



Preliminary petrographic report on blueschists, the materials of Neolithic polished stone tools from Hungary

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Abstract. Nearly 1000 Neolithic stone tool samples were looked over from the whole territory of Hungary. 26 of them showed blueish shade of colour so they may be blueschists at first sight. With the polarising microscopic investigation of 7 selected peaces beside of proving the macroscopical determinations we could devide these blueschists into 3 different types. This is the first report of the recognition of blueschist polished stone tools from Hungary. These blueschist stone tools are concentrated in the northeastern part of Hungary and their proportion decreases southwards. On the base of petrography and the closeness of the supposed source area it is very likely that the blueschist material of studied stone tools derived from the surroundings of Sugov valley, south Slovakia.

Key words: archaeometry, blueschist, petrography, Neolithic, axe

Introduction

Intensive microscopic petrographical investigation of Hungarian Neolithic polished stone tools started nearly 10 years ago. This work resulted an overlook of raw materials of polished stone tools from Pannonian Basin (Biró & Szakmány, 2000.). More intensive research in last few years was promoted by the IGCP-442 program, so the first blueschist tools have been found out last year from Hungary. This work is the first petrographic report of Hungarian blueschist raw material.

Archaeological background

26 blueschist stone tools out of 143 were found from 9 NE-Hungarian localities. Most of blueschist tools came to light from Felsővadász-Várdomb (14 out of 19 tools) and Borsod(Edelény)-Derekegyháza (5 out of 15 tools) localities. Other localities gave one blueschist tools from each.

Felsővadász-Várdomb locality

Felsővadász is situated in the Cserehát hills northeastern part of Hungary. The NW-SE elongated, so called "Várdomb" hill consisting of sand and sandstones extends in the SE margin of Felsővadász. The southern slope was very useful place for settle down of prehistoric man. The locality is known as a archaeological site from the end of 19th century (Lehoczky, 1883; Szendrei, 1888; Korek & Patay, 1958; Kalicz, 1968), but the first archaeological excavation was in 1978 (Hellebrandt, 1979), later there

were excavated remnants of prehistoric settlements (Koós, 1986a; 1986b). There were discovered some unit and legacy of Neolithic bükkian culture, Aeneolithic hunyadhalmi group and badenian culture, moreover hatvanian and füzesabonyian culture from the Bronze Age, there were some pit and graves among them.

One part of blueschist raw material polished stone tools was found from Neolithic pits and objects, moreover a lot of them have been found from spade layer with Neolithic, Bronze Age or both mixed material. Most of blades were made of metamagmatic rocks, namely blueschist, greenschist and serpentinites moreover some macroscopically not exact determinable metamagmatic rocks. The blueschist blades are not perforated, they are axes first of all, they are 4-7 cm long, 2-5 cm wide and 1-2 cm thick. All the blades have traces of hafting and traces of use wear.

Borsod (Edelény) – Derekegyháza locality

This locality is situated 20 km north from the Bükk Mts. in the Cserehát hills close to the southward flowing Tarna river. An opened settlement from the Bükkian culture (Middle part of Neolithic age) were recovered here in the middle of 20th century.

Most of tools were made of metamagmatic rocks which are perhaps belonging to one rock series, namely blueschist (5), actinoliteschist (5) and serpentinit (3). The raw material of rest three tools (diorite, metavulcanite and sandstone) has not such a strong connection to this rock group. 4 out of 5 blueschist polished stone tools were found in a litter pit and one in a soil layer. All 5 tools are

