The issue of the origin of raw materials and routes along which they circulated is probably one of the most interesting matters to study in the field of prehistory. It is probably the stone raw materials that, to the greatest extent and in a most tangible manner, demonstrate the specific points of contact between mutually distant areas. Our territory and prehistoric cultures in it, primarily those Neolithic and Aeneolithic, have not still been investigated to a degree where there can be any discussion about the circulation of raw materials within those cultures. For the time being, locations of the sources of the raw materials used in making stone tools, arms, and other items are still within the domain of supposition. For this reason, the routes along which these raw materials moved, from their source to the final products, have also remained in the domain of speculation. The same is true about the circulation of rocks and minerals outside the borders of the Neolithic cultures in our territory. Thus, for instance, the attempt to link the rare occurrence of small tools with a blade made of jadeite or nephrite in Serbian Neolithic to the widespread use of so-called «green stone» (serpentinite and jadeite) in Macedonian Neolithic, will remain a speculation for the moment, mostly because of the absence of precise petrographic and geochemical analyses which could provide a straightforward answer in respect of the exchange of stone raw materials from the territories occupied by other cultures.

Study of the Vinča culture late phase, in terms of technology more Aeneolithic than Neolithic, has recently become a focus in the study of Vinča stone production. It is very important to investigate in what way the decadency of one culture is reflected on the level of use of the raw materials in such circumstances: whether the diminishing of territory has any impact on the decrease in the stone raw materials quality due to more limited accessibility of the deposits of better quality stone, and whether stone «ersatz» of poorer quality are more used in early phases of the Vinča

Abstract. – This paper shows the results of petrographic analyses of raw materials used for making the ground stone industry implements in two Vinča culture sites: Vinča and Belovode. The assemblages from the aforementioned sites feature a number of specific characteristics. In Vinča, in late strata, a kind of devaluation in the selection of stone raw materials is registered, which is closely related to the decline in quality of stone processing and may be a consequence of territorial narrowing of the Vinča culture per se in its later phases, and of introduction of metallurgy in everyday life. For this reason an analogy with the Belovode site was made, which subsists only throughout the early phase of the Vinča culture and is doubtlessly a metallurgic settlement. Petrographic analyses of the raw materials from which ground stone tools used to be made at the Vinča and Belovode sites are only a part of the commenced petro-archaeological research. They imply that further investigations should focus on field work, principally in the vicinity of the sites themselves. Primarily by petrographic, and, as applicable, by other analyses of samples brought from the field work, and by comparison of the tools, it could be possible to define more precisely the territory from which the raw materials originated.

Key words. – Neolithic, Vinča culture, stone raw materials, petrographic analyses.
culture. The attempts were made to answer these questions by comparing stone industries from the two sites, Vinča and Belovode, from which the stone assemblage is examined petrographically.

The main reason for choosing to analyse these two sites is the specific nature of the development of their ground stone industries. In Vinča, in late strata, a kind of devaluation in the selection of stone raw materials may be identified, which was a result of the territorial narrowing of Vinča culture itself in its late phases. Related to this is also a deterioration of the stone processing quality, which begins with the Gradac phase and becomes quite noticeable in the late Vinča strata. Both phenomena from the late Vinča strata may be related to the introduction of metallurgy in everyday life of the Vinča population. It was for this reason that a comparison was made with the Belovode site which subsisted solely through the early phase of Vinča culture and was doubtlessly a metallurgic settlement. Carelessness in stone processing can be traced here ever since the early Vinča culture, and the selection of raw materials implies the local sources, territorially connected with copper ore deposits.

MODELS OF STONE USE IN SERBIAN NEOLITHIC

When studying the origin and circulation of stone raw materials in Neolithic and Aeneolithic, one must take into account some general issues in the development of stone industries production and use. In the territory of what is today Serbia during the Early Neolithic (Protostarčevce according to D. Srejović, Gura Bacului according to M. Garašanin, Starčevce I according to D. Garašanin and V. Milojčić, ENCB according to N. N. Tasić), the presence of Mesolithic tradition is apparent in the selection of raw materials and processing of stone in Early Neolithic. The influence of the Mesolithic tradition may be traced, in some of the Starčevo culture sites, even during the Middle Neolithic. In the chipped stone industry assemblage, in addition to the distinctive Neolithic inventory, microlithic tools, recorded at some of the Early Neolithic sites (Donja Branjevina, Ušće Kamničkog potoka, Knjepiste, Blagotin, Velešnica), is indicative of the Mesolithic tradition and, perhaps, a still active fast bow-and-arrow hunting as an ancient economic sector surviving from the past times. A part of the Mesolithic tradition was the exploitation, in terms of technology, of less quality raw materials, such as rock crystal, quartzite, and opal, which is directly linked to the then increased need for the raw materials for making the hunting weapons to be used only once. The use of the rock crystal in the chipped stone industry was recorded in Grivac, Divostin, Blagotin and Popovica Brdo in the vicinity of Šabac. It seems that Grivac can be associated with the exploitation of primary deposits of rock crystal. A greater presence of quartzite has been recorded in the assemblage from some of the Starčevo culture sites, in Blagotin and Velešnica for instance. In case of Blagotin, it is quite possible that organized exploitation of primary quartzite deposits took place there.

