UDK 903.2 »634« (497.11)
902.3:552 (497.11)

DRAGANA ANTONOVIĆ, Institute of Archaeology, Belgrade
KRISTINA RESIMIĆ-ŠARIĆ, Faculty of Mining and Geology, Belgrade
VLADICA CVETKOVIĆ, Faculty of Mining and Geology, Belgrade

STONE RAW MATERIALS IN THE VINČA CULTURE: PETROGRAPHIC ANALYSIS OF ASSEMBLAGE FROM VINČA AND BELOVODE

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 focuse 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.

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[1] to the widespread use of so-called »green stone« (serpentinite and jadeite) in Macedonian Neolithic,[2] 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.[3]

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

[1] Antonović, 2003, 34–37.
[2] Smoor, 1976, 178; Weide, 1976, 282.
[3] All objects from the territory of our country declared to be made of jadeite and nephrite have been analyzed only macroscopically!

culture. The attempts were made to answer these questions by comparing stone industries from the two sites, Vinča and Belovode,[4] 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 items production and use.[5] In the territory of what is today Serbia during the Early Neolithic (Protostarčevo according to D. Srejović, Gura Baciului according to M. Garašanin, Starčevo I according to D. Garašanin and V. Milojčić, ENCB according to N. N. Tasić),[6] 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 Kameničkog potoka, Knjepište, Blagotin, Velesnica),[7] 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 Popovića Brdo in the vicinity of Šabac.[8] It seems that Grivac can be associated with the exploitation of primary deposits of rock crystal.[9] A greater presence of quartzite has been recorded in the assemblage from some of the Starčevo culture sites, in Blagotin and Velesnica for instance. In case of Blagotin, it is quite possible that organized exploitation of primary quartzite deposits took place there.[10] Exploitation of opal,[11] namely of opalized serpentinite, was recorded in Rudnik, Glavica – Krivo Polje locality in Ramaća, where, upon a very limited surface exploration, it was assumed that it was an Early Neolithic quarry.[12] 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.[13] 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 Miloje 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 (Васић, 1932; Васић, 1936; Винча у праисторији…, 1984; Тасић, 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 (Šljivar, Jacanović, 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.

[6] Aranđelović-Garašanin, 1954, 136; Garašanin, 1979, 119–120; Milojčić, 1950, 109–110; Srejović, 1988, 15–17; Tasić, 1997, 43.

[7] Šarić, 2000, 242–243.

[8] Bogosavljević-Petrović, 2004, 382, 388–390, 408; Šarić, 2003, 14–19; Tringham et al., 1988, 205–206.

[9] Bogosavljević-Petrović, 2004–1, 389.

[10] Šarić, 2002, 19.

[11] Identification of materials according to Jovanović, Milić 1988, 57–60.

[12] Јовановић, Милић, 1988, 57–60.

[13] Богосављевић-Петровић, 2006.