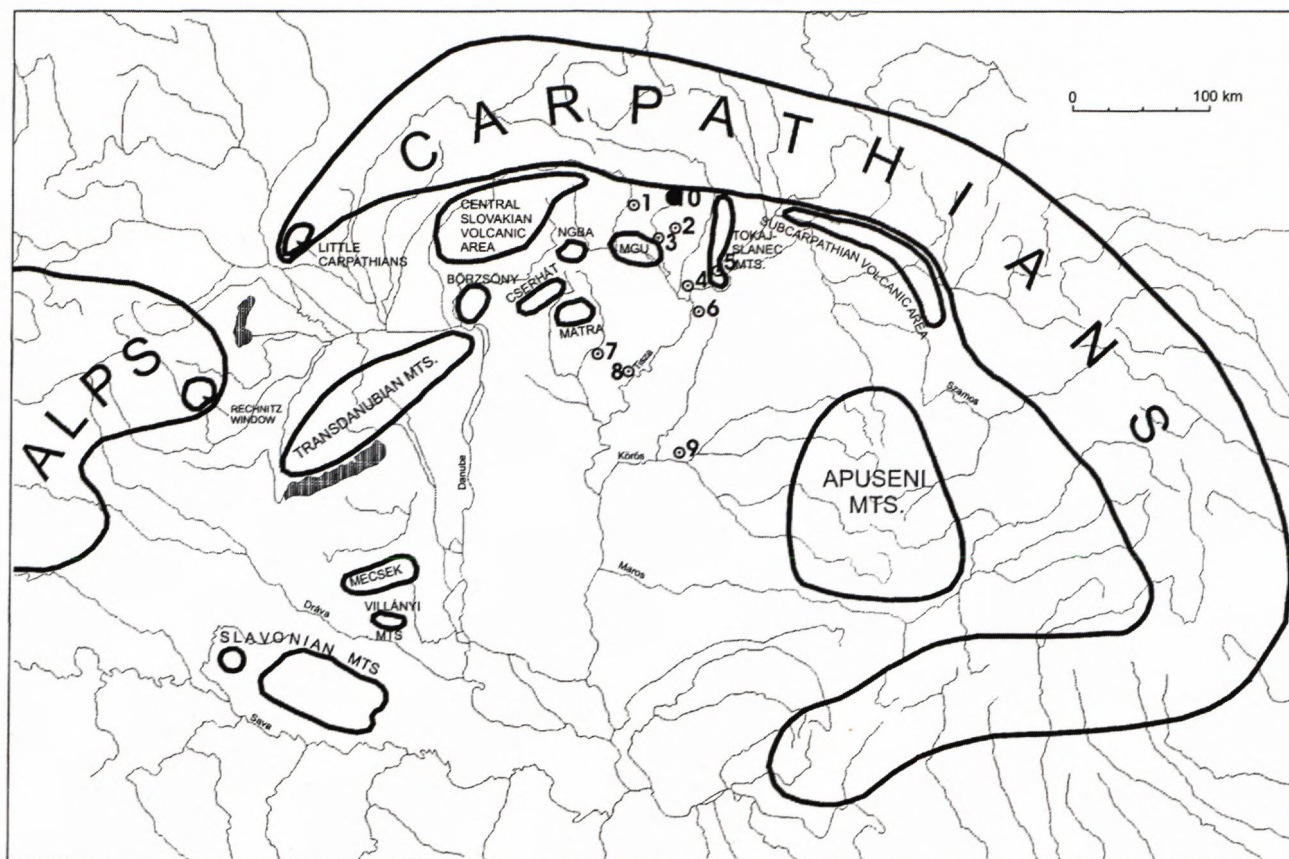


Fig. 1 The localities of blueschist polished stone tools in Hungary, and the closest blueschist outcrops

Abbreviations: MGU – Meliata-Gemic Unit; NGBA – Nógrád-Gemic Basaltic Area; Number of localities: 1 – Aggtelek; 2 – Felsősóvadász; 3 – Edelény; 4 – Tiszalúc; 5 – Bodrogkeresztúr; 6 – Polgár; 7 – Tarnabod; 8 – Kisköre; 9 – Dévaványa; 10 – Sugovvalley (blueschist outcrops)

axes, 4 of them show trapezoid form, and only one has form narrowing to the direction of its edge. Most of them appears in form of broken peaces, only one whole tool was found in this and next five localities. Traces of use wear are usually well visible and refer about chiseling and cutting functions. On the unbroken tool the traces of hatting are also become distinct.

From all the rest localities (Aggtelek, Tarnabod, Polgár-Folyás-Szilme, Dévaványa-Sártó, Kisköre-gát, Bodrogkeresztúr-Kutyasor, Tiszaluc-Sarkad) blueschist stone tools came out sporadically (one of each occurrences). These stone tools except one Bronze age tool are Neolithic, they are often represented only by fragments. In many cases traces of use wear and in few cases traces of hatting are visible.

Petrography

Locally, the blueschist stone tools have a great importance in the Carpathian basin (first of all in its north-eastern part). This rock type as a raw material of stone tools in our region has not been published earlier. Macroscopically the polished stone tools are made of fine-grained blueschist and very difficult to distinguish from those made of greenschist (and fine grained amphibole schists), because of the similar appearance of the two types. In many cases there are a lot of green or greenish

coloured minerals in the blueschists, moreover the texture of these rocks are similar.

