RADIOLARITES AND RADIOLARIAN CHERTS IN NORTHERN CROATIA - POSSIBLE SOURCES FOR THE PRODUCTION OF ARTIFACTS

RADIOLARIT ÉS RADIOLÁRIÁS TŰZKŐ ÉSZAK-HORVÁTORSZÁGBAN - LEHETSÉGES KŐESZKÖZ NYERSANYAGFORRÁSOK

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Abstract

Rhythmic bedding of alternating nonsiliceous and siliceous layers is one of the most prominent features of biogenic siliceous sediments. One of the best examples of rhythmites are Mesozoic ribbon radiolarites.

In Northern Croatia, the deposits of radiolarian cherts and radiolarites, partially associated with magmatic rocks are located in county Banovina (Zrinska Mt), Žumberak, Medvednica, Ivanščica and Kalnik Mts. These rocks are constituents of Late Jurassic subduction complex (tectonic melánge). Palaeontological investigations revealed their Triassic (Ladinian-Carnian) and Jurassic (latest Bajocian-early Callovian) age.

Macroscopical and microscopical examinations of samples reveal its low quality for stone tools production, but also its feasibility for local ad-hoc production. The radiolarites and radiolarian cherts near Lasinja in the northern Banovina are the possible sources for production of artifacts during (at least) the Lasinja culture period on wider territory of continental Croatia.

Kivonat

A biogén eredetű kovás üledékek többnyire kovás és kovában szegény rétegek ritmikus váltakozása formájában jelennek meg. Ezeknek az üledékeknek jellemző példái a mezozoos "szalagos" radiolaritok.

Horvátország északi részén a radiolaritok és radiolariás tűzkövek Banovina megyében (Zrinska hegység), Žumberak, Medvednica, Ivanščica és a Kalnik hegységben fordulnak elő, részben magmás kőzetekkel együtt. Ezek as kőzetek a késő jura időszaki szubdukciós komplexum részei (tektonikus "melanzs"). Paleontológiai vizsgálatok szerint triász (ladini-karni) és jura (késő bajóci-korai kallovi) korúak.

A minták makroszkópos és mikroszkópos petroarcheológiai vizsgálata szerint ezek többnyire gyenge minőségűek és kevéssé alkalmasak kőeszköz készítésére. Helyi és alkalmi felhasználásuk viszont elképzelhető. Észak-Banovina területén, Lasinja közelében azonban olyan radiolaritok és radiolariás tűzkövek is megtalálhatók, amelyeket legalább is a Lasinja kultúra idején használtak Horvátország tengermelléktől távolabb eső területein.

KEYWORDS: RADIOLARITE, CROATIA, STONE ARTEFACT

KULCSSZAVAK: RADIOLARIT, HORVÁTORSZÁG, KŐESZKÖZ

Introduction

Siliceous rocks are most suitable for production of stone tools due to their physical characteristics. Prehistoric non-metal using societies were dependable of knowledge and raw material availability in order to maintain performance of everyday activities. Therefore, recognition and knowledge about the location of such rocks were of vital importance for the survival of the community. Identification of sources of raw material enables us to reconstruct various aspect of prehistoric population behavior. Until recently, there was no provenance analysis of raw material used for prehistoric chipped stone tools on the territory of present day Croatia, as well as detailed analysis of archaeological lithic assemblages. In spite of that, we can identify radiolarites and cherts as far most common types of rocks for stone tools production used by prehistoric populations that inhabited continental Croatia.

In wider terms radiolarites are centimetre to decimetre thick stratified layers of radiolarian

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cherts rhythmically alternated with millimetre to centimetre thick layers of radiolarian shales, silicified shales or siltites (De Wever 1989, 1994; Decker 1991), moreover ribbon bedded radiolarian cherts (Jenkyns & Winterer 1982). Radiolarian cherts and radiolarite originate from radiolarian ooze i.e. deep-sea pelagic sediment containing at least 30% opaline-silica tests of radiolarians (> 3,500m under sea level i.e. below CCD line). There is no exact amount of radiolarian tests in chert required to be classified as radiolarite in the sediment-petrographical classification of siliceous rocks. Generally, radiolarite sensu stricto are cherts with more than 50% of radiolarian tests embedded in a siliceous matrix (Ruitz-Ortiz et al. 1989) (**Fig. 1**). In opposite, radiolarian cherts are cherts with less than 50% radiolarian tests embedded in siliceous matrix (**Fig. 2**).

The first data on radiolarian cherts and radiolarites associated with magmatic rocks at Medvednica Mt. was registered by Gorjanović-Kramberger (1908).