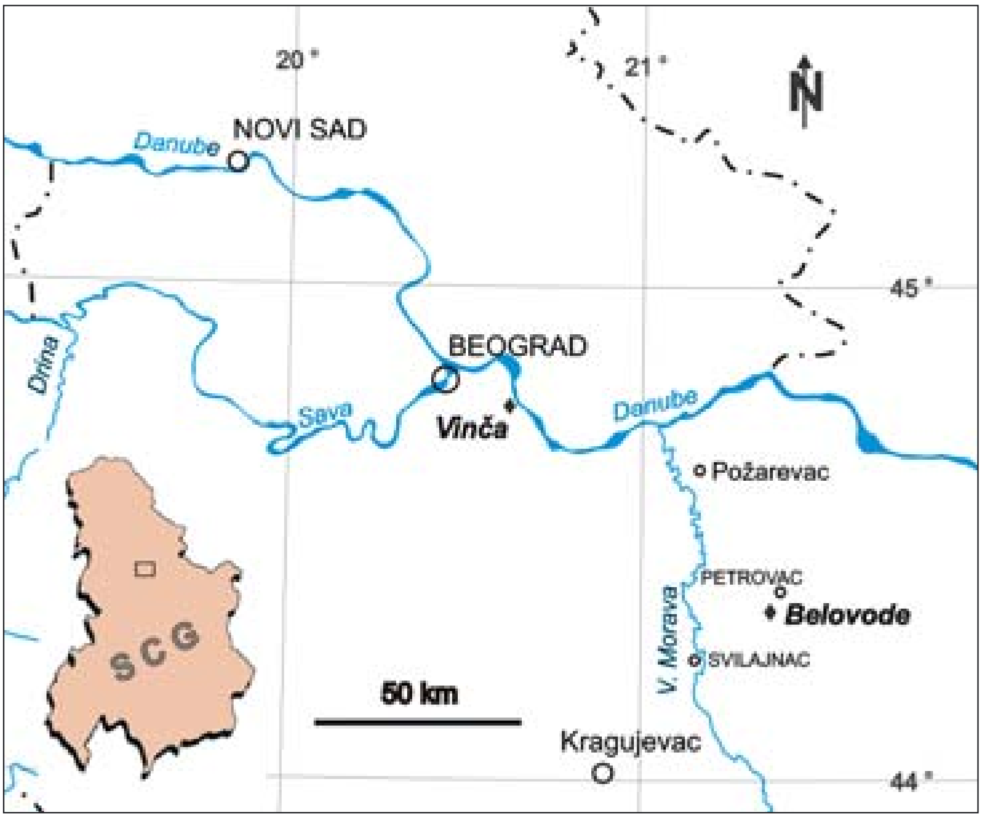

Fig. 1. Geographical position of the Vinča and Belovode sites

Сл. 1. Геоīрафски ӣоложај локалиӣеӣа Винча и Беловоде

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.

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[14] Antonović, 2003, 34–37, 132.

[15] Aranđelović-Garašanin, 1954, 136; Milojčić, 1950, 109–110; Tasić, 1997, 44.

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. Garašanin, Vinča C–D with the part B2 according to Milojčić, Gradac phase I–III according to B. Jovanović).[16] 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.[17] 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.[18] 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) metasiltstones, (5) silicified magnesites, (6) diabases and metadiabases, 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.[19]

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.

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[16] Garašanin, 1979, 175–181; Jovanović, 1992–1993, 10; Milojčić, 1949, 70–81.

[17] In our archaeology to date it has not been precisely determined what kind, or kinds of rocks we are discussing when we talk about the so-called »light white stone«. This description covers macroscopically similar rocks whose main characteristics include that they come in different shades of off-white and ecru, that they are relatively soft (unless they are silicified), that they are mostly porous and, therefore, light. Based on a small number of analyses (petrographic analyses, DTA, X-ray powder diffraction), these rocks have been differently defined: as magnesite, porcelainite, diatomeic soil, diatomeic shale, ash tuff, etc. (Antonović, 1997; Šarić, 2002, with quoted relevant bibliography). It is precisely due to such level of disparity with regard to the name, whose presence can be doubtlessly attributed to the fact that more thorough petrographic analyses have never been conducted, that for the time being our archaeology most often uses descriptive names such as »light white stone«, »soft white stone«, or »white rocks of different origin«, which nevertheless offers closest insight into the macroscopic appearance of this raw material (Antonović, 1997; Богосављевић-Петровић, 1992, 9–11; Bogosavljević-Petrović, 2004, 385–387, 411; Šarić, 2002, 20).

[18] Антоновић, 1992, 31–32; Antonović, 2003, 38–40.

[19] Antonović, 2003, 16–20.

sample	year of excavation	circumstances of findings	type of rock
		VINČA	
UZ–1	1933	depth 5.7 m, IB 116	Kornites
UZ–7	1934	depth 6.5 m, IB 336	
UZ–19	1934	depth 6.3 m, IB 377	
UZ–24	1934	depth 6.7 m, IB 301	
UZ–30	1934	depth 6.5 m, IB 354	
DV–19	2002	square CIV/2, locus 23, furnace 02/02, C–332	
DV–20	2002	square CIII/4, locus 18, excavation level 2, edm 932, C–314	
UZ–16	1934	depth 7.3 m, IB 550	
DV–7	2004	square CIII/4, locus 9, unit 31, edm 189	Spotted schist/kornites
DV–8	2004	square CIV/2, locus 14, unit 1, excavation level 1, edm 70	
DV–9	2004	square CIV/2, locus 9, unit 37, edm 232	
DV–10	2002	square CIV/4, locus 1, pit 05/02 (9), edm 822	
DV–16	2002	square CIV/4, locus 10, excavation level 2, edm 810	Greenschist
DV–17	1998	square DIV/1, locus 9, excavation level 1, C–207	
DV–18	2004	square CIV/2, locus 25, edm 106	
UZ–9	1934	depth 7.3 m, IB 466	Metasiltstone
UZ–3	1934	depth 8.0 m, IB 218	
DV–11	2004	square CIII/4, locus 9, unit 5 edm 113	
DV–1	2004	square CIII/2, locus 14, unit 2, excavation level 1, edm 023	Silicified magnesite
DV–2	2004	square CIV/2, locus 24, unit 1, edm 011	
DV–4	2004	square CIII/4, locus 19, unit 1, edm 085	
DV–15	1998	square EIII/3, locus 1, excavation level 1, C–184	Metamorphosed tuff
DV–6	2004	unit 20 – extension unit 20	Metamorphosed diabase
DV–14	2004	Surface findings from the southern excavation profile, from the 1980's, edm 321	Diabase
		BELOVODE	
DBV–1	2000	Trench VII, excavation level 21	Albite-epidote schist
DBV–7	1998	Trench VI, excavation level 16, surface with burnt soil, C–701	
DBV–8	1998	Trench VI, excavation level 11, surface with burnt soil, C–689	
DBV–9	1998	Trench VI, excavation level 10, C–668	
DBV–3	2000	Trench VII, excavation level 10	Epidote schist
DBV–5	2000	Trench VII, excavation level 17, C–922	Epidote schist
DBV–6	2000	Trench VII, excavation level 11	Sandstone (litharenite)