Exploitation of opal, namely of opalized serpentinite, was recorded in Rudnik, Glavica – Krivo Polje locality in Ramaca, where, upon a very limited surface exploration, it was assumed that it was an Early Neolithic quarry. The first analyses of the material from the recently discovered mine-quarry Lojanik in the vicinity of Mataruška Banja suggest that stone exploitation took place there back in Early Neolithic. Regardless of all these examples, based on what we know from the explorations that have been completed thus far, there can be no question about the exploitation of precisely defined sources of stone, but rather about the orientation to the same kind of the rock/mineral, regardless of their origin, which is indicative of a kind or organized procurement of raw materials. Aforementioned uniformity in the selection of raw materials can be traced to the chipped stone industry, while in making

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4 Eponymous Neolithic site in Vinča has been excavated, with interruptions, for almost a century: 1908–1913, 1924, and 1929–1934, by Miloj M. Vasić, and in the period 1978–1986, and from 1998 to date, the research has been continued by the Serbian Academy of Sciences and Arts Committee for Archaeological Explorations in Vinča (Vasić, 1932; Vasić, 1936; Vinča u praistoriji…, 1984; Tasić, 2005). The exploration of Belovode began in 1994, and the research conducted so far showed that this is a very significant locality, shifting the lower chronological limit of metallurgy introduction to the very beginning of Vinča culture (Šijivar, Jaknović, 1996).

5 It should be noted that models of stone raw materials use during Neolithic were defined in our country only based on the research made to date and without relying on any more thorough or more comprehensive analyses of stone materials, since the latter have not been undertaken in Serbian archaeology as yet.


9 Bogosavljević-Petrović, 2004–1, 389.


11 Identification of materials according to Jovanović, Miloš 1988, 57–60.


implements of ground stone, as a completely new production, no rules have been recorded with regard to the choice of raw materials. The exception to be noted is moderate use of jadeite, nephrite and serpentinite, which are the only materials suggesting any premeditated and intentional use of a certain type of stone, but which at the same time may add up to the importation of raw materials from distant areas, or the influence of neighbouring cultures.14

The first breakthrough in the development of stone industry in Neolithic occurred in the classical phase of the Starčevo culture (Starčevo II–III according to D. Garašanin, Starčevo II–IV according to Milojčić, MNCB according to Tasić).15 In the ground stone industry the uniformity was introduced with regard to the selection of raw materials and implements making. In addition to sporadic use of other rocks, macroscopically identical fine-grained rocks in different shades of grey, greyish green and greyish brown have become predominant. Only axes, adzes, and chisels were made from these rocks. As opposed to those in Early Neolithic that were made using the graining and polishing techniques, in this Neolithic phase semi-products of already mentioned ground-edge tools were made in the manner identical to that in case of the chipped stone industry implements. In this way there occurs the approximation, in terms of technology, of these two industries. In the final phases of the Vinča culture, this will result in complete overlapping of the chipped stone and ground stone industries to such an extent that, in case of a large number of tools, it is not be possible to distinguish between the types of implements. This overlapping is partly reflected in the manner in which implements were made, but is much more apparent and striking in the selection of the same raw materials. The aforementioned uniformity in the selection of raw materials and making of implements, introduced in the well-developed Starčevo culture, will continue in the Vinča culture. That is why the »Starčevo–Vinča technocomplex« is a much more appropriate name for the ground stone industry during the Middle and Late Neolithic.

The second breakthrough took place in the Gradac phase. It denoted further development of Vinča culture in its late phases (Vinča–Pločnik according to M. Gašanin, Vinča C–D with the part B2 according to Milojčić, Gradac phase I–III according to B. Jovanović). Obvious example is the widespread use of the so-called «light white stone», primarily in the ground, but at some sites in the chipped stone industry as well. The use of these raw materials, of poorer quality in technological terms, brought into the Vinča stone industry the lack of care and casualness in stone processing. The chipped stone industry follows the same late Vinča trend, thus affirming the presumption that degradation and disappearance of a culture is first visible in the technological changes.

