained, massive hard and tenacious. Usually, small and medium-sized flat **axes/axe blades** and **shoe-last chisels** were produced from this raw material. Mineral component are predominantly **diopside** and **feldspar**, rare **opaque minerals** and occasionally **biotite**. The texture are granoblastic, or poikiloblastic. Real **MS values** are **low** and with a strict range (0.2-0.4 $\times 10^{-3}$ SI).

Origin and provenance: Hornfels artefacts are widespread in the Carpathian Basin Neolithic sites, but their presence decreases towards N and NW. The possible source can be located in the **Banatite belt** or **other contact areas** with a high temperature magmatic body of the **S-E Carpathian Basin**.

Hornfels polished adzes and N+ micrograph

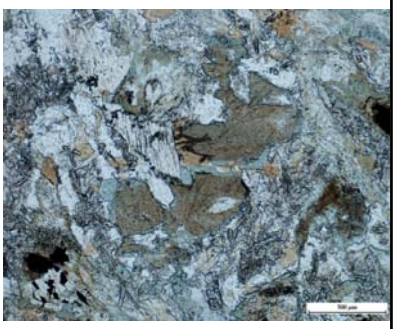
CUTTING-EDGED, POLISHED STONE TOOLS

METADOLERITE-METAMICROGABBRO

Petrography: this lithotype is quite common in form of **shaft holed hammer-axes**. They are fine-medium grained, hard, massive rocks. According to their grain sized and intensity of metamorphic alteration they can be subdivided in different varieties. The original mineral composition was **plagioclase**, **pyroxene**, **ilmenite**, and few **apatite**. The original texture is intergranular-subophitic. Primary minerals altered during the metamorphic process. Instead of pyroxene, **brown hornblende** and later **actinolite**, **saussuritized** plagioclase, and new **albite** formed, the ilmenite altered to **titanite**. **Chlorite** might occur too. Sporadically prehnite, zeolite, calcite also formed. Real **MS values** show the existence of 2 different groups: one with **high** (20-45 $\times 10^{-3}$ SI), the other with **low** (generally <1, max 2.5 $\times 10^{-3}$ SI) MS.

Origin and provenance: in the Carpathian Basin and its neighbouring areas similar Mesozoic metaophiolites occur in 3 different localities:

A) near **Szarvaskő** (W-Bükk Mts., N Hungary)
B) **Maros Valley** (E-Romania)
C) **Sava-Vardar Zone** (Serbia-Bosnia-Croatia).



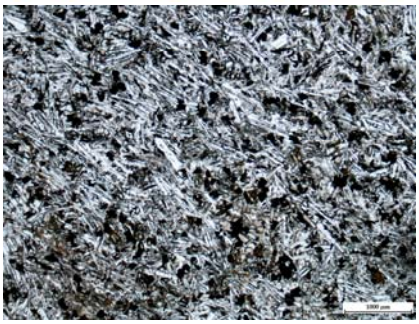
Perforated hammer-axe and 1N micrograph

CUTTING-EDGED, POLISHED STONE TOOLS

BASALT

Petrography: **perforated hammer-axes** are manufactured from this black, fine grained rock, macroscopically very similar to the dolerite-metadolerite group. Only few (or no) **olivine** phenocrysts occur; the rock has fluidal texture; the **plagioclase** laths are parallel/sub-parallel. Besides plagioclase, the matrix consists of **clinopyroxene**, **olivine** (generally completely altered), **opaque minerals** and **glass**.
MS values are generally **high** (7-27 $\times 10^{-3}$ SI).

Origin and provenance: similar rocks are widespread in other Neolithic sites in S Hungary. The raw materials origin perhaps can be located in **Mecsek Mts**.



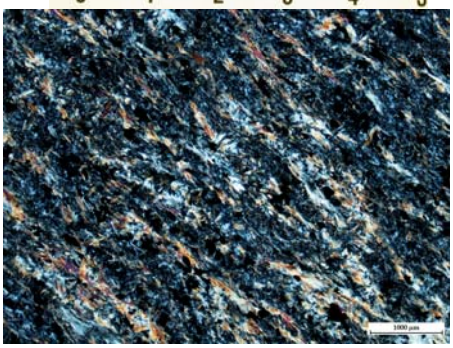
Fragmentary basalt polished , perforated hammer-axe and 1N micrograph

CUTTING-EDGED, POLISHED STONE TOOLS

GREENSCHISTS

Petrography: mineral composition, texture and secondary alteration are highly variable, but generally they are very fine grained, massive dark green rocks. The main mineral components are **amphibole**, saussuritized **plagioclase**, **zoisite-epidote**, **new plagioclase**, **chlorite**, **opaque minerals**. **MS values** are very **different** (0.1-40 $\times 10^{-3}$ SI), which indicates **different origins** and provenance.