Macroscopic description

Nearly 1000 stone tool samples were looked over from the whole country. 26 of them showed blueish shade of colour so they may be blueschists at first sight. Macroscopically the blueschist stone tools have blueish black, dark greenish blue or in some cases dark blueish (-blackish) green colour, with or without thin white or whitish bands or in some cases lenses, parallel to the well or very well appeared foliation. The green colour is due to the large amount of green minerals (epidote, chlorite, actinolite, the latter is due to the greenschist facies overprint, which is very often in these rock types). The material of stone tools is mostly fine grained (less than 1 mm grainsize), but there are some medium grained samples too among them. Macroscopically the greenschist and the blueschist types are very similar to each other; it is almost impossible to distinguish them.

Microscopic description

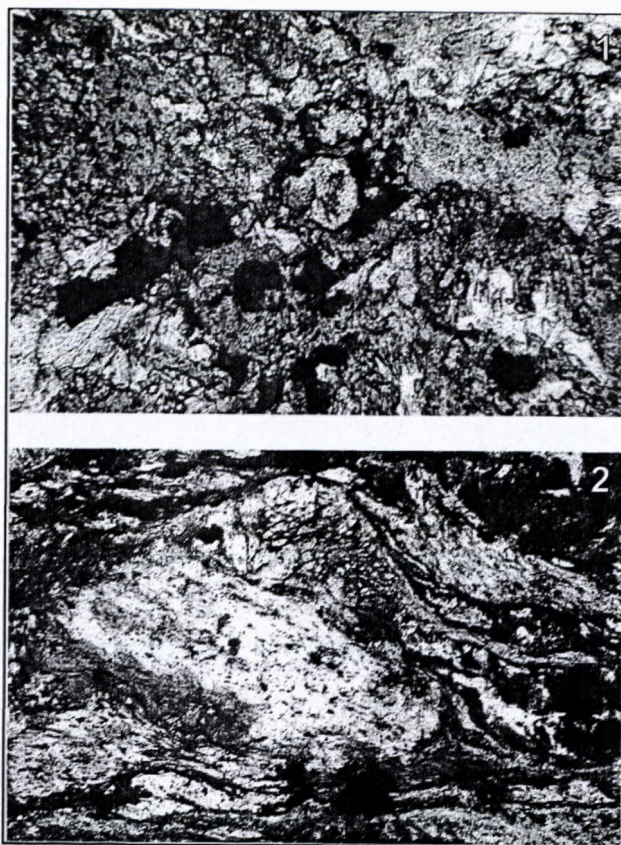
7 blueschist stone tools were selected for polarising microscopic investigation to prove the macroscopic determination and to make more precious characterisation

of the rocks. 30 μ m thin sections were made of the selected samples. Firstly we determined the mineral content and the texture of the rocks, then on this base the exact rock name were given. Special features were also detected to make comparism with each other and also with possible source material.

Selected rock materials of tools, described by naked eyes as blueschists, showed little differences in main mineral content determined in thin section. All of them proved to be real blueschists with the appearance of large amount of blue amphibole (most probably glaucophane).

3 type of blueschists could be distinguished by petrographical microscope. In two samples (one from Edelény (15/1949.224), the other from Felsővadász (FVD-11/7)) which are belonging to the first group of rocks relict clinopyroxene preserved in form of isometric or elongated, strongly deformed and more or less altered grains wich have nearly same grainsize (50-100 μ m). These pyroxenes are augites and show typical pretectonical characters. Twinned chrystals are rare, but curved grains and wavy extinction are characteristic, dispersion is strong. Its original proportion in the rock was about 15-20 % with equal distribution. Alteration reached about 60 % of the whole amount of augite and produced badly chrystallised brown hornblende, small amount of very finegrained titanite, zoisite-clinozoisite and pumpellyite and few tremolite. Most of finegrained titanite has been formed from ilmenite, which originally was represented as amoeba like grains in comparably significant proportion (1-3 %) and grainsize (50-100 μ m). Due to shearing process during the metamorphism beside total alteration ilmenite was strongly deformed and turned into weakly oriented, long, thin and curvy titanite aggregates. Mozaik like aggregates of slightly elongated equigranular chrystals of epidote form wavy bands and lenses around relict, cracked pyroxenes. Remaining places are filled with mostly wavy laths and bunches of blue amphiboles. Two other samlpes from Felsővadász (FVD-41 and FVD-51) could be ranked to this group too, but these blueschists are little bit differ from previous two samples by their finergrained appearance and smaller amount and less remained relict pyroxenes. In all four blueschist samples traces of relict magmatic texture (ophitic and intergranular) are visible.