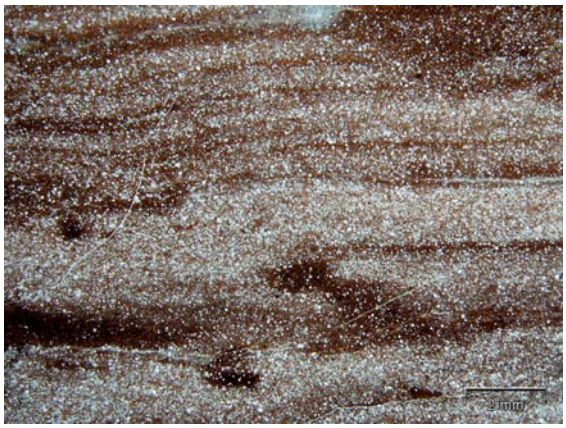

Fig. 1.: Microphotograph of Triassic radiolarite from Medvednica Mt.

1. ábra: Triász radiolarit mikroszkópi képe, Medvednica Hegység

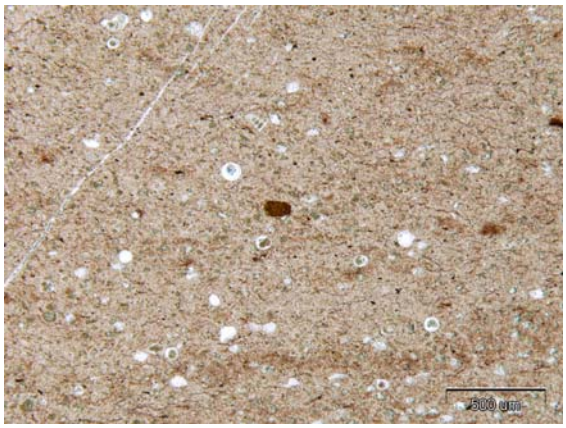

Fig. 2.: Microphotograph of Jurassic radiolarian chert from Medvednica Mt.

2. ábra: Jura radiolarit mikroszkópi képe, Medvednica Hegysé

During the mapping for the Basic geological map 1:100.000, new data on radiolarite were obtained (Šikić et al. 1979; Šimunić et al. 1981). The detailed geological map of magmatic-sedimentary complex of Ivanščica, Kalnik and Medvednica Mts revealed many occurrences of the radiolarian cherts and radiolarites of Triassic and Jurassic age (Halamić & Goričan 1995; Halamić 1998; Halamić et al. 1999; Halamić et al. 2001, 2005).

During Neolithic and Copper age, various cultures and groups of people among them had various methods of supply. The availability and quality of raw material are not always crucial factors for selecting specific raw material type, sometimes even in the frames of a single settlement (Barfield 2003, Voytek 2000). Other various aspects, such as tradition, relations with other groups, community mobility, knowledge and factors that we are not able to identify and/or comprehend form an important part of the equations. First and most important step is identifying possible sources of siliceous rocks in wider geographical area. After identifying specific types of material, by the frequency of occurrence on certain sites, we can detect if some material is specific for the certain culture, or the certain period within the culture. The more specific material is, the more information we will get from simple distribution analysis (Biró 2004). There are established methods for identifying movements of people during Neolithic and Copper Age by their use of raw material. Those models sometimes do correspond to new population arrivals (which is visible through breaks in communication routes), and sometimes do not, (Kaczanovska & Kozłowski 1997, 223-233).

This paper presents results of first attempts towards the identification of the sources of raw material used during prehistory in this part of the Balkans.

Occurrences of Triassic and Jurassic radiolarian cherts and radiolarites in Northern Croatia

The radiolarian cherts and radiolarites of Triassic and Jurassic age are situated at Medvednica, Kalnik, Ivanščica, Žumberak and Zrin Mts in a zone between Tisia Unit (TU) to the East, Pelso Unit (PU) to the North and Dinaric Carbonate Platform to the South (DCP). We presume that these occurrences belong to the continuation of Central Dinaric Ophiolitic Belt (CDOB) from Bosnia and Hercegovina, prolongated through the Zagorje-Mid-Transdanubian Zone (ZMTZ) to Hungary (Darnó Hill) (**Fig. 3**). The Triassic radiolarian cherts and radiolarite from Žumberak and Ivanščica Mts sedimented on the carbonate platform slope lie on the limestone or dolomite of Middle Triassic age (**Fig. 4**).