Origin and provenance:
among the possible provenance we can indicate the **South** and **North Bohemian Massive**, respectively the **Želešice** and **Železný Brod** (Jesenik Mts) types on the basis of their mineralogical, textural and MS features. Moreover there are also other types, whose provenance can be located perhaps in the **Sava-Vardar Zone** and/or **Apuseni Mts**.



Chisel and N+ micrograph

OTHER LESS COMMON LITHOTIPES

There are some chisels or shoe last axe made of:

•white **siltstone** or **limy silicified mudstone** (MS=0 × 10^{-3} SI)
Origin and provenance: according to the wide presence in the Vinča stone industry, the **Sava-Vardar Zone** can be suggested as provenance.

•light-coloured, or red-lilac **acidic-intermediary vulcanite or meta-vulcanites, dyke rocks** (MS=0.5-6 × 10^{-3} SI)
Origin and provenance: **Sava-Vardar Zone**, or the **Apuseni Mts**.

•**alkaline-dolerite/tephrite/phonolite**
Origin and provenance: **Mecsek Mts**.

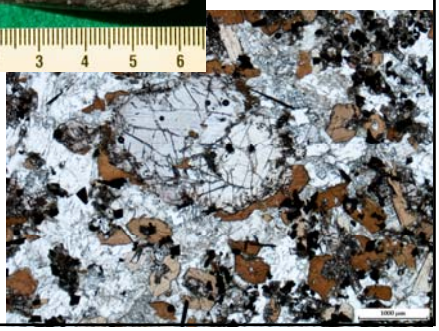
•**metaultrabasites**
Origin and provenance: **Vardar Zone**

•**amphibolite**
Origin and provenance: **Sava-Vardar Zone** or the **Apuseni Mts**.

CUTTING-EDGED, POLISHED STONE TOOLS

White siltstone adze

Alkaline dolerite



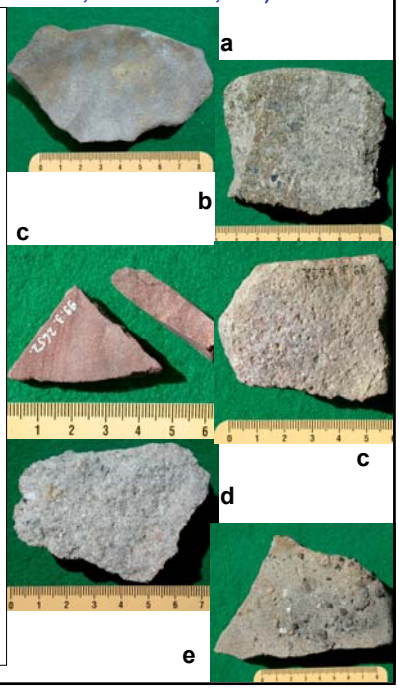
GROUND STONES TOOLS (MILLSTONES, GRINDERS, ABRADERS, etc.)

SANDSTONES

Petrography: several types of sandstones occur among the grinding stones category. The variability concerns colour, grain size and composition of the clasts. The most significant types are:

a) dark grey sandstones (in some cases with high white mica content), well sorted;
b) polymict poorly sorted, generally dark grey sandstones);
c) red or lilac sandstones, sometimes with lamination or bedding, generally with acidic vulcanite clasts;
d) white silicified metasandstones;
e) well sorted, **medium dark grey sandstones** with well rounded clasts, sometimes with small pebbles. The cement of this type is coarse grained calcite.

Origin and provenance: the high variability indicates different geological formations and, hence, provenances. For type **b**, the flysch zone (**Apuseni Mts**., **Sava-Vardar Zone**) might be suggested; for type **c**, the **Mecsek Mts**. and/or **Papuk** and **Apuseni** and finally, for type **e**, the **Apuseni Mts**., with some doubts in absence of more detailed analytical work.



GROUND STONES TOOLS (MILLSTONES, GRINDERS, ABRADERS, etc.)