The next two samples (also from Edelény (15/1949.233) and Felsővadász (FVD-42, see the photoplate)) form the garnetbearing group of studied blueschists. Relicts of magmatic minerals are missing, only weakly preserved pseudomorphs after pyroxene consisting of medium and finegrained mosaic crystals of chlorite, wite mica, quartz, albite and few titanite are present. Mass of titanite appears in form of aggregates as described in the previous group. Mostly large, big euhedral blue amphibole gives 30-50 % of the whole rock. Angular spaces between them are filled by medium grained isometric, mosaic chrystals of albite, quartz, white mica and epidote. Euhedral mainly medium grained garnet is scattered evenly in the rock. In the sample from Felsővadász larger, more altered garnet chrystals are also present.



Photoplate 1. Microphotos of blueschist stone tools from Felsővadász

Fig.1. Garnet, blue amphibole, titanite and chlorite in blueschist (sample FVD-42, 1N, shorter side of the photo is 0.55 mm)

Fig.2. Pretectonic and zone blue amphibole with mica and chlorite (sample FVD-B, 1N, shorter side of the photo is 1.43 mm)

The third type of selected rocks is represented by only one sample from Felsővadász (FVD-B, see phototable). This rock suffered very strong greenschist facies metamorphism and contemporary shearing which probably expunged almost all traces of previous processes. Only more or less rounded large chrystals of former plagioclase remained partly unaltered. Most of these grains transformed to actinolite, albite, chlorite, sericite and undeterminable by petrographic microscope finegrained green material. Connected to these monocrystals in the direction of stronger sheared zones polycrystalline aggregates of wavy extinguishing quartz and albite with scattered small actinolite laths and needles in them appear in form of wavy bands and lenses. Some large pale green or almost colourless amphibole crystals with darker core and few finegrained titanite bearing grains with similar pretectonic appearance were also detected. These large lenselike aggregates and grains are surrounded by strongly oriented wavy bands of mineral assemblages rich in small euhedral and large subhedral amphibols (tremolite, actinolite, brownish hornblende and very few greenishblue-green amphibol). Thiner titanite and opaque mineral rich bands are often alternating with amphibol rich ones. Some of the

almost colourless and greenishblue amphibols may have composition close to glaucophane or riebeckite, so we were describing this rock among blueschists, in spite of the present mineral content on the basis of which this rock is an actinoliteschist. Transitional character of this rock from blueschist to actinolite schist can be registered by major and certain trace element (Sc, V, Cr, Co, Sm, Eu, Gd, Dy) analysis of the whole rock, made by PGAA method (Kasztovszky-Szakmány in prep.). Microprobe analysis of amphiboles is needed for exact determination.

Discussion

Neolithic blueschist stone tools are known only from several places from Europe for example first of all in Italian part of Western-Alps (D'Amico and Starini, 2000.). In the Carpathian-Pannonian region these type of tools are rare, because there is only one occurrence at Sugov Valley and surroundings where blueschist occurs on the surface in large area and in big quantity (Faryad, 1997a., Faryad and Hejnes-Kunst, 1997, Faryad, 1997b) and which could serve as source territory for this kind of raw material. In this paper we give the first description of blueschist stone tools from the territory of recent Hungary.

Among 142 tools from 9 place of occurrences 25 showed macroscopically blueschist character. Our preliminary observations were supported by petrographic investigations of 7 thin sections.

Abundance of inland blueschist stone tools is limited to northeast Hungary (see the map). Within this territory the distribution shows well defined regularity: moving away from the supposed source territory i.e. to the south, the frequency of occurrence and the ratio of blueschist to other rock types decreases. Considering the localities, the blueschist tools are in good correlation with the tools made of serpentinite, gabbro-dolerite and andesite. Andesite is a wide distributed rock type in north Hungary, but serpentinite and gabbro-dolerite can be considered as members of blueschist bearing ophiolitic rocks series.

Blueschists from geological outcrops of Sugov valley and surroundings are regarded as members of just the same rock series described from neolithic localities with blueschist tools. Petrographical similarities (the same mineralogical composition, particularly the existence of pyroxene and garnet in the same textural position both in the stone tools and the outcrops) also strengthen the identifying of the blueschists from geological outcrops of the source area with the blueschists from stone tool findings.

Conclusion

This is the first report of the recognition of blueschist polished stone tools from Hungary.

We established that the blueschist stone tools are concentrated in the northeastern part of Hungary and their proportion decreases southwards.

On the base of petrography and the closeness of the supposed source area it is very likely that the blueschist material of studied stone tools derived from the surroundings of Sugov valley, south Slovakia.

Detailed identification of tools and source rock materials is possible by further detailed instrumental investigations.

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