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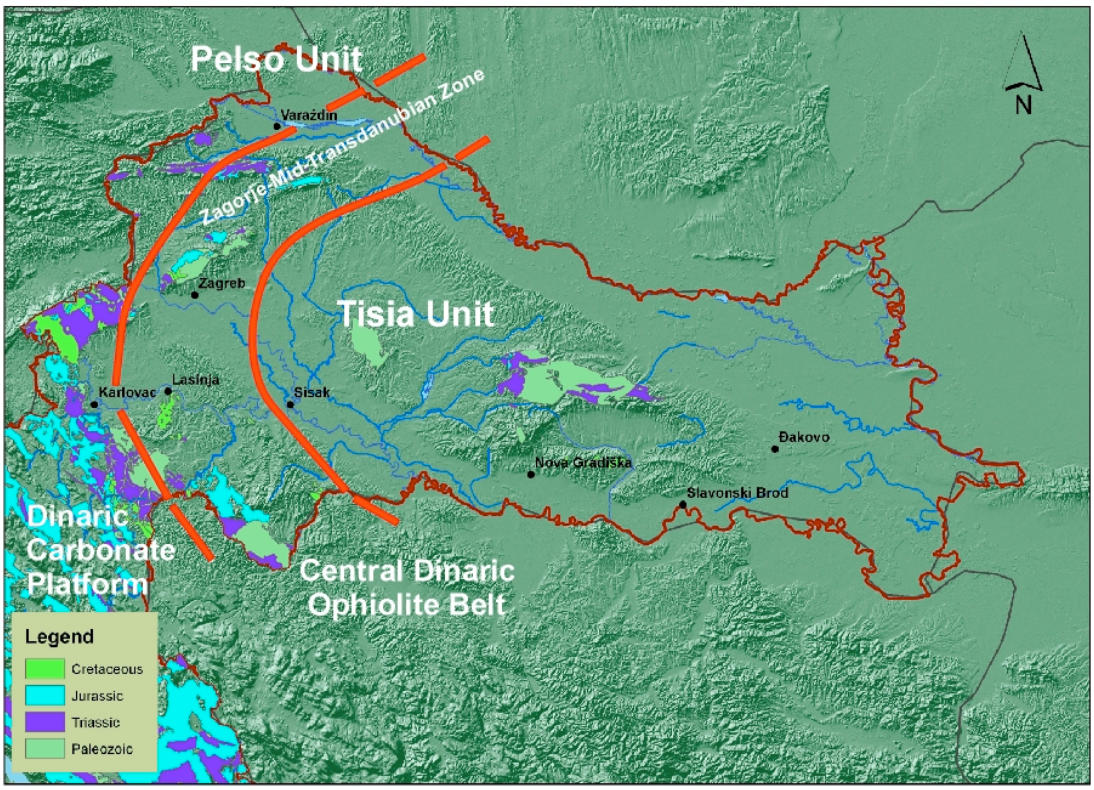

Fig. 3.: Presumed continuation of Central Dinaric Ophiolitic Belt through Northern Croatia to Hungary

3. ábra: A Közép-Dinári Ofiolit Öv feltételezett folytatása Észak-Horvátországból Magyarország felé

The Triassic and Middle Jurassic basin radiolarian cherts and radiolarite from Medvednica, Kalnik and Zrin Mts are associated with basic magmatic rocks (frequently pillow lavas) and are incorporated, during the Late Jurassic subduction, into the ophiolitic tectonic melánge. Both types of radiolarian cherts are typical ribbon bedded radiolarites and they are associated with basic magmatic rocks (**Fig. 5, Fig. 6**). They are tectonically strong disintegrated and break apart in centimetre, rarely in decimetre, pieces. Such pieces of radiolarites have low quality for chipping and were generally used only locally, or during shortage of better quality raw material. Low quality raw material was used for production of simple, expedient tools (Andrefsky 1994). On the other hand, radiolarites from area around Lasinja and parts of the Central Dinaric Ophiolitic Belt in Bosnia and Herzegovina are not as disintegrated because of weaker regional tectonic stress, and therefore can be extracted from the bedrock in bigger blocks or collected as pebbles in rivers beds from surface. Pebbles in question were eroded from the Bosnian mountains, and transported by the Bosna, Vrbas and Una rivers. Material was accumulated, and available for collecting by the mouths of those river

Possible sources of material for the production of artifacts

Lithic assemblages from only 20 archaeological sites from Northern Croatia have been analyzed so far. Radiolarites and radiolarian cherts are predominant in all lithic assemblages. According to the available data we can conclude that Sopot and Lasinja cultures were using Jurrasic and Triassic radiolarian cherts from Central Dinaric Ophiolitic Belt. That material could have been collected from 3 sources: primary sources in Banovina, primary sources in central Bosnia, and from secondary deposits in the river beds. It is not easy (or maybe even impossible) to distinguish the exact location where the blocks were obtained. If the artifacts that retain cortex, have abrasions on it, so called "fluvial cortex", which indicate that material was exposed to intense mechanical weathering associated with fluvial transport), and therefore collected from secondary deposits (in river beds, or from surface) we can at least exclude primary sources.