There can be no doubt that certain patterns were present with regard to procurement of stone raw materials in the Neolithic, which is also apparent from what was said above. However, what remains unknown is the way stone was procured: whether there were any precisely defined deposits or quarries from which the stone was excavated, or seemingly identical raw materials were gathered randomly. In the groundstone industry of Starčevo–Vinča techno-complex, two big groups of rocks that dominate in the material were to date macroscopically identified. They are classified solely based on their physical and technical characteristics: fine-grained greyish-green and «light white stones». That is precisely why it has been decided to have these two broadly defined groups of rocks more accurately defined. Microscopic analyses were made on selected samples from several sites in Serbia, originating from different Neolithic phases: Vinča, Belovode, Lepenski Vir, Donja Branjevina. Findings of the analyses conducted on these materials from Vinča and Belovode (Fig. 1) are presented in this paper; they were selected because they are culturally and territorially related.

### PETROGRAPHIC ANALYSES

The complete sample collection from the Vinča and Belovode sites was macroscopically examined, and characteristic samples were analysed microscopically as well. The polarisation microscope for transmitted light, Leica DMLSP equipped with digital camera Leica DC 300 was used. In the following text the results of selected petrographic analyses (macro- and microscopic examinations) of 24 samples from Vinča, 16 of which originate from the excavations in the period 1998–2004, while eight samples come from the period of 1933–1934 will be presented. Seven samples from the site in Belovode are also studied. The analysed samples are shown in table, below as well.

### RAW MATERIALS FROM THE LOCALITY OF VINČA

In the Vinča locality, stone objects manufactured by grinding were mostly made from metamorphic rocks, while igneous and sedimentary rocks were much less presented. According to mineralogic and petrographic characteristics, the material is classified in seven groups (in order of increasing abundance): (1) kornites, (2) greenschists, (3) kornites/spotted schists, (4) metamict stones, (5) silicified magnesites, (6) diabases and metabasites, and (7) metamorphosed tuff (Table). The rocks belonging to the groups 1, 2, 3, 4, 6 and 7 are macroscopically very similar and can be roughly described as fine-grained greyish-green rocks, which is the description under which they are recognised in archaeological literature.

**Kornites**

*Macroscopic appearance.* Kornites appear as fine-grained, hard, aphanitic rocks, greyish-green, or dark-grey to black in colour, sometimes with black or red intralayers or darker strips. Fabric of kornites is generally massive with elements of a banded structure.
Microscopic appearance. Kornites are fine-grained rocks with granoblastic texture, with elements of porphyroblastic, lepidoblastic, or nematoblastic texture in some samples. The main minerals are epidote and quartz, +/− albite, and there sporadically appear also the spiky actinolite (UZ–7, UZ–19), small quantities of chlorite, biotite and tourmaline (UZ–24), scapolite (UZ–30), a certain quantity of sericite (DV–20), as well as the association of actinolite, rare plagioclase and wollastonite, along with the opaque mineral (haematite?) in the sample UZ–16.

Epidote, together with quartz, dominates in all samples. It occurs as tiny, up to about 0.2 mm in diameter, isometric grains homogenously distributed in the groundmass. In the sample DV–19, epidote forms strips that are up to 1 mm thick, where a greater quantity

Fig. 2. Microscopic appearance of the raw materials from the Vinca site:
A – kornites (DV–20): granoblastic texture; Nx; vertical edge of photograph 1 mm;
B – greenschist (DV–17): microscopic appearance; Nx; vertical edge of photograph 1 mm;
C – spotted schist/kornites (DV–8): porphyroblasts of albite (arrows); Nx; vertical edge of photograph 2 mm;
D – metasiltstone (DV–11): microscopic appearance; Nx; vertical edge of photograph 2 mm;
E – diabase (DV–14): ophitic texture; Nx; vertical edge of photograph 2 mm;
F – metamorphosed diabase (DV–6): relics of former phenocrysts of clinopyroxene (arrows); Nx; vertical edge of photograph 2 mm;
G – silicified magnesite (DV–2): siliceous matter (arrows) in cryptocrystalline magnesite; Nx; vertical edge of photograph 1 mm;
H – metamorphosed tuff (DV–15): clasts of quartz of volcanic origin (arrows) in metamorphosed tuff; Nx; vertical edge of photograph 1 mm
of salic minerals occurs. Only rarely, accumulations of larger usually prismatic epidote crystals, can be observed. It can constitute up to 65 % vol. of the rock. Quartz is mostly fine-grained, about 0.005 mm to about 0.1 mm in diameter. It is associated with albite and these two minerals form salic stripes approx. 0.2 mm (DV–20) wide. Albite, together with quartz, can make up to 35 % vol. of the rock. It is located in the interstitial spaces or occurs as rare irregular porphyroblasts (Fig. 2A) displaying double twinning.