ANDESITE

Petrography: at least 5 different types could be distinguished.
a) the **commonest** type has **plagioclase**, **clinopyroxene** and **opaque minerals** as phenocryst, moreover, **endogenic inclusions**. In some cases orthopyroxene, brown hornblende and biotite phenocrysts occur too. Accessory mineral is apatite. The groundmass consists of different quantity of glass. The **MS values** have **2 different ranges**: 6-7 and 13-17×10^{-3} SI.

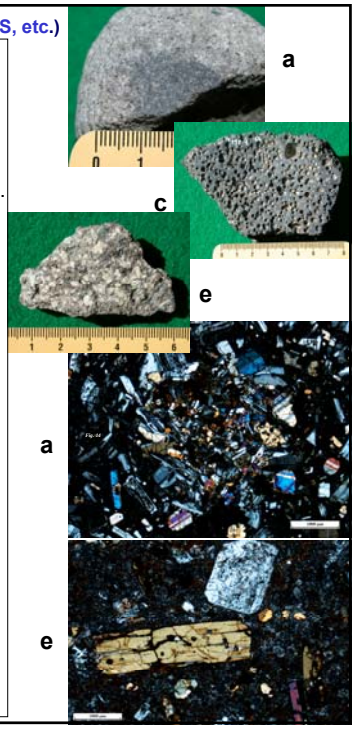
b) ***biotite andesite***;

c) ***amafitic andesite*** with large vesicles;

d) ***garnet bearing andesite,*** oxidised and altered;

e) ***plagioclase hornblende andesite*** with re-crystallized groundmass.
The **MS values** of b-e andesites range between 2-8×10^{-3} SI. The alteration of the rocks decreases the MS values.

Origin and provenance: most of the andesites might belong to the young, Tertiary vulcanite series, which occur in the **Sava-Vardar Zone**, **Apuseni Mts.**, and to the North in the **Intra Carpathian volcanic arc**; however, type **a** is similar to the **Börzsöny Mts**. andesites.



GROUND STONES TOOLS (MILLSTONES, GRINDERS, ABRADERS, etc.)

GRANITE-METAGRANITE

Petrography: 6 different types could be distinguished:
a) pink granite with **perthitic K-feldspar** (microcline) and sericitized plagioclase. Quartz is abundant; biotite in aggregate and some muscovite is also present.

b) reddish, **coarse grained granite** with **garnets** and quite large **biotite** aggregates. Feldspar is coarse grained with small amphibole needles inclusions;

c) quartz-monzonite type with less amount of quartz. Microcline is coarse and plagioclase fine-grained. Mafic minerals are hornblende and biotite;

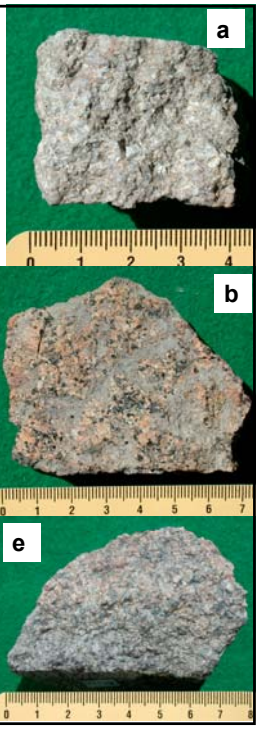
d) granite-aplite is finer grained, and it has only few **mafic minerals**;

e) metagranite, whit strong alteration of the original minerals. Both K-feldspar and plagioclase are partly sericitized, and there is a new plagioclase generation. The original biotite altered partly to limonite and white mica. Tourmaline also occur.

f) The last type consists of large amount of **quartz**, sericitized **K-feldspar**, **sericite-muscovite**, and **limonite** (after biotite?).

The **MS values** of granites-metagranites are **low**, <2.5 ×10^{-3} SI.

Origin and provenance: the most probable area is the **Sava-Vardar Zone** and/or **Apuseni Mts**., where different in age granitoide rocks varieties are widespread.



GROUND STONES TOOLS (MILLSTONES, GRINDERS, ABRADERS, etc.)