The microscopic analysis of artifacts in thin sections revealed that the majority of findings at that Nova Gradiška site Slavča belong to the radiolarian chert or radiolarites of Triassic and Jurassic age.

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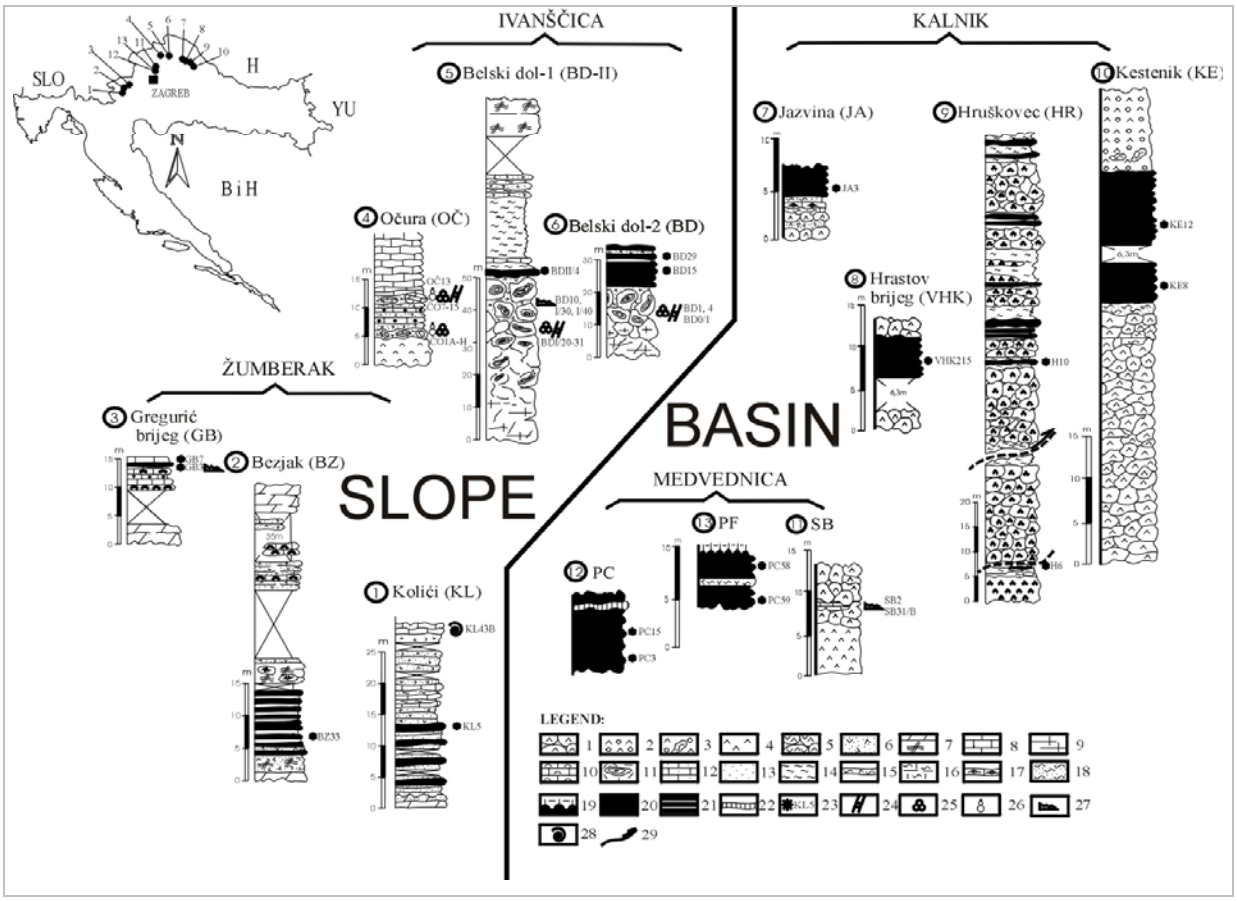