**Greenschists**

*Macroscopic appearance.* These rocks are characterised by the greyish green to green colour. They are fine-grained, show granoblastic to lepidoblastic texture, and massive in fabric.

*Microscopic appearance.* Rocks of this group are of granoblastic and nematoblastic texture (and lepidoblastic one in sample DV–17), and of massive, locally banded (DV–17) and schistose fabric (DV–18). According to the mineral composition, they can be defined as: epidote schist (DV–16), chlorite-epidote schist (DV–17) and epidote-amphibole-chlorite schist (DV–18).

Epidote is dominating in all the rock types. It is accompanied with chlorite in the sample DV–17 and amphibole in the sample DV–18, with quartz and albite as regular components and in all samples. Epidote mostly occurs in aggregates of acicular crystals which sometimes show regular orientations (Fig. 2B). The length of the epidote crystals can be up to approx. 2 mm (sample DV–16). It is associated with chlorite and amphibole in the groundmass, and together with them constitutes up to 75 % vol. of the rock. Chlorite is presented in flakes, which do not exceed 0.2 mm in diameter, and, in the sample DV–18, are associated with amphibole. Amphibole occurs as prismatic crystals. Albite is located in the interstitial spaces, together with quartz, mostly in the form of blurred platelike crystals, occasionally twinned and somewhat coarser in size. Quartz occurs in the form of extremely minute micro- to cryptocrystalline grains, and is most likely product of silicification. These two minerals make up about 30 % of the rock. In some parts of the sample DV–17, salic minerals form the bands. Metallic minerals (approx. 1 % vol. of the rock) occur as individual, isometric and allotriomorphic

![Fig. 3. Microscopic appearance of the raw materials from the Belovode site: A – albite-epidote schist (DBV–1) with the nucleuses of porphyroblasts (arrows); Nx; vertical edge of photograph 1 mm; B – epidote schist (DBV–2); Nx; vertical edge of photograph 1 mm; C – sandstone (DBV–3): clasts of volcanics (V), pumice (P), quartz (Q); Nx; vertical edge of photograph 2 mm](image-url)

СЛ. 3. Микроскопски изглед сировина са локализација Беловоде: A – албита-епидотска крицца (DBV–1) са зачепцима йорфиробласти албита (стрилица); Nx; вертикална ивица фојторафије 1 mm; B – епидотска крицца (DBV–2); Nx; вертикалне ивице фојторафије 1 mm; C – пећин (DBV–3): класти вулканита (V), пумица (P), кварца (Q); Nx; вертикална ивица фојторафије 2 mm

grains or form fine-grained powdery aggregates. In the sample DV–18 they occur as relics of formerly euhedral and non-transparent minerals, most likely of magmatic origin.

**Spotted schists/kornites**

This group of rocks was distinguished as a specific category since petrographic examinations were not sufficient to decide between the kornites and green rocks/spotted schists.

*Macroscopic appearance.* Rocks of this group are grey, light-grey to greyish-green in colour, while UZ–16 is dark grey to black with greenish jets and spots. They are fine-grained aphanitic rocks, and, more rarely, it can be macroscopically observed that they are granoblastic with the elements of porphyroblastic texture (DV–8, DV–9). The fabric is massive and homogenous, and rarely banded.

*Microscopic appearance.* According to their mineral composition and texture, they are defined as: quartz-epidote spotted schists/kornites (DV–7), quartz-albite-epidote spotted schists/kornites (DV–8), albite-epidote spotted schists/kornites (DV–9), quartz-albite-epidote spotted schists/kornites (DV–10). The rocks are granoblastic, with the elements of porphyroblastic texture (DV–8, DV–9, DV–10), as well as massive and relatively homogenous. Elements of speckled structure can be seen in samples of porphyroblastic structure, while the sample DV–10 displays locally a banded structure.

Prevailing minerals in these rocks are epidote, quartz and albite, while metallic minerals are accessories. Epidote and quartz compose fine-grained aggregates of different shapes, most often in the form of bands. Epidote is somewhat more abundant and coarser than quartz in the sample DV–7. In the samples DV–9 and DV–10, grains of epidote compose millimetre accumulations or bands. Quartz and albite are allotriomorphic, and quartz is smaller. In the sample DV–8, albite (Fig. 2C) occurs as small porphyroblasts, less than 0.5 mm in diameter, which are distributed in bands, and which are, in addition, richer in quartz and metallic minerals. In the sample DV–9, albite occurs in the form of inclusion-bearing porphyroblasts with the vague edges towards the groundmass. Metallic minerals occur in the form of isolated subhedral or anhedral grains which are very evenly distributed in the mass of this metamorphic rock.