Table – List of the macroscopically and microscopically analysed samples with the information about the circumstances of the findings and rock types

Табела – Попис узорака анализираних макроскопски и микроскопски са подацима о условима налаза и одредбама стена

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 wolastonite, 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

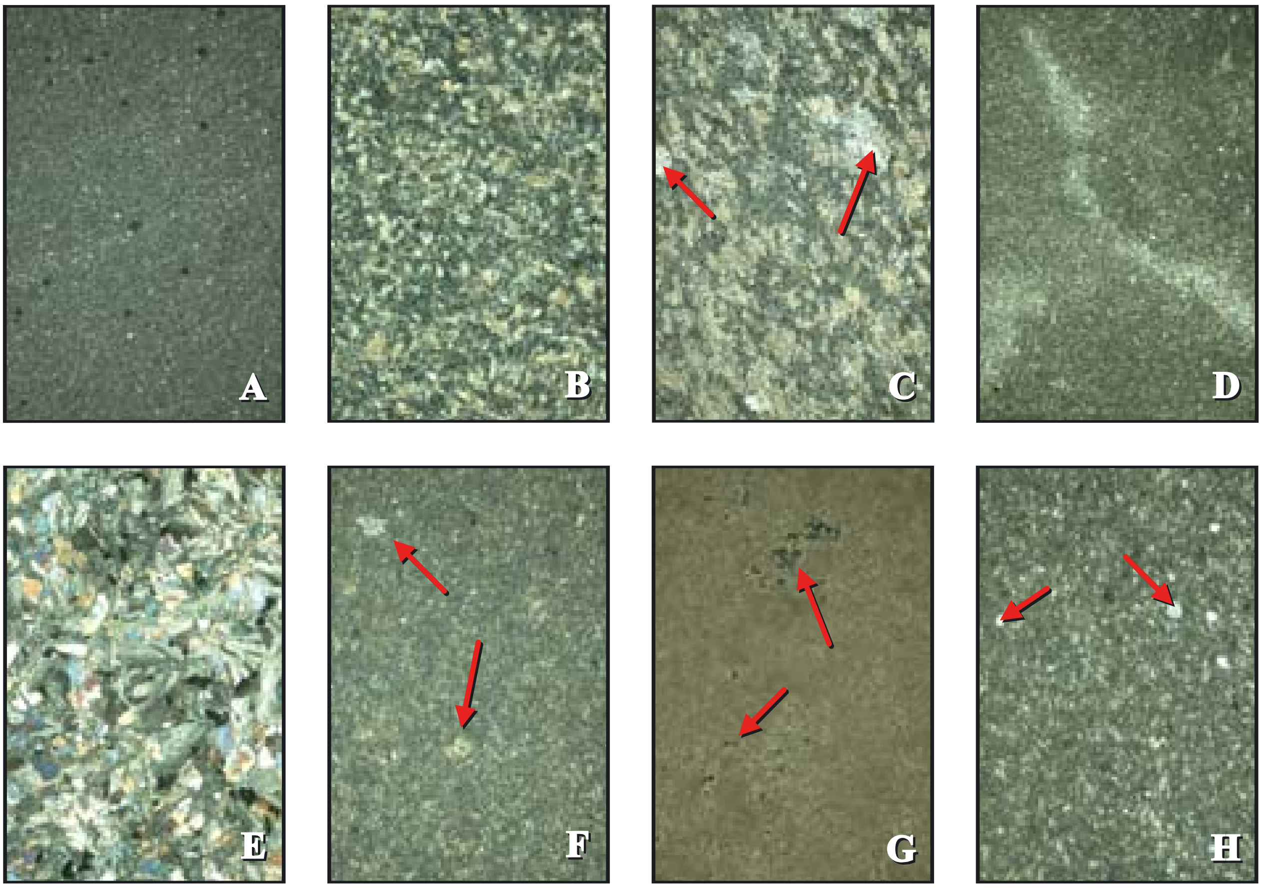

Fig. 2. Microscopic appearance of the raw materials from the Vinca site:
A – kornites (DV–20): granoblastic texture; Nx; vertical edge of photograph 1 mm;
B – greenschist (DV–17): microscopic appearance; Nx; vertical edge of photograph 1 mm;
C – spotted schist/kornites (DV–8): porphyroblasts of albite (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): relicts 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

Сл. 2. Микроскопски изглед сировина са локалитета Винча:
A – корнит (DV–20): гранобластична структура; Nx; вертикална ивица фотографије 1 mm;
B – зелени шкриљац (DV–17): микроскопски изглед; Nx; вертикална ивица фотографије 1 mm;