OTHER ROCKS

rocks which sporadically occur in the tool assemblage:

micaschist, ***quartz-muscovite schist***, ***gneiss***,

different varieties of ***limestone***, ***marl***,

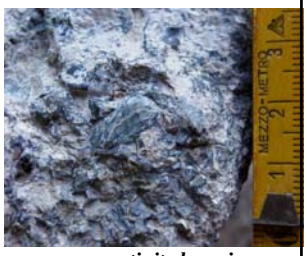
tuffite,

radiolarite, ***radiolarite-breccia***

serpentinite breccia

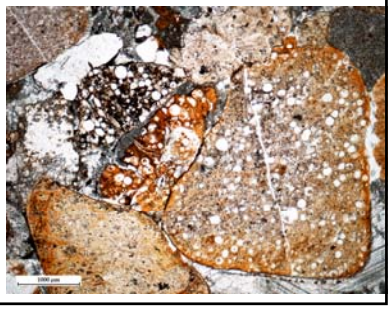
Origin and provenance: the most probable outcrops area is the **Sava-Vardar Zone**, or the **Apuseni Mts.**

micaschist



serpentinite breccia

radiolarite



radiolarite-breccia

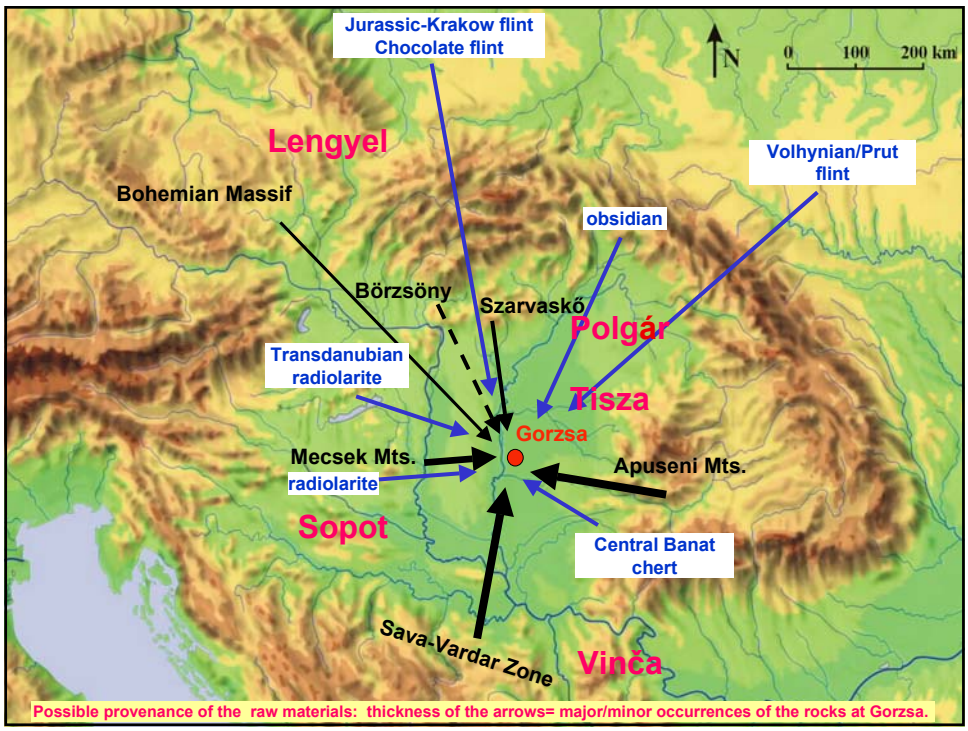
PRELIMINARY CONCLUSIONS

At the present stage of the research the archaeometric analyses show that, despite the fact that the site of Gorzsa is located in the middle of an alluvial area, far from rock outcrops,

a wide variety of lithotypes was brought to the site and used in form of stone artefacts.

The recognized, possible provenance areas are the Sava-Vardar Zone, the Apuseni and the Mecsek Mts., from which the greater part of the different rocks can be found.

Occasionally, raw materials or artefacts were imported from northern areas, such as the Börzsöny Mts., Szarvaskő and Bohemian Massive.



Possible provenance of the raw materials: thickness of the arrows= major/minor occurrences of the rocks at Gorzsa.

PRELIMINARY CONCLUSIONS AND FUTURE PLAN

In the future, we hope to finish at least the analyses of one trench for which the stratigraphy has been studied and clarified so that we can address patterns of technological, typological and raw material use through time.

Depending on the context of the assemblage, we can also address questions concerning the use of space and the existence of special activity areas within the settlement.

On another level, the study is valuable for understanding the organization of technology during the occupation of this site in the Late Neolithic. That is, we plan to examine the choices made by the toolmakers and tool users in terms of raw material, tool type and use/function. We hope that the reconstruction of the pattern of raw material procurement, will help to clarify the complexity of cultural connections during the V millennium BC in the Great Hungarian Plain.

Finally, to complete the archaeometric part of the analysis, PGAA, XRF XRD, SEM and Electron Microprobe are planned to restrict the possible provenance areas.

Thank You

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