**Metasiltstones**

*Macroscopic appearance.* Rocks of this group are fine-grained, dark-greyish green, dark-grey to black, or light-greyish green and have aphanitic appearance and massive fabric, with elements of schistosity.

*Microscopic appearance.* Metasiltstones are fine-grained, granoblastic, with elements of nematoblastic texture and massive in fabric (Fig. 2D). Sometimes elements of relic blastoalevrolitic texture can be seen. More intensely metamorphosed sample DV–11 is dominantly composed of epidote and quartz. Extremely small and subhedral epidote grains are most abundant – sometimes they form up to 70 % of the rock volume. Epidote is mostly presented in small prismatic crystals, uniformly distributed in the groundmass. Quartz occurs as very small aggregates, and very rarely as independent isometric grains. It makes up approx. 30 % vol. of the rock. Also observable are the lense-like aggregates which are richer in quartz. Poorly metamorphosed alevrolites UZ–9 and UZ–3 consist of quartz grains that are 0.02–0.04 mm in size, muscovite-sericite, a small quantity of biotite and feldspar, quite a lot of organic matter, and some limonite. Cement is siliceous. UZ–3 consists of quartz, muscovite-sericite, a small quantity of carbonate and ample quantities of organic matter with some limonite. The grains range in size 0.01–0.03 mm, and are bound together with siliceous cement.

**Diabase**

*Macroscopic appearance.* Sample DV–14 is black in colour, displaying ophitic texture and homogenous and massive structure. On the surface, there are sporadic thin skins of brownish colour, most likely due to the presence of hydroxides and iron oxides. The primary magmatic minerals are represented by white needle-shaped plagioclase and fennic minerals in between them.

*Microscopic appearance.* The rock shows ophitic texture and massive fabric (Fig. 2E). It is built of plagioclase and clinopyroxene, as main minerals, and subordinate are metallic minerals, while chlorite, epidote and calcite are secondary.

Plagioclases occur as elongated idiomorphic to hypidiomorphic grains, up to 3 mm long, and less frequently as coarse phenocrysts whose dimensions are approx. 5 x 3 mm. The grains are relatively fresh, and the ones distinguishable among the secondary minerals include epidote and calcite which are distributed as irregular aggregates. The quantity of plagioclase is approx. 55 % vol. of the rock.

Clinopyroxenes (approx. 35 % vol. of the rock) occur as allotriomorphic grains of various shape. They are smaller than plagioclase and have approx. 1 mm in diameter. In addition to isolated grains, radially distributed clinopyroxene crystals can also be noted.
Accessories and secondary minerals make up together approx. 10 % vol. of the rock. Metallic minerals are evenly dispersed across the rock and very rarely form aggregates. They occur in the form of allotriomorphic isolated crystals. They are rarely larger than 0,5 mm in diameter. Chlorite occurs in interstitial spaces and is most likely a product of glass alteration. Epidote and calcite are alteration products of plagioclase.

Metamorphosed diabase

Macroscopic appearance. Sample DV–6 is of greyish-green colour, of nematoblastic and granoblastic fine-grained texture and massive in fabric, with rare elements of schistosity.

Microscopic appearance. The rock is of lepidoblastic, granoblastic and nematoblastic, with elements of blastoporphyritic texture. The rock fabric is massive and relatively homogenous. The rock is composed of chlorite, amphibole, epidote, feldspar, quartz and a small amount of opaque minerals.

All femic minerals are associated in very fine-grained aggregates, where it is often very difficult to distinguish between individual crystals. They make up over 75 % vol. of the rock, while the rest is composed of feldspars and quartz. The feldspars are most probably represented by albite. Traces of the relict porphyritic texture in the form of completely transformed phenocrysts, probably clinopyroxene, which are now represented by the aggregates of secondary minerals (Fig. 2F), can be observed. Metallic minerals are very small and they are always present as isolated crystals.

Silicified magnesites

Magnesites have frequently been, together with some other kinds of rocks of different origin, such as altered and metamorphosed tuffs, diatomite, wood, and similar, classified in archaeological literature as belonging to the group of the so-called »light white stones«.

Macroscopic appearance. Rocks of this group are light-grey to white in colour, aphanitic in texture and massive in fabric. The rock is compact, its sharp edges can cut glass, and it shows no reaction with cold and dilute HCl. In the sample DV–4 one may notice the presence of a large number of minute holes filled up with silica component, so that in intersection the rock appears »spotted«.