C – пегави шкриљац/корнит (DV–8): порфиробласти албита (стрелице); Nx; вертикална ивица фотографије 2 mm; D – метаалевролит (DV–11): микроскопски изглед; Nx; вертикална ивица фотографије 2 mm; E – дијабаз (DV–14): офитска структура дијабаза; Nx; вертикална ивица фотографије 2 mm; F – метаморфисани дијабаз (DV–6): реликти некадашњих фенокристала клинопироксена (стрелице); Nx; вертикална ивица фотографије 2 mm; G – силификовани магнезит (DV–2): силицијска материја (стрелица) у криптокристаластом магнезиту; Nx; вертикална ивица фотографије 1 mm;
H – метаморфисани туф (DV–15): класти кварца вулканогеног порекла (стрелица) у метаморфисаном туфу; Nx; вертикална ивица фотографије 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

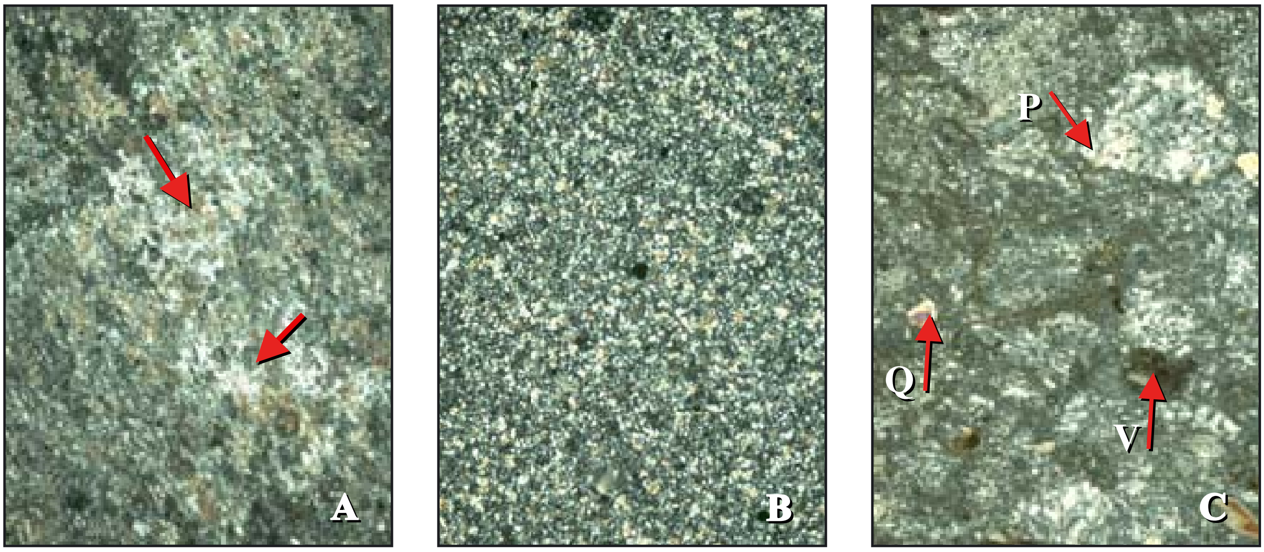

Fig. 3. Microscopic appearance of the raw materials from the Belovode site:
A – albite-epidote schist (DBV–1) with the nucleuses of porphyroblasts (arrows); Nx;
vertical edge of photograph 1 mm; B – epidote schist (DBV–2); Nx; vertical edge of photograph 1 mm;
C – sandstone (DBV–3): clasts of volcanics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