Fig. 4.: Lithological columns of radiolarian cherts and radiolarites in Northwestern Croatia. Legend: 1-pillow lava, 2-metabasalt with amygdaloidal structure, 3-shale xenoliths in metabasalt, 4- massive metabasalt, 5-andesite-basalt, 6-pyroclastic rocks, 7-massive dolomite, 8- bedded limestone, 9- massive limestone, 10-limestone with Pelecypoda, 11-limestone with "oncoidal" structure, 12-calcarenite, 13-siltstone, 14-shale, 15-tuffitic shale, 16-calcitized shale, 17-silicified radiolarian limestone, 18-silty shale, 19-marl, 20-radiolarite s. str., 21-radiolarian chert interlayered with pyroclastic rocks, 22-Mn-enriched beds, 23-radiolarians, 24-calcareous algae, 25-foraminifers, 26-calcareous sponges, 27-conodonts, 28-cephalopods, 29-overthrust (Goričan et al. 2005).

4. ábra: Radioláriás tűzkő és radiolarit előfordulások litológiai szelvényei ÉNy Horvátországban.

Fig. 5.: Triassic radiolarites from Kalnik Mt.

5. ábra: Triász radiolarit a Kalnik hegységben

On multi-layer prehistoric site Slavča, settlements of Sopot culture, Lasinja culture, Kostolac culture Vučedol culture were found (Mihaljević 2000, 2006). Lithic assemblages from Sopot and Lasinja culture periods were analyzed, and two general types of rocks were recognized: silica group minerals and radiolarian cherts. Dark green and green radiolarites predominate in the Lasinja culture lithic assemblage while in Sopot culture they are also present, but less than silica group minerals (Šošić & Karavanić 2004), (Biró - personal communication). On number of recently excavated, not yet published Lasinja culture sites from rescue excavations in Slavonia, dark green and grey radiolarites predominate in the assemblage, similar to Lasinja outcrop.

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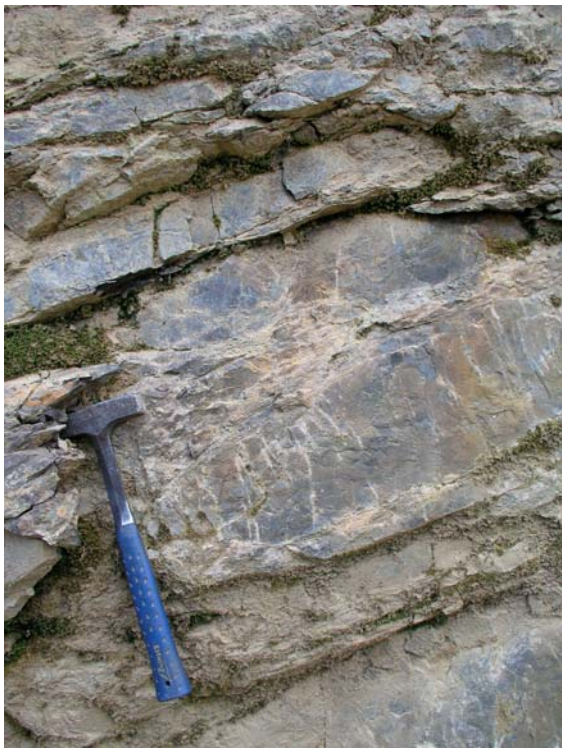

Fig. 6.: Jurassic radiolarian cherts near Lasinja

6. ábra: Jura korú radioláriás tűzkő Lasinja környékén

In addition, on Sopot culture sites, for example early Sopot culture site Kruševica near Slavonski Brod, where 8 workshops areas were found predominant raw material are described radiolarian cherts (Miklik-Lozuk 2004, 38). One of the most important questions is when were the sources in Banovina and Bosnia discovered by the prehistoric populations. So far, it is confirmed that Lasinja culture population knew of and used the Kremešnica source, and there are indication that Sopot culture population also had that information.

Next step is to try to establish whether there was a well formed network of Lasinja culture sites with system of control and exchange of goods (as for instance in Lengyel culture in Hungary, Szentgál-Tűzköveshegy where 8 Lengyel cultures settlement were placed to control the access to the mine (Biró & Regenye, 1991:357-359), or LTK in various parts of Europe (Biró 1996, Kaczanowska 2003)

Conclusions

• The low quality of radiolarian cherts and radiolarites (very strong tectonized) of Triassic and Jurassic age in Northwestern part of Croatia are of poor quality and were used for local production and expedient tools only, but more detailed study is necessary in the future.

• The possible sources for part of the assemblage from Slavča (Nova Gradiška) are near Lasinja and in Central Dinaridic Ophiolitic Belt in Bosnia and Hecegovina. Pebbles accumulated near the mouths of Vrbas and Una rivers were also used as raw material.

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