Microscopic appearance. Rocks are microcrystalline to cryptocrystalline in texture, while their fabric is massive (Fig. 2G). Their homogeneity is spoiled by oval cavities with fan-like aggregates of chalcedony or mounts of silica components.

Silicified magnesites consist of micro- to cryptocrystalline magnesite and cryptocrystalline to amorphous silica that make up over 98 % vol. of the rock. In the sample DV–1 the presence of fan-like aggregates, which fill up the cavities in magnesite can be observed. The cavities are mostly of sub-millimeter dimensions and their cross-sections are of elliptical shape. Larger cavities, approx. 1 x 3 mm, are generally lens-like. Regularity of the cavities may suggest that they are of organic origin (oval shells?). Siliceous matter is present in the rock DV–2 in two ways: in the form of fine-grained jets that are closely associated with magnesite, as regards the amorphous opal, and as irregular aggregates that are usually filled up with chalcedony. These mounts of silica were once surrounded by cryptocrystalline magnesite which gives the rock the »spotted« appearance. The content of silica matter is highest in the sample DV–4. In addition to these constituents, there also occurs an insignificant quantity of finely dispersed organic matter.

Metamorphosed tuff

Macroscopic appearance. The rock (DV–15) is greyish-green and has aphanitic appearance. Because of the small dimensions of the sample, any macroscopic studies were impossible.

Microscopic appearance. The rock is of blastoclastic texture and is massive in fabric. It is composed of the clasts of quartz, feldspar, chlorite, and other femic minerals lying in a chlorite-epidote-sericite matrix. The quartz clasts are minute, isometric, and their diameter only rarely exceeds 0.1 mm (Fig. 2H). They are translucent, they contain inclusions, and their form suggests volcanic origin. Fragments of feldspar phenocrysts occur less frequently than those of quartz and they are homogenously distributed in the rock. Relicts of femic constituents appear less frequently than feldspars and they are associated with metallic minerals. Femic minerals are completely transformed into chlorite. All clasts make up approx. 30 % vol. of the rock. The matrix is formed of epidote, chlorite and sericite, and makes up approx. 70 % vol. of the rock.

RAW MATERIALS FROM THE SITE OF BELOVODE

Petrographically studied raw materials from the site of Belovode are mostly represented by schists which, according to the mineral composition, may be divided into albite-epidote and epidote schists. Only one sample was identified as sandstone – litharenite.
Albite-epidote schists

**Macroscopic appearance.** Albite-epidote schists are grey, bright-grey or greyish green in colour. Their appearance is aphanitic and granoblastic texture is only rarely observed macroscopically. Their fabric is massive, with some elements of schistosity.

**Microscopic appearance.** This group of rock is characterised by granoblastic and nematoblastic texture and massive or schistos fabric. They are formed of epidote, albite, chlorite, quartz, and metallic minerals. Epidote (sometimes up to 60–65 % vol. of the rock) occurs in the form of evenly distributed fine-grained aggregates or develops irregular, rarely banded aggregates. It is associated with chlorite. Albite and quartz together constitute up to 25–30 % vol. of the rock. They mostly form lens-like nests, or jets and stripes. It is typical that albite appears as nucleuses of porphyroblasts (Fig. 3A). Chlorite makes up less than 10 % vol. of the rock. It occurs in the form of green flaky aggregates that always come together with epidote. Metallic minerals occur as of small xenomorphic grains less than 0.2 mm in diameter, which are evenly dispersed in the rock. They make up 1–2 % vol. of the rock.

Epidote schists

**Macroscopic appearance.** Samples DBV–3 i DBV–5 are of bright-grey colour, aphanitic texture and massive fabric. Across the polished surfaces elongated nests and irregular concentrations of quartz and albite of white colour are noticeable.

**Microscopic appearance.** The rocks are of granoblastic texture. Fabric is massive, locally with elements of schistosity (Fig. 3B). They are predominantly built of epidote, and also present are quartz, albite and metallic minerals, while in the sample DBV–5 chlorite is present, as well. Epidotite and quartz in the sample DBV–3, and epidote and chlorite in the sample DBV–5, form the base of the rock (80–90 % vol. of the rock). Epidote occurs in the form of isometric grains which are mostly uniform in size (up to 0.2 mm in diameter), and homogenously distributed in the rock. Quartz and albite build the remaining rock mass and fill up the interstitial spaces between the epidote aggregates occurring in the form of somewhat larger crystals, which are common syenectic intergrown. What is typical here is that albite appears in the form of optically continuous patches which denote the early porphyroblast formation. Metallic minerals are present as individual irregular grains and they make up 1–2 % vol. of the rock.