Сл. 3. Микроскопски изглед сировина са локалитета Беловоде:
A – албитско-епидотски шкриљац (DBV–1) са зачецима порфиробласта албита (стрелица); Nx;
вертикална ивица фотографије 1 mm; B – епидотски шкриљац (DBV–2); Nx; вертикалне ивице
фотографије 1 mm; C – пешчар (DBV–3): класти вулканита (V), пловућца (P), кварца (Q); Nx;
вертикална ивица фотографије 2 mm

grains or form fine-grained powdery aggregates. In the sample DV–18 they occur as relicts 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 taxture (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 relict 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 femic 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 blastoporphyric 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 porphyric 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 exeeds 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 taxture 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. Epidote 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 often symplectitic 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 microcrystals of quartz and feldspar aggregates. Besides, there also appear rare fragments of volcanics with preserved relicts of porphyric 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 shale. 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 kornites, 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 massives 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,[20] and equally developed is the contact aureole of Tertiary volcanic rocks.[21] 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[22] 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

[20] Pavlović, 1980.
[21] Васковић, 1993.
[22] Bogdanović, Milojević, 1985.

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Резиме:

ДРАГАНА АНТОНОВИЋ, Археолошки институт, Београд
КРИСТИНА РЕСИМИЋ-ШАРИЋ, Рударско-геолошки факултет, Београд
ВЛАДИЦА ЦВЕТКОВИЋ, Рударско-геолошки факултет, Београд

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 опипљив начин покажу конкретне додире између удаљених области. Наша територија и праисторијске културе на њој, пре свега оне неолитске и енеолитске, још увек нису истражене у тој мери да би могло да се говори о циркулацији сировина у оквиру самих култура.

Проучавање млађе фазе винчанске културе, која је у технолошком смислу више енеолитска него неолитска појава, представља у последње време тежиште у изучавању винчанске камене производње. Значајно је да се испита како се декаденција једне културе одражава на искоришћеност сировина у таквим условима: да ли смањење територије утиче на смањење квалитета камених сировина због мање доступности лежишта квалитетнијег камена и да ли се у већој мери користе мање квалитетне »имитације» камена употребљаваног у старијим фазама винчанске културе. На ова питања покушано је да се одговори упоређивањем камених индустрија са два локалитета, из Винче и Беловода, са којих се камени материјал испитује петрографским анализама.

Главни разлог анализирања резултата са ова два локалитета представља специфичност у развоју њихових индустрија глачаног камена. У Винчи, у млађим слојевима, региструје се својеврсна девалвација у избору камених сировина као последица територијалног сужавања саме винчанске културе у њеним касним фазама. Са тим је повезано и опадање у квалитету обраде камена које почиње од градачке фазе и у касно-винчанским слојевима постаје веома упадљиво. Обе појаве из млађих слојева Винче могу да се повежу и са улажењем металургије у свакодневни живот винчанске популације. Из тог разлога направљења је паралела са локалитетом Беловоде које траје само током старије фазе винчанске културе и несумњиво је металуршко насеље. Немарност у обради камена овде се прати већ од ране винчанске културе, а избор сировина указује на локалне изворе територијално повезане са лежиштима бакарне руде.

Приликом проучавања порекла и циркулације камених сировина током неолита и енеолита морају се имати у виду неки општи моменти у развоју производње и употребе камених предмета. На територији данашње Србије, у раном и делом у средњем неолиту евидентно је присуство мезолитске традиције у одбиру сировина и обради камена. Реч је о микролитском оруђу и експлоатацији у технолошком смислу мање квалитетних сировина (горски кристал, кварцит и опал) који указују на можда још увек активан брзи лов луком и стрелом и повећану потребу за сировинама за израду ловног оружја са једнократном наменом. И поред свих ових примера, на основу садашњег нивоа истражености, не може да се говори о експлоатацији тачно дефинисаних извора камена, већ само о оријентисаности на исту врсту стене/минерала, без обзира одакле они потичу, што указује на неку врсту организованог добављања сировина. Поменута униформност у избору сировина се прати у индустрији окресаног камена, док у изради оруђа, од глачаног камена, као потпуно новој производњи, није забележено никакво правило у одабиру сировина.