Sandstone – litharenite

**Macroscopic appearance.** Sample DBV–6 is light grey in colour and has a clastic texture and massive in fabric.

**Microscopic appearance.** The rock is of psamitic texture and massive fabric. It is composed of the fragments of rock, quartz and feldspar (Fig. 3C). The matrix is clayeyish and makes up less than 15 % vol. of the rock. The clasts comprise a wide range of lithology, with predominant to lens-like fragments of volcanic origin, probably pumice. Volcanic glass is completely devitrified and transformed into micocrystals of quartz and feldspar aggregates. Besides, there also appear rare fragments of volcanics with preserved relics of porphyritic texture. The fragments of volcanic origin make up over 85 % vol. of the detritus. Other fragments include the clasts of serpentinite, as well as rare fragments of quartzite and slate. As a rule, they are smaller than the fragments of volcanic origin. The most abundant crystal fragments is quartz, whose form suggests that it is of volcanic origin. In addition to quartz, also noticeable are platy to prismatic crystals of plagioclase. The total quantity of crystals in the detritus is approx. 15 % vol. of the rock.

CONCLUSION

Petrographic analysis of raw materials from the sites Vinča and Belovode showed that throughout the duration of the Vinča culture in the material of ground stone industry, fine-grained greyish-green rocks were predominant. According to their mineralogical and petrographic characteristics, they mostly correspond to korinites, spotted and green schists, less often to metasiltstones, and metadiabases. They give the Vinča ground stone industry a characteristic and recognisable appearance. The use of other kinds of rocks will be more significant in some other phases of the Vinča group development, but they will never threaten the domination of grey-green rock. The only bigger breakthrough in the continuous development of ground stone industry, and in the customary selection of raw materials, is the appearance of the so-called »light white stones« in the late Vinča strata, which became the hallmark of this period. The implements made of these rocks are most abundant in Central and Western Serbia, while they rarely appear in the remaining parts of the country.

Raw materials that are classified in those two groups highlight the specific nature of Vinča ground stone industry and to the greatest extent contribute to
that uniformity that is so obvious in stone industry of the Vinča culture, in particular in the territory of Central Serbia. On the one hand, this reveals that prehistoric man knew how to recognize and intentionally select a certain material for making the implements; on the other hand, such uniformity may be indicative of the existence of deposits which were exploited.

Even though there is no clear evidence of the deposits from which the analysed materials originate, there are some indicators that may point at the region of stone exploitation. Firstly, the possibility that raw materials were gathered from the river bed in an organised manner should be excluded, although both of these sites are situated on the rivers (Vinča on the Danube, and Belovode on the Mlava). If the dimensions of implements are taken into account, and they are relatively high, the conclusion is that they generally were not made of river pebbles, since these were usually used to make smaller artifacts. Petrographic criteria make it possible, above all, for several separate groups of rocks to be distinguished. Thus, the kornites, spotted schists, and partly greenschists from the site in Vinča reflect a certain measure of continuity, and it may be presumed that they were collected from different parts of one and the same contact metamorphic aureole. «Light white stones», which are in this case represented by silicified magnesites, may be associated with the regions in which serpentinites are widespread, since quite often serpentinite massive are associated with magnesite veins of different thickness. The albite-epidote and epidote schists from the Belovode site, which petrogenetically belong to the same group of rock, could also originate from the same place, most likely from the regions consisted of regional metamorphic rocks. It is most likely that the population of the Neolithic Vinča and Belovode did not go far beyond their settlements for these types of raw materials, considering that the surrounding terrain is characterised by versatile geological material and that it was formed of these and similar rocks. In the vicinity of Vinča, on mountain Avala, there are big and well uncovered serpentinite profiles, and equally developed is the contact aureole of Tertiary volcanic rocks. In wider surroundings of Belovode, for instance, in the terrain mapped on the Sheet of Veliko Gradište (OGK 1:100,000), Bogdanović and Milojević describe in the Explanatory book for the sheet of Veliko Gradište the mapped Cambrian units (actinolitic, chlorite-epidote, sericite-chlorite schists) which would, according to the characteristics of the texture and mineral composition, correspond to the raw materials from which the analysed ground implements from this locality were made.

Analyses of the raw materials from which the ground stone tools were made on the sites in Vinča and Belovode are only a part of the petro-archaeological explorations. They have indicated the direction for further exploration which leads towards field work, primarily in the surroundings of the localities. At first petrographic, and, as required, other analyses of the samples brought from the terrain, as well as comparison with the analyses of the implements, could produce a more precise definition of the region from which these raw materials originate.

Translated by Branislava Jurašin

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КАМЕНЕ СИРОВИНЕ У ВИНЧАНСКОЈ КУЛТУРИ:
АНАЛИЗА МАТЕРИЈАЛА ИЗ ВИНЧЕ И БЕЛОВОДА

Питање порекла сировина и путева којима су се оне кретале вероватно представља једно од најинтересантнијих проучавања у области праисторије. Камене сировине у највећој мери могу да на општином начин показују конкретне дозире између узализнен великих колекција. Наша територија и праисторијске културе на њој, претстављају посебну културу. Између свих њих, најпажња треба да се досведи на врло специфичну њихову сировину, која је сачувају изузетна квалитетна сировина која се користи у сировинама за израду различитих врста оружја. Изузетна је уз графичким апликацијама у областима спољном изгледа и квалитета сировина. Ово је указ на специфичну врсту сировина која се користи у производњи оружја.

Прочување мање фазе винчанске културе, која је у технолошком смислу више екстензивна него екстензивна појава, представља у посебно време тежину у изучавању винчанске камене производње. Значајно је да се испитује како се ова култура сировину одржава на основу секундарништва сировина у комплексу праисторије. Природним начином, сировине које се користе у производњи оружја, сачувају изузетни квалитет. Иако у винчанској култури је било релативно велики број сировина које се користе, оне су сачувају важан приоритет у производњи оружја. У винчанској култури, сировине које се користе у производњи оружја, сачувају важан приоритет у производњи оружја. У винчанској култури, сировине које се користе у производњи оружја, сачувају важан приоритет у производњи оружја.

Одредене законитости у набавању каменних сировина сачувају употребу сировина из различитих источника. У резултату, сировине које се користе у производњи оружја, сачувају важан приоритет у производњи оружја. У винчанској култури, сировине које се користе у производњи оружја, сачувају важан приоритет у производњи оружја.
приносе да униформност која је примећена у каменој индустрiji винчанске културе, посебно на територији централне Србије, постане тако очигледна. То нам, с једне стране говори да је праисторијски човек умело да препозна и смиљено одабере одређени материјал за израду алатки, а с друге стране, оваква ујединачност може да укаже и на постојање лежишта одакле је вршена експлоатација.

Иако још увек нема ясних доказа о лежишту/лежиштима одакле анализирани материјал потиче, постоје извесни показатељи који би могли да укажу на подручје експлоатације камена. Најпре треба исказући могућност да је сировина организовано сакупљана из речног корита, иако се оба локалитета налазе на рекама (Винча на Дунаву, а Беловоде на Млави). С обзиром на димензије алатки, које су релативно велике, сматра се да углавном нису прављене од речних облутака, од којих се обично добијају снитије артефакти. Петроографски критеријуми омогућавају да се, пре свега, неколико издржених група стена, посматрају у оквиру једног генетског процеса. Тако коритни, пегави шкрњаци и делом зелени шкрљаци са локалитета Винча показују изванредан континуитет и може се претпоставити да су прикупиљени из различитих делова једног контактно-метаморфног ореола.

Албит-епидотски и епидотски шкрљаци са локалитетета Беловоде, који генетски припадају истој групи стена, такође би могли да потичу са једног места, нијевероватније из области која изграђују метаморфнити регионалног метаморфизма.

За ове врсте сировина, становници неолитске Винче и Беловоде највероватније нису одлазили далеко од својих насеља, с обзиром да се околни терен карактеришу разноврсном геолошком грађом и да је изграђен управо од оваквих и сличних стена. У близини Винче, на Авали, налазе се велики и добро откривени профили серпентинита, а такође је развијен и контактни ореол око терцијарних вулканских стена. У широј околности Беловоде, на пример, на терену картираном на листу В. Градиште (ОГК 1:100.000), Богдановић и Милојевић (1985) у Тумачу за лист В. Градиште описују кариране камирјумске јединице (актинолитске, хлоритско-епидотске, серицитско-хлоритске шкрљање) које би, према одликама склопа и минералном саставу, одговарале сировинама од којих су израђене анализирание глачане алатке са самог локалитета.

Анализа сировина од којих су претпостављене глачане алатке на локалитетима Винча и Беловоде само се део започетих петроархеолошких истраживања. Она су указала на даљи правац испитивања који води ка тереским радовима, пре свега у околнини самих локалитета. Најпре петроографском, а по потреби и другим анализама примерака донетих са терена и компаративом са анализама алакти могло би се много прецизније дефинисати подручје одакле сировине потичу.

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