Први преломни моменат у развоју камене индустрије током неолита настаје у класичној фази старчевачке и продужиће се током винчанске културе. У индустрији глачаног камена уводи се униформност у избору сировина и изради оруђа. Почињу да преовладавају макроскопски идентичне финозрне сивозелене стене од којих се праве искључиво секире, тесле и длета. Други преломни моменат настаје у градачкој фази увођењем тзв. »лаког белог камена« у производњу каменог оруђа што је донело немарност и површност у обради камена, портврђујући тезу да се деградација и ишчезавање једне културе најпре примећује у технолошким променама.

Одређене законитости у набављању камених сировина су сигурно постојале током неолита. Оно што је за сада непознато је како је камен добављан: да ли су постојала тачно дефинисана лежишта и каменоломи из којих је вађен, или је насумично сакупљана наизглед иста сировина. У индустрији глачаног камена старчевачко-винчанског технокомплекса су макроскопским путем до сада установљене две велике групе стена које доминирају у материјалу и које су груписане само на основу физичко-техничких особина: финозрне сивозелене и »лаке беле стене«. Управо зато је решено да се ове две широко дефинисане групе стена прецизније одреде. Извршене су микроскопске анализе на одабраном узорку са више локалитета у Србији, из различитих фаза неолита: Винча, Беловоде, Лепенски Вир, Доња Брањевина. У овом раду дати су резултати анализа материјала из Винче и са Беловода који су одабрани због своје културне и територијалне сродности.

Петрографском анализом сировина са локалитета Винча и Беловоде установљено је да су током целе винчанске културе у материјалу индустрије глачаног камена биле најзаступљеније финозрне сивозелене стене, које по својим минералошко-петрографским карактеристикама одговарају најчешће корнитима, пегавим и зеленим шкриљцима, ређе метаалевролитима, дијабазима метаморфисним у различитом степену. Оне винчанској индустрији глачаног камена дају специфичан и препознатљив изглед. Друге по заступљености су биле тзв. »лаке беле стене« у млађевинчанским слојевима, које и постају обележје овог периода.

Сировине опредељене у те две групе дају посебно обележје винчанској индустрији глачаног камена и највише до-

приносе да униформност која је примећена у каменој индустрији винчанске културе, посебно на територији централне Србије, постане тако очигледна. То нам, с једне стране говори да је праисторијски човек умео да препозна и смислено одабере одређени материјал за израду алатки, а с друге стране, оваква уједначеност може да укаже и на постојање лежишта одакле је вршена експлоатација.

Иако још увек нема јасних доказа о лежишту/лежиштима одакле анализирани материјал потиче, постоје извесни показатељи који би могли да укажу на подручје експлоатације камена. Најпре треба искључити 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 ситнији артефакти. Петрографски критеријуми омогућавају да се, пре свега, неколико издвојених група стена, посматрају у оквиру једног генетског процеса. Тако корнити, пегави шкриљци и делом зелени шкриљци са локалитета Винча показују известан континуитет и може се претпоставити да су прикупљени из различитих делова једног контактно-метаморфног ореола. »Лаке беле стене«, које су у овом случају представљене силификованим магнезитима, могу се везати за подручја у којима су распрострањени серпентинити, јер су неретко серпентинитски масиви прожети магнезитским жицама различите дебљине (од неколико милиметара навише). Албит-епидотски и епидотски шкриљци са локалитета Беловоде, који генетски припадају истој групи стена, такође би могли да потичу са једног места, највероватније из области које изграђују метаморфити регионалног метаморфизма.

За ове врсте сировина, становници неолитске Винче и Беловода највероватније нису одлазили далеко од својих насеља, с обзиром да се околни терен карактерише 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 околини Беловода, на пример, на терену картираном на листу В. Градиште (ОГК 1:100.000), Богдановић и Милојевић (1985) у Тумачу за лист В. Градиште описују картиране камбријумске јединице (актинолитске, хлоритско-епидотске, серицитско-хлоритске шкриљце) које би, према одликама склопа и минералном саставу, одговарале сировинама од којих су израђене анализиране глачане алатке са самог локалитета.

Анализа сировина од којих су прављене глачане алатке на локалитетима Винча и Беловоде само су део започетих петро-археолошких истраживања. Она су указала на даљи правац испитивања који води ка теренским радовима, пре свега у околини самих локалитета. Најпре петрографском, а по потреби и другим анализама примерака донетих са терена и компарацијом са анализама алатки могло би се много прецизније дефнистати подручје одакле сировине потичу.